QUANTITATIVE METHODS IN SOCIAL PROTECTION SERIES

Modelling in health care finance

A compendium of quantitative techniques for health care financing

Michael Cichon • William Newbrander
Hiroshi Yamabana • Axel Weber
Charles Normand • David Dror • Alexander Preker

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To all our friends and colleagues
who work to keep national health
systems affordable for all in need

The authors
July 1999

FOREWORD

Quantitative health care analysts around the world must constantly respond to the queries of health policy makers. These days, their main question is *'how much?'*. They may ask for information that is relatively simple and straightforward – the financing provisions of existing schemes, for example. At the other end of the spectrum, they may ask for complex analyses – for example, regarding possible future scenarios. Some typical questions from policy makers include:

- *What would be the aggregate cost of an increase in doctors' fees by amount* x*?*
- *What would we save if we were to increase co-payments by amount* y*?*
- *How much does the existing system cost?*
- *Can we afford to introduce a national health insurance scheme? If so, how would it affect the health care financing liabilities of the government, employers and employees?*
- *Who bears the cost at present, and how can the financial burden be reallocated?*

This book will help analysts to answer these questions. Answers can only be derived from simpler images of complex realities – i.e. from financial models of national health care systems. The book offers instruction on how to build such models. In order to do so, analysts need to have at least a grounding in macroeconomics, health economics, health policy, financial planning and management, as well as actuarial techniques. This is a tall order for any one person. Without such knowledge, analysts run the risk of using ad hoc methodologies, which often breed uneasiness about the capacity to deal with the problems at hand.

Lessons from the field experience of the ILO and other organizations are brought together in this book. Quantitative work in many countries is often done in an uncertain policy environment, with deficient data, and usually under a variety of other constraints.

The approach to the subject of this book is pragmatic and output-oriented, offering a guideline for the busy professional. The book attempts to create synergies and bridge gaps between quantitative health economics, health financing and actuarial science. Field practice will put the techniques mentioned here to the test. It is intended for planners and managers in charge of national health care financing systems, as well as specialists in international technical cooperation.

Theoretical, actuarial and health-related economic concepts are translated into pragmatic tools for short- to medium-term financial planning, management and monitoring. This book also follows up on a previous guidebook on health insurance published by the WHO and the ILO.[1] We hope that it will prove to be a practical guide to financial modelling for the specialist, as well as a reference for modelling methodology.

This volume is part of a series on quantitative techniques in social protection being published by the Financial, Actuarial and Statistical Branch of the Social Security Department of the ILO, together with the International Social Security Association. Other volumes in this series are:

- *Actuarial mathematics of social security pensions*
- *Actuarial theory of social security pension schemes*
- *Actuarial practice in social security pension schemes*
- *Social budgeting*

These monographs are all scheduled to be published over the next two years. The objective of this series is to provide a full set of compendiums on the quantitative analysis of national social protection schemes. It is also hoped that they will find their way into university and professional training courses, where training materials on these issues are notoriously scarce. Future ILO and ISSA training courses on quantitative techniques in social security issues will also use these manuals as required reading.

The Financial, Statistical and Actuarial Department welcomes your comments and feedback on the book in general, on your experience with the use of the modelling techniques described here, and on their adaptation to the specific situations found in your country or scheme.

Colin Gillion
Director
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Geneva, Switzerland

Dalmer D. Hoskins
Secretary General
International Social Security Association
Geneva, Switzerland

[1] WHO and ILO, *Social health insurance: A guidebook for planning*, Geneva: WHO, 1994.

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Notes: B = Box (e.g. Figure B2.1 is found in Box 2.1, in Chapter 2)
IB = Issue Brief (e.g. Figure IB2.1 is found in Issue Brief 2)

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Janet Needham	Prepared papers for the ILO some years ago, upon which the accounting section of the book drew.
Guy Carrin	Contributed the description of the latest WHO model, *SimFin*, which simulates financial needs and government budget options for the health system.
David Collins	Checked on our write-up of accounting principles in health care schemes.
Theodore Fisher	Undertook the first round of comprehensive editing and lay-out work, and made this volume readable. He also prepared the index.
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Our sincerest thanks to them all.

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PART I

THE CONTEXT OF MODELLING

INTRODUCTION

1

Health care systems are a prominent focus for national leaders and policy makers in most countries today. This fact reflects concerns about the availability of necessary health services for the population, as well as about the efficiency and costs of current health systems in delivering those services. The degree of importance of this issue in any given country is directly related to the size of the health care system relative to the national economy. Nearly all decisions of policy makers about national health systems must be based on the quantitative aspects of the options available, and the impact of any decisions taken. A quantitative description of the current health system and projection of the impact of changes to the system through new policy initiatives is also critical to reform. Hence, the ability to quantitatively describe health systems as well as to create a range of "what if" scenarios based on new directions for those systems is increasingly important in all countries.

The objective of this book is to help those who do the quantitative work that serves as a background for policy decisions to present reasoned projections which will, in turn, facilitate the creation of informed policies. Those called upon to map the current state of health systems, to simulate financial outcomes of proposed changes to existing health systems, or to predict the future under different scenarios will need to use mathematical modelling techniques. This book is concerned with describing the context and techniques for developing quantitative descriptions and projections through modelling. It provides the tools to build models of health care financing systems.

1.1 BACKGROUND

The main objective of a health care delivery system is to maintain or improve the health status of the population. This is accomplished mainly by preventing disease and illness – or in the case of illness, by providing curative and rehabilitative care. These objectives should be carried out as efficiently as possible, and at costs that are both bearable for the participants and financially sustainable for society.

A social or national health care system would also aim to guarantee access to health services for the entire population, regardless of individual ability to pay. Many national health care systems in Africa, Asia, Europe, Latin America and North America may be regarded as successful because of their extent of access to care, and the high quality of that care. However, many schemes in the developing world do not yet provide adequate physical or financial access to quality health services for the entire population. In the past two decades, the cost of health care systems has become an increasing concern for governments in developed as well as developing countries. In the past, rapid real economic growth often made it possible to increase both the level of access to and quality of care. This was the case, for example, in the postwar period of most OECD countries. However, since the mid-1970s and the economic crises of the 1980s and 1990s, evidenced in the dramatic reductions in GDP growth rates, the emphasis in many countries has shifted from expanding services and improving quality to attempting simply to maintain the level of existing services. Thus, the sustainability and cost containment efforts of health systems have become the major challenges, and financing is a critical element in meeting these challenges. The emphasis in health care financing today has shifted to cost containment through efficiency gains in existing systems, while finding effective mechanisms for funding the overall health system in a long-term, sustainable fashion. For less affluent countries of the world, the pressure to reform their health systems and financing mechanisms has become even more acute.

Demand for health services continues to rise. While some of the increase may be attributable to population growth and changing disease patterns, demand has also been created through such factors as new technologies to diagnose and cure illnesses. These technologies are generally more costly than existing ones, and often represent only a slight marginal benefit in terms of health outcomes relative to increased costs. While consumers demonstrate a considerable tolerance for rising health care prices, collectively financed health care systems are increasingly sensitive to the rising costs of health care. The ultimate consequence of unrestrained cost increases may be a rationing mechanism for the distribution of health services. Simply allowing the health care market and prices to perform this rationing function creates ethical concerns and provokes debate about the equity of the system. This ongoing debate in many national systems reflects the fact that interactions between three key factors are not fully understood: the objective *need* for health goods and services, the *demand* for those goods and services, and the development of benefit *entitlements* under the health care financing system. The relationship between the use or consumption of health services and health outcomes is also not well understood, especially since stochastic biological processes make this relationship difficult to determine. In short, uncertainty is a major characteristic of the health sector.

In order to provide affordable, accessible and effective health services to those of the population in real need, resources must be targeted at the most cost-effective interventions. This is accomplished primarily through the effective allocation and efficient use of existing resources, through such means as utilization and cost control. For the health care delivery system to be financially sustainable, sound resource allocation, financial governance, and monitoring of health outcomes are necessary, regardless of whether the system is primarily public, private or mixed.

1.2 MODELLING

Quantitative tools are needed for sound resource allocation and financial governance of health systems. These are of two primary types: *descriptive tools* and *analytical tools*. Descriptive tools are standard instruments for sound governance, and consist of financial reporting and controls in the form of accounts and statistics. Analytical tools allow policy makers to perform *status quo mapping*, which is used to assess the financial development of existing systems, under the assumption that present regulatory or managerial frameworks are maintained. The "map" of the system thus obtained is then used to determine the level of financial resources necessary to maintain the present level of quality and quantity of care. Analytical tools are therefore necessarily based on comprehensive, meaningful statistics and accounting. The results of these projections of the status quo can then be used to negotiate medium-term financial allocations from the government (in tax-financed systems), or from workers and employers (in contribution-financed systems). Status quo mapping can also be useful in determining whether modifications are necessary in benefit or financing provisions. Analytical tools are also used to perform *simulations* of the financial impact of proposed changes in the policies and parameters of the system, in the form of "what if" scenarios and projections.

The analytical tools needed to perform these operations consist of *models*, which are mathematical formulations of health care financing systems. These models are based on the regulations governing the health system's financing and available benefits. They also take into account other pertinent information, such as the result of the interaction of various actors on the health care market, payment incentives, and variables concerning the economic situation.

Despite the usefulness and availability of such tools, the planning and management processes within national health systems often ignore or do not make use of mathematical models or of the outcomes generated by these models. Likewise, there is often uncertainty about the appropriate format for initial and periodic financial valuations or reviews of statutory health care systems. Without models, neither an initial analysis of the financial viability of a scheme nor regular financial monitoring will provide sufficiently clear financial information.

Models are pragmatic tools of governance. They provide information with which to make informed decisions about the current system, or about options for the future. Models do not make health policy decisions; they only provide the data and intelligence information necessary for the decision-making process.

The need for change to improve existing health systems and adjust to new circumstances has resulted in countries from all economic strata needing to use modelling to make their health systems relevant and sustainable both today and in the future. Quantitative modelling is an important tool to make these changes, yet it is greatly misunderstood and underutilized in many countries faced with critical decisions about their health systems.

1.3 OBJECTIVES AND AUDIENCE

To address the issue of the lack of use and accessibility of quantitative modelling in health care systems, the ILO has sought to provide a publication which would serve as a guide to modelling. The objectives of this book are to describe modelling of health system financing by:

- identifying the foundations of modelling
- delineating the modelling process
- providing the techniques of modelling and their construction
- presenting practical examples of the modelling of health systems
- demonstrating the uses of modelling in health policy formulation.

This book is intended to assist health care professionals, policy makers and decision makers in the public and private sectors. It is intended to provide them not only with an understanding of the basics of modelling techniques, but also to assist them in becoming connoisseurs of the uses of modelling in the policy-making process. It is also a resource for health system and health insurance managers for understanding the purpose, uses, and techniques of modelling. They may find the techniques useful when they are adapted to the degree of detail required by managers responsible below the national level. Finally, it is provided as a practical guide to financial modelling for specialists working in the health care area.

This volume has been compiled *by* health system and financing practitioners *for* health system and financing practitioners. While it does not require the reader to be a statistician or an actuary, this book is most useful to those who feel comfortable dealing with numbers. Some basic level of competence in mathematics is expected if the book is to serve its purpose. It is also expected that the reader has some interest and understanding of the process and complexity within which policy decisions are made regarding national health systems. If the reader is acquainted with basic management methods in the health system, he or she will feel comfortable with this book and its discussions of modelling techniques, outcomes and applications. Mindful of our colleagues who have to model health care systems, often alone, in health ministries, social security institutions and planning offices, it is self-contained and does not require additional books or resources to make it effective for the reader. Additional resources, such as the issue briefs and glossary of terms at the back of this volume, provide additional background which may be required by those not as conversant in areas such as statistics, accounting, health economics, or health management.

1.4 THE STRUCTURE OF THIS BOOK

This book is organized into three parts. In Part I, following this introduction (Chapter 1), Chapter 2 reviews the context and focus of modelling and its use within national health systems. This includes discussion of the applicability of modelling to specific situations and the issues for which it can serve as a tool. Chapter 3 describes the object of modelling: health care financing systems. It presents the variety of systems in various countries, and the importance of using models so that policy and managerial decisions can be made with the greatest amount of relevant information to hand.

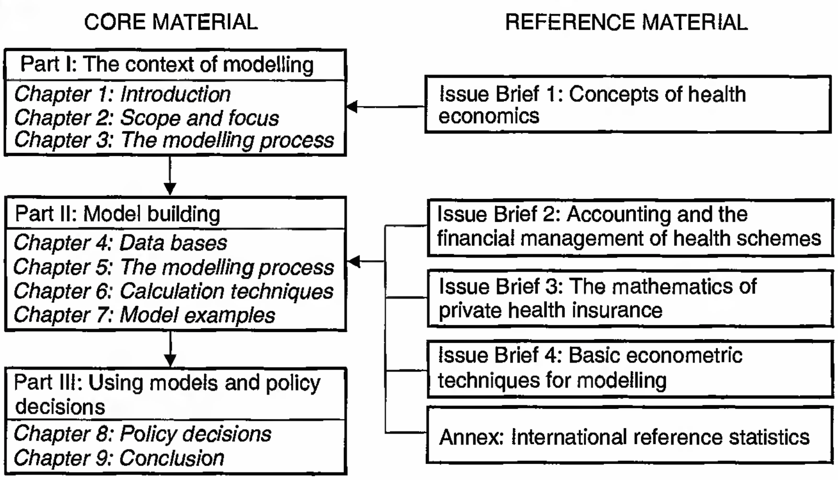
Part II is the core of the book, and deals with the actual techniques and methods for building models of health care financing systems. Chapter 4 identifies the data base necessary for modelling, including the necessary statistical and accounting information required for effective modelling. This chapter deals with the complementary issues of health system financing and the snapshots of these financing arrangements that are produced by the accounting system. Attention is also paid to the importance of health statistics as a source of data for the modeller, planner and policy maker. Chapter 5 discusses the actual process of building a model. The design of a model provides the guidance and parameters for the practical implementation of the principles contained in this volume. The scope of models is presented, both at the national level and the level of individual schemes. Underlying this presentation is a robust modelling philosophy, based both on theoretical concepts commonly used in health economics and on prevailing practices in financial reporting. Chapter 6 presents calculation techniques for modelling, and is therefore the most quantitatively oriented of the chapters. It illustrates how projections of future population and need for health services are determined, as well as estimates of the income and expenditure of national systems or of individual schemes. Part II concludes with a presentation of nine examples of modelling in Chapter 7, and includes a wide range of models, from the simplest to the most complex.

Part III discusses the application of models of health care system financing, and looks to the future. Chapter 8 discusses the practical limits of quantitative modelling: what it can and cannot be used for. This discussion steps out of the usual realm of modelling and exposes modelling practitioners to today's epidemiological, normative and ethical issues of health policy. Chapter 9 encourages the reader to use the modelling techniques described in this book in as many ways as are practical. The authors propose some thoughts on key issues that lie ahead, and that may be the ground for additional modelling work in the future.

At the end of the book are a number of reference materials: four Issue Briefs, an Annex of International Reference Statistics, a Glossary of Terms and a Bibliography. The Issue Briefs are intended to provide additional accessible resource material for the reader who does not feel fully comfortable with the health system and financing issues addressed and assumed in Parts I to III of the book. *Issue Brief 1* covers some of the concepts of health economics. Familiarity with these concepts can help a great deal in understanding the modelling of health care systems. This will provide a reference for those readers who desire a brief "refresher course" on this topic, without diverting the attention of other readers from the main subject of the book. *Issue Brief 2* describes accounting concepts and financial management of health schemes. In our experience, modellers are frequently asked to give advice on setting up and maintaining accounts, and this issue brief will help answer questions in this regard. *Issue Brief 3* deals with actuarial techniques for private insurance, while *Issue Brief 4* summarizes useful information on econometric regression techniques. Both of these subjects can be important for modellers when dealing with certain aspects of health care systems. Together, the four issue briefs provide a methodological compendium of key techniques and background information.

A compilation of certain international health statistics is found in the annex. These statistics serve as a reference to help modellers place their own systems in an international comparative context and help them build model assumptions where there is an inadequate national information base. A glossary of terms

Figure 1.1 A roadmap through this book, or *What this book does*



frequently used in the literature of health systems, financing, and accounting is also provided. This is followed by a bibliography, which provides references used in the text as well as suggested supplementary reading which may be useful to the reader. The bibliography will be useful to those who seek a deeper knowledge in the field.

The structure, flow, and interrelationships of the book's parts and chapters where the reference materials may be most useful to the reader, are indicated in figure 1.1.

SCOPE AND FOCUS 2

Modelling is an involved process, and a clear definition of the nature, scope and context of financial models used in health care systems is required. This chapter will define financial models in health care and their focus – the "how much" of health policy. It will also discuss the limits and uses of modelling in the health care field, and describe the role of modelling in the larger health policy formulation process. The need to check the affordability of certain health care options is one of the main objectives of modelling. Policy decisions about health care spending require not only an understanding of health benefits and policy outcomes, but also of the broader economic context of the country. Despite the importance of these factors, political considerations will often override economic ones in health financing policy choices. The concepts presented in this chapter will provide the basis for describing the techniques of modelling covered in Part II.

2.1 MODELLING IN HEALTH CARE FINANCING: FOCUS, CONTEXT AND PROCESS

2.1.1 Definitions

Models attempt to translate complex observations into simpler images in order to better understand reality. In science, a model is defined as "*an image of nature which stresses characteristics that are considered essential and ignores aspects that are considered to be non-essential. A model is ... a means to describe experienced reality ... and a basis for the prediction of future behaviour ... Models are built on the close interaction between hypotheses and observations*". An **economic model** is defined as "*a simplified image of real economic processes.*"[1]

Actuarial models are a combination of simplified images of natural processes that determine the numerical development of a population (e.g. births, deaths and migration). They also include images of human behaviour (e.g. labour force participation, or compliance with tax and contribution payment requirements) and simplifications of financial rules for the allocation of certain transfers to receiving population subgroups.

This book deals with **financial models**, and for our purposes, financial models are considered to have the above characteristics. We consider financial models to be a subgroup of the intersection between the set of economic models and the set of actuarial models. Financial models in the health sector are, in turn, a subgroup of the overall set of financial models. They describe the expenditure and financing of the national health care delivery system, or a subsystem thereof, and permit the projection of the future financial status of the system, provided that future income and demand resemble those assumed in the model. They provide a mapping of the complex interactions between financiers (contributors and taxpayers), third-party financial intermediaries (insurance schemes or the State), providers, and beneficiaries (patients) in the health sector.

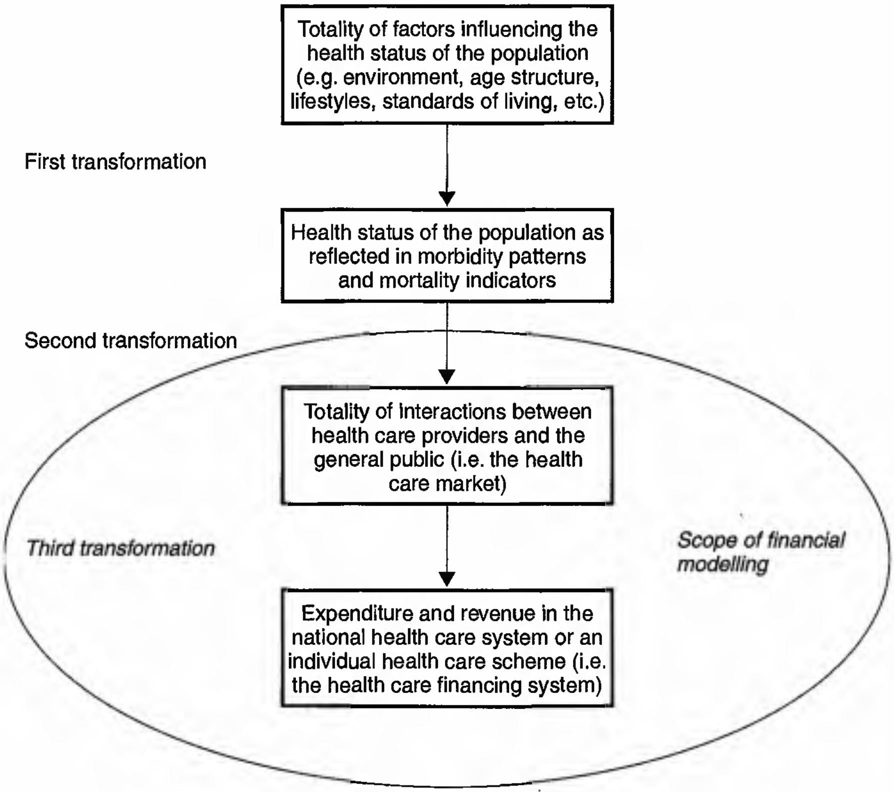
A **national health care delivery system** is a set of health care schemes that operates in a single country. A **health care scheme** is a body that organizes the delivery and financing of health care services for defined population subgroups (e.g. contributors and their dependents). Sometimes, two or more health care schemes may share a single delivery system, even though there is a line of demarcation between the schemes in terms of financing. This is the case, for example, in countries where social insurance schemes buy services from a public provider network. Financing rules determine who must contribute (or pay taxes, or pay private insurance premiums) and, hence, who is covered under the scheme. They also determine the volume and structure of resources that can be given to providers in exchange for their supply of services to the eligible population.

Throughout this book, health care schemes are often referred to as **health care financing schemes**. These schemes have a certain financial structure, which is mapped in accounts and statistics. Their financial structure is the consequence of the interactions between care providers, patients, financiers, and other agents that define processes and set standards in the health care market (e.g. the State).

2.1.2 Scope

A financial model maps the observed financial structure of the system or subsystem and projects this structure into the future, or simulates the effect of a change in a selected parameter or parameters. While financial models project and simulate behaviour, they generally do not make an effort to explain it. A financial model for the health sector could be used, for example, to estimate the total amount of expenditure for a component of the system, such as for ambulatory care. The general approach would be to assume that persons of different age groups would use a certain amount of services over a given period, and also to make certain assumptions regarding the development of prices over time. The multiplication of these utilization rates and unit costs

Figure 2.1 Three basic transformations in national health sectors and the scope of financial models



yields expenditure for each type of service analysed. These expenditure subtotals are then added to arrive at total benefit expenditure within the system or part of the system analysed.

Financial models generally do not attempt to explain *why* the covered persons have a need for or use the amount or type of health care goods and services they consume. That is, the model would not try to determine which environmental or lifestyle factors would trigger a certain development in morbidity, which would in turn trigger a need for a certain type of health care. This type of analysis belongs to the realm of epidemiological studies. Figure 2.1 shows the scope of financial modelling within the overall system of health care and medical care modelling, broadly by three types of transformations.

The first type of transformation translates all factors that determine health status in a given country or society into an observable model of health status within the population. This type of model is usually built by epidemiological experts, and seeks to link an observed overall health status or selected health indicators to a set of causes.[2]

The second type of transformation relates some or all health status indicators to actual transactions on the health care market. This transformation represents the link between epidemiological information and economic information concerning demand variables on the health care market. The demand for health care services reflects morbidity patterns, and the aggregate services (preventive, curative and rehabilitative) performed by health service providers. It should be noted that health policy often struggles with the question of how to assess and respond to demand variables. Demand variables obviously have an impact on the total level of expenditure of health systems. However, the relationship between goods and services offered by the medical profession and a certain status of health or ill health is complex, and is based on determinants that consider more than just the medical needs of patients. In fact, without developing this point fully here, we submit that demand variables may originate both from the supply side and the demand side of the health care market. Hence, even though they represent an important cause of expenditure on health services, demand variables and the assessment of their impact is outside the scope of this book, as the topic goes beyond health economics. The type of model represented by this second type of transformation is usually constructed by public health modellers analysing health resource use, in an attempt to determine which interventions by medical providers result or would result from a certain health status. At the same time, aggregate demand is also dependent on available resources, and on incentives or disincentives built into the health care financing system.

The fact that resource availability, not just medical science, has an impact on care provided has several implications for the third type of transformation typically performed by modellers. This is a mapping of the interactions on the health market in terms of their financial consequences. Such a mapping is the core of a financial model for health care. As mentioned earlier, financial models might also take into account changing resource availability and the possibility of behavioural shifts on the part of providers, triggered by technological shifts. In general, financial models only consider such factors at a fairly high level of aggregation – they are primarily dealt with in the second type of transformation, discussed above. A financial model would probably have to refer back to external models of health resource use in order to map technological and resource impacts with greater precision.

Therefore, if you are looking for a model to explain *why* a certain population subgroup shows a certain morbidity profile, it will not be found in this book. You should consult instead a book on public health models. This book will, however, answer questions such as:

- What would an observed portfolio of health services cost the system's financiers?
- How might these costs develop in the future?

- How might costs change with modifications to the benefit portfolio, price-setting arrangements or eligibility criteria for coverage under the system?

2.1.3 Focus

Financial models provide answers to questions such as "*How much would it cost, if...?*" or "*How much would we save, if...?*" These questions can be sweeping in scope, such as: "*How much would it cost workers, employers and taxpayers if we were to introduce a certain type of national health insurance scheme?*" They can also be on a much smaller scale, such as: "*How much would we save if we were to introduce higher co-payments for pharmaceuticals?*" These "how much" questions (HMQs) are the nucleus of financial modelling. They are normally answered in absolute terms (in currency units) and in relative terms (as a percentage of total taxable income, of contributions, or of GDP). Relative cost estimates generally have more explanatory power than absolute values. Example 2.1 portrays a typical HMQ, and the nature of its answers. We can discern in it the basic formula for all "how much" questions in any health financing scheme. A basic equation defines the central relative cost indicator, which allows all HMQs to be placed into a scheme-specific context.

Example 2.1 Demoland 1: A typical "how much" question in financial modelling

Demoland, a developing country, has a Social Health Insurance (SHI) scheme for its formal-sector workers, that is limited to the coverage of hospital care only. In the event of illness of a member of a covered family, these hospital charges would place a heavy burden on the budget of families.

Like many other developing countries, Demoland is now undergoing a difficult structural adjustment process, and the currency was devalued to preserve the competitiveness of Demoland's agricultural and industrial exports. As a result, the price of pharmaceuticals (which were all imported) skyrocketed in local currency terms. Government outpatient clinics and dispensaries formerly provided drugs free of charge to the public, including to insured persons – or at least those drugs that were available.

Due to the increase in prices and a contraction in GDP (and therefore in the tax base), the government has been forced to eliminate the provision of drugs for all but the poor and chronically ill. The government has requested that the SHI cover the cost of pharmaceutical supplies for insured persons. The SHI, in turn, has requested its modellers to establish a cost estimate.

The modellers have established an estimate for the next five years, the results of which are summarized in the following table. They estimate that the new benefit would initially cost about 1.05 billion Demoland Currency Units (CUs), and that these costs would increase over the next five years to 2.18 billion CUs. (We will not concern ourselves at this point with how the modellers arrived at this estimate – it will become clear in chapters 5 and 6.) These figures "speak" to the modellers and the budget experts of the SHI, but they do not necessarily speak to policy makers or to the general public.

One could easily use the figures obtained to argue that the new benefit is too expensive. In fact, however, to pay for the new benefit, an increase in the pay-as-you-go contribution rate of the scheme by about 1.05 percentage points would be necessary in 1998. Another point is that pharmaceutical costs are expected to rise more quickly than the costs of other benefits. It is expected that the net increase of the contribution rate exclusively attributable to the introduction of the new benefit would be 1.38 percentage points in 2002. Assuming that the contribution rate is now equally shared between the employers and workers, the additional burden might be acceptable to the social partners in view of the fiscal trouble of Demoland's government.

Table E2.1 Cost estimate for the coverage of pharmaceuticals in outpatient care (all figures CU bn, except as indicated)

	1998	1999	2000	2001	2002
SHI expenditure					
Present benefits	7.00	7.70	8.47	9.32	10.25
New pharmaceutical benefit	*1.05*	*1.26*	*1.51*	*1.81*	*2.18*
Administrative cost	0.40	0.45	0.50	0.56	0.62
Total expenditure	8.45	9.41	10.48	11.69	13.05
SHI revenues					
Total insurable earnings	100.00	112.00	125.44	140.49	157.35
Income from co-payments	0.35	0.39	0.42	0.47	0.51
Government subsidies	0.42	0.44	0.45	0.46	0.48
Contribution income (PAYG financed)	7.68	8.59	9.61	10.76	12.06
Total income	8.45	9.41	10.48	11.69	13.05
Old required PAYG contribution rate (%)	**6.63**	**6.54**	**6.46**	**6.37**	**6.28**
New required PAYG contribution rate (%)	***7.68***	***7.67***	***7.66***	***7.66***	***7.66***

The basic formula

We assume that all health care financing schemes are financed either by contributions (to public or private insurers) or by taxes. Given this assumption, the pay-as-you-go cost rate of any health care scheme providing a defined package of health care benefits and encountering administrative costs can be expressed as:

(Formula 2.1)

$$\mathrm{PAYGR(t)} = \frac{\mathrm{TBE(t)} + \mathrm{AC(t)} - \mathrm{OI(t)}}{\mathrm{TTB(t)}}$$

where, for year (or other period) t:

PAYGR(t) = Pay-as-you-go cost rate of the scheme (this could be the pay-as-you-go contribution rate, or the tax rate which would need to be levied on the tax or contribution base)

TBE(t) = Total benefit expenditure

AC(t) = Sum of administrative and other non-benefit costs
OI(t) = Income from sources other than contributions or taxes (e.g. from the investment of contingency reserves)
TTB(t) = Total tax (or contribution) base for the financing of the scheme (e.g. total insurable earnings of the insured population, if the scheme is financed by contributions; total tax base of the government, if the scheme is financed by general revenues; total income tax, if the scheme is financed from earmarked taxes on income; etc.)

Formula 2.1 yields the contribution rate or tax rate which is considered to be theoretically adequate to cover expenditure for a given year (or other period of defined length). For insurance schemes, the actual contribution rate charged or fixed for the period would normally be calculated on a slightly different basis, to allow for a safety margin in case of fluctuations in benefit expenditure. The formula also describes the financial equilibrium of the system, where the income and expenditure of the scheme are equal. In the case of a scheme financed through general taxation revenues, the formula holds true automatically because the tax rate merely reflects expenditure, which is normally defined by available tax resources. In insurance schemes, the formula defines the contribution rates that must be charged (ignoring changes in reserves). The required contribution rates in Example 2.1 were calculated using this formula.

2.1.4 The context of financial modelling in health care

Before a "how much" question can be answered using any model, the modellers must understand how the respective health care scheme or system operates. They must have a notion of the mechanisms whereby the need for medical services is translated into actual expenditure under the scheme. (Most of this process is explained in Issue Brief 1, which summarizes some basic concepts of health economics.)

One might be inclined to assume that the consumption of health services depends on the health status of the population. However, a closer look reveals that the story is more complex. Box 2.1 explains the nature of the relationship between external factors and health status.

It is unlikely that the complex interactions between environmental factors, standards of living, the general health status of the population and expressed and financed demand for health care will be modelled in full detail by any financial model. Nevertheless, modellers must identify quantifiable influencing factors, and make an effort to model these – leaving other factors unspecified, and therefore implicit.

A closer look at the interdependence between external factors and health status (as discussed in Box 2.1) shows that most determining factors are related,

Box 2.1 Determinants of health

Several factors are at work in producing the great variability in health status observed across population groups. These factors include:

- income levels and poverty
- education, especially of girls and women
- food, water and sanitation
- cultural and social factors
- health-related policies and interventions.

Income and poverty levels – because of their implications for adequate nutrition, housing and access to services such as clean water, sanitation, primary education and basic health care – remain a powerful determinant of good health. The health of millions of people has benefited greatly from improvements in income in many Asian and Latin American countries during recent years. The health of others, such as populations in many sub-Saharan African countries, continues to suffer as a result of persistent economic difficulties.

Education is good for health – especially in the case of girls and women. This has been observed, for example, in China, Costa Rica and Sri Lanka. Educated individuals more readily adopt healthier lifestyles, learn to make more efficient use of scarce resources such as food and health care, and avoid health risks caused by the use of tobacco, alcohol and illicit drugs. In most countries, norms regarding childbirth and child care, the status and abuse of women, personal hygiene, and sexual behaviour exert powerful influences on health, and are deeply rooted in the local culture.

Public policies that promote healthy environments and lifestyles, along with regulations against dangerous or unhealthy activities by individuals and organizations, enhance the achievement of good health. Examples of successful policies include reducing pollution in India, limiting the use of tobacco, alcohol and drugs in Indonesia, making road travel safer in Mexico, improved water and sanitation systems in Turkey and gun control in the United Kingdom.

Finally, people fall ill and die prematurely in all societies and at all levels of income and education. Health services are needed to provide specific preventive intervention and treatment, even in the world's poorest countries.

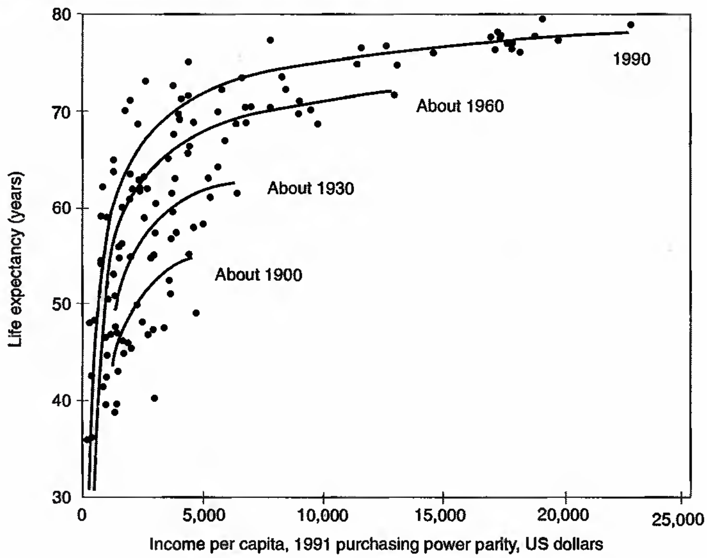
In public health models, the burden of ill health – including *mortality and morbidity* (M) – in any population is sometimes defined as the product of *incidence* (I) times the *case-fatality rate* (CFR, for mortality) or *duration and severity of illness* (D, for morbidity). Incidence represents the number of new cases in the population within a specified time frame, usually one year. The case-fatality rate is the rate of death among those with an established disease. Morbidity may persist, diminish completely, or become more severe:

$$\mathbf{M = I \times CFR\ (or\ D)}$$

Incidence may be affected by a wide variety of *risk factors*. For example, malnutrition and vitamin A deficiency increase the incidence of childhood measles, and smoking increases the incidence of cancer, heart disease and stroke. More broadly, incidence is also affected by determinants such as income, education and social class. Poor groups, for example, generally have a much higher incidence of most diseases than do rich groups.

The case-fatality rate may be affected by *access to preventive and curative health services* that can prevent deaths or reduce morbidity. Antibiotics, for instance, prevent deaths from acute respiratory infection in childhood, while low-cost deworming agents reduce morbidity from intestinal worm infection. Some risk factors also affect the case-fatality rate and morbidity – for example, malnutrition increases the case-fatality rate among children with acute respiratory infections. Income, education and other determinants may affect case-fatality rates or morbidity through access to health services.

Figure B2.1 Income levels and life expectancy



Because of the complex synergies that exist among factors such as income levels, education, behaviour, public policy and health services, people all over the world live almost 25 years longer today than they would have at similar relative income levels in 1900 (see figure B2.1). Improved knowledge, accompanied by better access for individuals, families and communities to a continually expanding armoury of effective and affordable intervention methods, has contributed significantly to reducing illness and injury. The chances of suffering chronic disability or death as a result of illness or injury has also decreased. To illustrate: in 1990, Chile's real income was very close to that of the United States in 1900; yet while life expectancy in Chile in 1990 was 71 years, that of the United States in 1900 was only in the high 40s.

Source: World Bank

directly or indirectly, to average income. High income levels have a clear positive effect on health status. We can assume that there is a relationship between health status and health care consumption, even if marginal benefits decline at higher consumption levels. It is also obvious that there is a relationship between income and the amount and intensity of health services consumed. Health status determines the need for health services in all cases, but it does not necessarily determine actual demand for health services, because poor people simply might not have the means to satisfy their need for care. These points have two implications for the financial modeller. First, it can be assumed that utilization rates are related to income levels. This relationship can be expressed by means of an income elasticity of demand for health care. Second, this elasticity is not constant at all levels of income, but rather is higher at low income levels. Potential demand is high among persons with low incomes, because their health status is poor. As more resources become available for health care through higher incomes, the increase in utilization is greater than at higher income levels, where most of the potential demand is already satisfied. For most financial models, it might be sufficient to model the impact of health status on demand for care implicitly, by making explicit assumptions concerning the income elasticity of utilization.

Another identifiable factor that drives health care consumption is age. Populations of different age groups have different health statuses, and therefore different health needs and consumption – provided they are able to finance that consumption. The ability to finance consumption depends largely on the benefit provisions of the health care financing system (e.g. the social health insurance scheme or the national health service). The consumption differentials between population subgroups can generally be determined through statistical analysis. For the modeller, this means that if the population structure of the scheme in question were to change, aggregate demand for services would change. Whether the actual amount and structure of services delivered would in fact change depends to some extent on the capacity of the health care delivery system. Thus, the population structure and the capacity of the delivery system are important factors which are likely to influence expenditure.

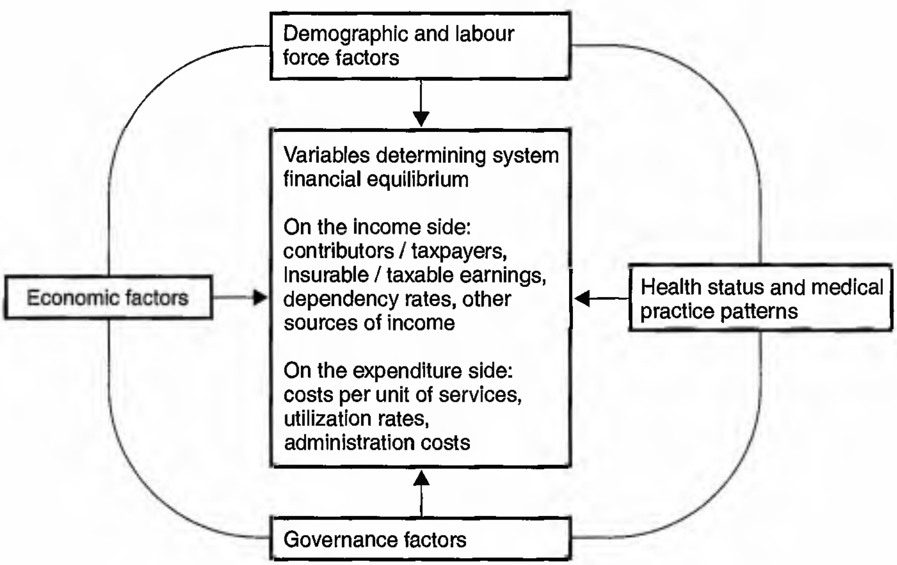
The income side, on the other hand, is determined to a large extent by the number of contributors or taxpayers, and their average insurable earnings. The financial equilibrium of a health care financing system is directly affected by developments in the economic environment of the scheme. For example, if GDP and employment contract, one would expect the number of contributors or taxpayers to contract as well, and not necessarily with an equivalent contraction in the number of covered persons. Many social insurance schemes cover the unemployed and their families free of charge, which means that shrinking employment might, in the short run, have little or no impact on expenditure levels, even though the income of the scheme would shrink. A contraction in GDP might also lead to lower per capita insurable earnings, which would again have a negative impact on the overall income of the scheme.

The above discussion does not represent a full list of factors influencing the financial equilibrium of a health care financing scheme. However, they do illustrate effectively that health care financing does not operate in a social and economic vacuum. Health care modellers need to identify the factors that influence the financial equilibrium, translate them into concrete model variables, and build them into the model. The factors that influence the financial equilibrium can be grouped roughly into four categories:

- *demographic and labour force factors*, such as developments in the total population, the population structure, and the economically active population
- *economic factors*, such as employment, wage and income levels, as well as prices and interest rates
- *factors affecting health status, medical technology and medical practices*, such as certain morbidity rates or the availability of certain medicines and technologies
- *governance factors*, such as decisions on eligibility for coverage under the scheme and on the range of benefits to be provided to the covered population, and the effectiveness with which contributions are collected.

Figure 2.2 is a schematic representation of a health care financing model. It illustrates the interconnection of the health care financing system with its

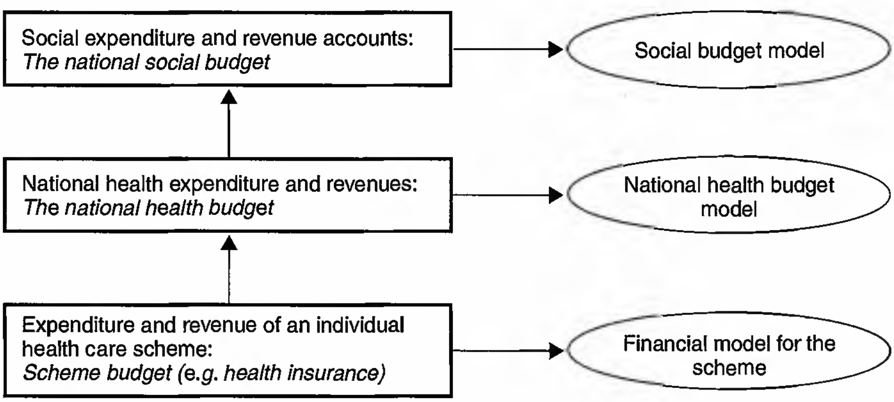
Figure 2.2 The financial equilibrium of a health care financing scheme and its determining factors



economic, social, demographic and governance environment. The figure shows financial equilibrium as the core of the system, while environmental variables feed into the calculation of the equilibrium, according to Formula 2.1 (see page 15). This figure is a simplification, and does not attempt to portray all the interactions between the influencing factors. It is obvious, for example, that economic development has an impact on the average income per family. Epidemiological evidence also indicates that the level of income has an impact on the utilization of health services, which in turn has an impact on health status. Other interdependencies between environmental factors can easily be found.

Models of health financing schemes also have a social accounting context. Just as each health care financing scheme is one component of a national health care financing system, the financial model of the scheme is one component of the model for national health expenditure and revenue. The latter could be called a national health budget model. Similarly, the national health system is one component of the national social protection system, which encompasses all provisions that provide social benefits to the population. National health expenditure and revenues are therefore a component of national social expenditure and social expenditure financing. The national health budget model is also a component of the national social budget model, if one exists. A national social budget is a compilation of all national social expenditure and revenues available for the financing of these expenditures.[3] Social expenditure includes, inter alia, expenditure on pensions, health care, short-term cash benefits, unemployment benefits and social assistance. Figure 2.3 illustrates the modelling hierarchy in the health and social sector. This is followed by Example 2.2, which continues the Demoland exercise. Here, we place the Demoland SHI into the context of national health and social expenditure.

Figure 2.3 The hierarchy of models and accounts in social protection and health care



2.2 THE DUAL PROCESSES OF HEALTH POLICY DESIGN AND MODELLING

In this section, the relationship between financial modelling and health policy is illustrated. First, we discuss the *raison d'être* for models: their role as a tool for sound governance. Second, we turn to the interaction between the modelling process and health policy formulation.

2.2.1 Models as tools of governance

Modelling is never an end in itself. As demonstrated by Example 2.2, financial models have two major uses: (a) they can serve as an early warning system for

Example 2.2 Demoland 2: The Social Health Insurance system in its accounting environment

The modellers in Demoland have also been asked to extend their calculations beyond the boundaries of the SHI to analyse the effect of the proposed changes in the financing of pharmaceutical benefits on the national health and national social budgets. Demoland is a developing country with a relatively fast-growing economy, where the formal-sector SHI covers only about one-third of the population. Consequently, the national health budget is still dominated by the tax-financed National Health Service, which still serves the majority of the population, even if its per capita benefit expenditure is more modest than that of the SHI. Demoland's national health and national social budgets have fairly typical structures.

The results of these extended analyses are displayed in the accompanying tables. Tables E2.2a and E2.2b show the results of a simulation of the national health budget – first under status quo conditions, and then with the simulation of the system under the new benefit provisions. Table E2.2c shows the effect of both the status quo projection and the simulation of the new provision on the overall national social budget.

Effects on the health budget. The health budget exercise reveals some interesting points. In the first year, the changes to the system merely lead to a shift in expenditure from the National Health Service (financed through taxation) and the SHI. The effect is that the overall burden on the government for the financing of the health sector drops by about 0.2 per cent of GDP, compared to the status quo projection. This potential saving remains approximately constant throughout the projection period. While the government saves, contributors pay more – but to some extent they save as well, since their co-payments for government-supplied drugs are lower. (It is assumed that the cost of pharmaceuticals for covered persons is now fully covered by the new social insurance benefit.)

However, the net additional burden on the SHI contributors in the final projection year equals 0.4 per cent of GDP (if we also take into account the decrease in out-of-pocket outlays). The difference between government savings and the net additional burden on the contributors is caused by an overall increase of health care costs by 0.2 per cent of GDP, as compared to the results of the status quo projection. This is because the estimated cost to the SHI for the new pharmaceutical benefit increases faster than under the status quo projection, where the benefit was provided by the government. The previous government calculation of the cost of the pharmaceutical benefit includes the assumption that the government would simply "cap" the expenditure. "Capping" expenditure means that there would either be some shortages of pharmaceuticals in outpatient clinics and health centres, or the government would succeed in reducing the price of pharmaceuticals. Under the first alternative, shortages would have to be met either through out-of-pocket outlays or through simple non-consumption (which would have an obvious negative impact on health status). Success of the government in reducing prices under the second alternative, meanwhile, would imply that the cost management efforts of the health insurance scheme are less effective than those of the government (i.e. of the Ministry of Health).

Effects on the social budget. The social budget exercise indicates the same savings for the government as the national health budget, and the increase in overall social expenditure is equal to the increase in the national health budget. This assumes, however, that the new policy will have no effects on other social benefits, such as pensions, short-term benefits, unemployment benefits, or social assistance. For the social policy planner, the social budget exercise reveals some interesting insights. For example, pension expenditure would increase more rapidly than health expenditure. This calls for a closer analysis of pension expenditure. If benefit provisions are overly generous, one could probably find a way to make some savings and thus avoid an increase in overall social expenditure. Perhaps an increase in overall social insurance contribution rates for employers and workers could also be avoided or kept to a minimum.

Table E2.2a SHI Demoland: Status quo projection

National health budget exercise	Status quo projection (CU bn, except as indicated)				
	1998	1999	2000	2001	2002
Health expenditure					
Total expenditure of SHI (old)	7.40	8.15	8.97	9.87	10.87
Expenditure of National Health Service	20.00	21.20	22.47	23.82	25.25
Private insurance	0.74	0.78	0.82	0.86	0.90
Employer-based care	1.50	1.58	2.50	2.63	3.50
Total health expenditure	29.64	31.70	34.76	37.18	40.52
Health sector revenues					
Social security contributions	6.63	7.33	8.10	8.95	9.88
Private insurance contributions	0.74	0.78	0.82	0.86	0.90
Imputed employer contributions	1.50	1.58	2.50	2.63	3.50
Out-of-pocket outlays	0.70	0.77	0.85	0.93	1.02
General revenues	20.07	21.25	22.50	23.82	25.21
Total revenues	29.64	31.70	34.76	37.18	40.52
Total expenditure (% of GDP)	8.80	**8.96**	**9.35**	**9.53**	9.89
Government financing of health care (% of GDP)	**5.96**	**6.01**	**6.05**	**6.10**	**6.16**
GDP (CU bn)	337.00	353.85	371.54	390.12	409.63

Table E2.2b SHI Demoland: New benefit simulation

National health budget exercise	New benefit simulation (CU bn, except as indicated)				
	1998	1999	2000	2001	2002
Health expenditure					
Total expenditure of SHI (new)	8.45	9.41	10.48	11.69	13.05
Expenditure of National Health Service	18.95	20.09	21.29	22.57	23.92
Private insurance	0.74	0.78	0.82	0.86	0.90
Employer-based care	1.50	1.58	2.50	2.63	3.50
Total health expenditure	29.64	31.85	35.09	37.74	41.37
Health sector revenues					
Social security contributions	7.68	8.59	9.61	10.76	12.08
Private insurance contributions	0.74	0.78	0.82	0.86	0.90
Imputed employer contributions	1.50	1.58	2.50	2.63	3.50
Out-of-pocket outlays	0.35	0.39	0.42	0.47	0.51
General revenues	19.37	20.52	21.74	23.03	24.40
Total revenues	29.64	31.85	35.09	37.74	41.37
Total expenditure (% of GDP)	**8.80**	**9.00**	**9.44**	**9.67**	**10.10**
Government financing of health care (% of GDP)	**5.75**	**5.80**	**5.85**	**5.90**	**5.96**
GDP (CU bn)	337.00	353.85	371.54	390.12	409.63

Table E2.2c SHI Demoland: Effect of new benefit on national social budget

SHI Demoland	National social budget exercise (CU bn, except as indicated)				
(old) = status quo projection (new) = new benefit simulation	1998	1999	2000	2001	2002
Social expenditure					
Total social health expenditure (old)	29.64	31.70	34.76	37.18	40.52
Total social health expenditure (new)	*29.64*	*31.85*	*35.09*	*37.74*	*41.37*
Pension expenditure	34.00	37.40	41.14	45.25	49.78
Social insurance	27.20	29.92	32.91	36.20	39.82
Second-tier (employer-based)	6.80	7.48	8.23	9.05	9.96
Short-term benefits	6.00	6.30	6.82	6.95	7.29
Unemployment benefits	5.00	4.95	4.91	4.86	4.81
Social assistance	4.00	4.20	4.41	4.63	4.86
Other	3.00	3.18	3.37	3.57	3.79
Total current social expenditure (old)	81.64	87.73	95.20	102.44	111.05
Total current social expenditure (new)	*81.64*	*87.88*	*95.53*	*103.00*	*111.90*
Social sector revenues					
Social security contributions					
Health insurance (old)	6.63	7.33	8.10	8.95	9.88
Health insurance (new)	*7.68*	*8.59*	*9.61*	*10.76*	*12.06*
Pension insurance	23.80	26.18	28.80	31.68	34.85
Unemployment insurance	5.50	5.45	5.40	5.34	5.29

Table E2.2c (Continued)

SHI Demoland (old) = status quo projection (new) = new benefit simulation	National social budget exercise (CU bn, except as indicated)				
	1998	1999	2000	2001	2002
Social sector revenues (continued)					
Private insurance contributions					
Health insurance	0.74	0.78	0.82	0.86	0.90
Pension insurance	3.40	3.74	4.11	4.53	4.98
Imputed employer contributions					
Health insurance	1.50	1.58	2.50	2.63	3.50
Pension insurance	3.40	3.74	4.11	4.53	4.98
Out-of-pocket outlays (old)	0.70	0.77	0.85	0.93	1.02
Out-of-pocket outlays (new)	*0.35*	*0.39*	*0.42*	*0.47*	*0.51*
General revenues (old)	35.97	38.18	40.52	43.01	45.65
General revenues (new)	*35.27*	*37.45*	*39.76*	*42.22*	*44.84*
Total income (old)	81.64	87.73	95.20	102.44	111.05
Total income (new)	*81.64*	*87.88*	*95.53*	*103.00*	*111.90*
Total social expenditure (% of GDP, old)	**24.23**	**24.79**	**25.62**	**26.26**	**27.11**
Government financing of social protection (% GDP, old)	**10.67**	**10.79**	**10.90**	**11.02**	**11.14**
Total social expenditure as % of GDP (new)	***24.23***	***24.84***	***25.71***	***26.40***	***27.32***
Government financing of social protection (% GDP, new)	***10.47***	***10.58***	***10.70***	***10.82***	***10.95***
GDP (CU bn)	337.00	353.85	371.54	390.12	409.63

potential future financial problems; and (b) they can be used to explore the financial effects of alternative policy options. The latter aspect is of particular importance, since real-world experiments in the realm of social policy (unlike many other fields of inquiry) are often unacceptable from an ethical or financial point of view. Models are therefore an instrument of governance, a supporting tool for policy makers – no more, no less. This theme runs throughout this book. It is one of our main messages.

The ultimate objective of all financial modelling in health care is to support policies to improve the effectiveness or efficiency of national health care delivery systems. Improving the **effectiveness** of the national delivery system is synonymous with achieving health gains. Enhanced **efficiency** is achieving these gains at the lowest possible cost, or maximizing the output for a given level of inputs. While the efficiency objective might be pursued singularly by governments in financial distress, the effectiveness objective should never be pursued in isolation from the political, economic and demographic environment in which the system operates. All national social policies, and hence all national health policies, operate under financial, fiscal and political constraints. Financial resources are always limited, and political constraints might include preferences for certain types of health care delivery or financing systems which cannot always be explained according to the efficiency or the effectiveness criteria. Some countries in Central Europe, for example, maintain expensive forms of social insurance systems, despite evidence from other European countries that a national health service would achieve the same or similar health outcomes at a lower level of spending. This is clearly a political choice, determined by an implicit political negotiation process between the general public, the government and health care providers.

Within its financial, fiscal and political constraints, however, every health care system should operate at the highest possible level of efficiency – i.e. it should achieve the greatest possible health gains given these constraints. Monitoring the efficiency of a large financial transfer system, such as a health care system, requires costing. Costing, as we have seen above, requires modelling.

2.2.2 Health policy design and the modelling process

Models need clear mandates. This means that the question(s) that models answer need to be clearly formulated. Financial models answer "how much" questions (HMQs), but these can only be asked if the subject of analysis is clearly defined. One policy option for analysis could be to take no action – the objective of this policy would be to maintain the current state of affairs, in which case the model would simply map the status quo. Another option could be to formulate a new health policy objective, with a defined strategic approach for implementation. This would require a different modelling approach. Thus, before the modelling process can begin, the goals of national health policy and a strategy for their implementation must be determined, within the given set of constraints. The nature and design of the model is determined by the health policy to be pursued, including its goals and strategies.

The ultimate, long-term objective of all national health policies should be to improve the health status of the population. This objective must be broken down into a number of lower-level, short-term, concrete objectives. One objective might be to reduce the morbidity and mortality attributable to certain types of illnesses. This requires medical action, to be taken within the health care delivery system. When the nature of such action has been determined, financial models will answer the associated HMQs (e.g. how much the planned course of action will cost the contributor or taxpayer). Another health policy objective could be to achieve a certain level of health with the least possible resources. Again, financial models can be used to determine a possible level of savings – that is, to answer the associated HMQ. Still other health policy objectives could simply involve reducing expenditure or increasing the resources available for health care. The first of these might not be a desirable objective in and of itself, but given the fiscal constraints in many countries, health policy makers will often be confronted with the simple request to find ways to reduce expenditure. In this case, too, the need for a financial model is obvious.

Health policy design and modelling are interactive, parallel processes in any responsible government. They proceed in a series of six steps which are listed below, of which steps 3, 4 and 5 may have to be repeated in an iterative process.

- ***Step 1: Formulating a health policy goal.*** The process starts with the definition of a health policy goal – for example, to reduce government expenditure on health care without reducing the overall resource base for the sector, and therefore without creating negative effects on the health status of the population.
- ***Step 2: Modelling the status quo.*** The defined goal indicates the nature of the model that is needed. In Step 1, a model for the entire national health financing system (a health budget) would have to be built. The modelling process begins with the construction of a model of the status quo of the health care financing system – just as the modellers of Demoland did in Example 2.2. The status quo model serves as a reference point for subsequent simulations

Box 2.2 The World Bank guide to health policy design

The World Bank has also developed more elaborate guidelines for health policy design procedures, which are presented in Box 2.2.
The identification of crucial policy questions, as a prerequisite for sound modelling, requires that each of the following ten dimensions be addressed during the policy design process.[4] Each of the dimensions is followed by a set of key questions:

1. *Underpinning economic and sectoral analysis.* Key macroeconomic and health care sector issues need to be identified.

- Has a coherent macro framework been elaborated, in documents such as national development plans, a country assistance strategy of the World Bank or the WHO, or a policy framework paper (PFP) of the IMF?
- Is the health sector indicated as a priority in these frameworks?
- Do the underlying political, social, economic or institutional contexts have an impact on the health sector, or vice versa?
- Are there underlying macroeconomic distortions that need to be addressed before progress can be made in addressing sector-specific issues?
- Are there flaws in the macro framework that need to be corrected?

2. *Objectives.* There should be a clear definition of health policy objectives.

- Are there clear objectives that can be linked to the underlying economic and sector analysis of key issues that need to be addressed?

3. *Analysis of alternatives.* In order to achieve the objectives defined, the major alternatives must be identified. For example, available policy options may

include supply-side interventions, changes with regard to demand-side beneficiaries, or policies affecting the competitive environment.

- Have a full range of alternative approaches been considered for improving health outcomes, including investments outside the health sector?
- Is a multi-sectoral approach required?
- Has a least-cost analysis been made of the major alternative strategies and design options?
- Has an assessment been made of the impact on demand (i.e. potential winners and losers)?

4. *Assessment of fiscal impact.* The potential fiscal impact and affordability of the major alternatives must be analysed.

- Have the fiscal and macroeconomic implications (impact on the total tax burden, public debt, inflation, economic growth and labour markets) been explored through economic modelling and financial projections of revenues and recurrent expenditures?
- Has an analysis been made of fiscal and private affordability of both government and private financing arrangements?

5. *Assessment of the distributional impact on poverty groups.* Each possible alternative should be examined for its impact on the poor.

- Has there been an assessment of the distributional effects on poverty groups of the policy options and alternative interventions under consideration?
- Has there been an assessment of targeting techniques?
- What are the effects of risk pooling and user charges on the poor?

6. *CEA, CUA, CBA.* The major alternatives should be subjected to cost-effectiveness, cost-utility or cost-benefit analysis.

- Can the operation of the health sector or its components be analysed using CEA, CUA, or CBA?
- Have all relevant costs, effects and benefits been quantified?
- Are demand and non-governmental supply functions included in the analysis?
- Are there ways to avoid repeating analyses by using best-practice examples?

7. *Sensitivity and risk analysis.*

- What is the likely impact on health sector outcomes of changes in certain underlying parameters, such as inputs, demand and costs?
- Which are the main risk factors – e.g. political instability, institutional resistance and changes in ownership?

8. *Sustainability.*

- Has there been an assessment of the political, social, institutional, financial, and environmental factors which might impact on the sustainability of the proposed operation?

- Is there political commitment and ownership?
- Is the proposed intervention compatible with cultural factors?
- Does the sector have the managerial capacity to execute the proposed activities?
- Is there a stable and adequate source of financing to sustain recurrent costs?
- Are there any anticipated environmental consequences, such as medical waste?

9. *Performance criteria*. There should be criteria which allow monitoring and evaluation according to success of the policy in meeting the defined objectives.

- What are the key economic performance indicators which will be used to track progress of the proposed operation(s)?
- Is there a counterfactual which provides a baseline for monitoring?

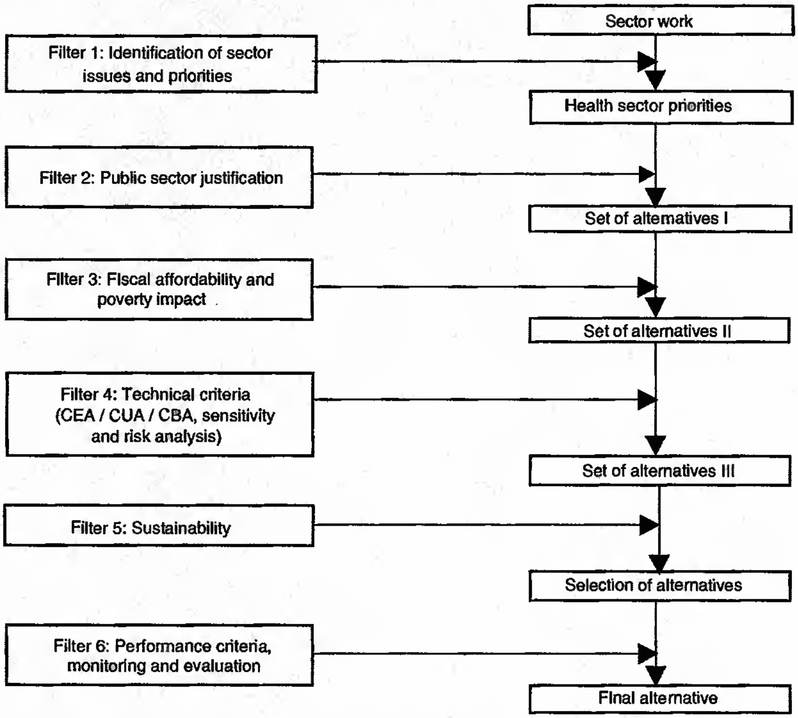
10. *Overall coherence and completeness analysis*.

- Are the overall conclusions from the economic and financial analysis consistent with the broad health-sector policy framework for the country in question?

Often, there will be conflicts in the conclusions reached after analysing the first nine dimensions. Therefore, after completing the assessment of the first nine dimensions, it is important to step back and review the findings before making any final decisions. A number of alternative policies may be considered during the design process. The following is a checklist of selection criteria which may be useful in narrowing down the alternatives in the final stages of analysis. The list is followed by a schematic, algorithmic representation of the health policy design process:

a. Eliminate all options that are not consistent with the macro framework, and for which there is no compelling justification for public-sector involvement (or restrict involvement for any such options to providing information and establishing an appropriate regulatory framework).
b. Eliminate all options that do not allow for clear, monitorable objectives.
c. Eliminate all options that are not fiscally affordable.
d. Eliminate all options that do not favour poor or vulnerable population groups.
e. Eliminate all options that are not cost effective, or that have a high cost-benefit ratio relative to other alternatives.
f. Eliminate all options where the risks far outweigh the possible benefits.
g. Eliminate all options that are unlikely to be sustainable.
h. Exercise great caution in pursuing activities for which a counterfactual cannot be established, or for which performance indicators cannot be quantified.

Figure B2.2 Algorithm of critical decisions in policy design



It is obvious that financial modelling can directly assist in the analysis of five of the ten dimensions listed above (dimension nos. 4 and 6–9). Models are thus a crucial "filter" in the policy design process.

Source: World Bank Human Development Network

of policy alternatives. The construction of a status quo model is a key element in the modelling process.

- *Step 3: Identifying specific policy options.* In order to achieve the general goal, a specific policy option or set of options must be identified. In the Demoland examples, the partial shift of financing for pharmaceuticals to the SHI was identified.
- *Step 4: Modelling the policy measure.* The modellers map the policy measure(s) by modifying the status quo models. The potential impact of policy measures is identified by comparing status quo results with the results of the model as modified to reflect the suggested policy. The results of the model are referred to policy planners and policy makers.

- ***Step 5: Analysing the results.*** The policy makers analyse the results of the modelling exercise. Two outcomes of the analysis are possible:
  a. Policy makers accept the measure(s). The implementation process may begin.
  b. Policy makers reject the measure(s). The process reverts to step 3.
- ***Step 6: Implementation.*** This marks the end of the parallel policy design and modelling processes. Regulations and laws are drafted and shepherded through the political decision-making process. Once the measure is in effect, the model results should be used to monitor whether the measure produces the predicted results.

2.3 MODEL LIMITATIONS AND THE LEARNING PROCESS

Models only provide a mapping of observed reality. Due to the complexity of the subject, a complete image of the characteristics and the behaviour of the modelling object will not be achieved. Financial models are usually particularly weak in mapping unprecedented events, such as sudden technology shifts or a rapid fall in the number of contributors and taxpayers due to a sudden economic downturn. In other words, all models are prone to error, a fact that needs to be recognized and built into modelling procedures. A model is not a crystal ball; it does not predict the future. Rather, models *project* a possible future state on the basis of observations and assumptions on future conditions.

Actuaries play a key role in modelling by analysing present data and legislation, and by projecting future outcomes based on various assumptions. They recognize the uncertain nature of projecting future outcomes by establishing repetition routines. Such routines are part of the financial management and planning process for any benefits scheme; they simply prescribe that the actuarial valuations of a scheme be repeated at certain intervals. In the case of long-term benefits schemes, such as pension schemes, these intervals are usually three years. However, a pension scheme would usually exhibit much more stable financial development, due to the greater predictability of its expenditure and revenue levels. In health care schemes, where financial developments are much more volatile for a variety of reasons, the repetition intervals should be shorter; they are usually set at one year. The occasion of repetition could be, for example, the annual budget exercise of a health insurance scheme, during which the contribution rate for the next few financial years is determined. Intervals might be shorter, as well. Quarterly or short-term projections would not be unusual for health care schemes.

Each new projection must be based on new data. This is when the deviation of the projected results from the observed financial situation of the scheme or system should be compared. Systemic deviations between the model image and observed reality should be identified, and (to the extent possible) abolished. Another ground rule in modelling is that models are never final – they can and should always be improved. It is important to keep models in a constant process of modification based on experience and additional information; otherwise, they will soon become obsolete. Modelling is not an event, it is a process.

2.4 SUMMARY

Modelling is a tool that uses quantitative techniques to facilitate the understanding of a complex situation such as that in the health sector, with its myriad demographic, economic, and political factors. A model attempts to present a simplified explanation of reality, causes and effects, in order to predict the future effects of certain causes or interventions. There are a variety of models relevant to the health sector, including financial, national health budget, and social budget models. Modelling will prove useful to policy- and decision-makers in the health system because it can be used at the national level to determine the distribution of scarce resources, or the amount of expenditure on the national health care delivery system. It can also define expected revenues for individual health care schemes, as well as the expected outflow of expenditure under certain conditions. It is within this context that health modelling can affect health policy. The role of modelling in the process of formulating health policy is summarized in Box 2.3.

The modelling process and choices made based on it will only be as good as the precision of the model and quality of the data. Because data is often sparse, inaccurate or incomplete – or all of these – models must be refined over time, as the quality and availability of data improves. As models are refined and improved, the confidence placed in the results of the modelling will increase as well. Chapter 3 reviews the issues of health care financing, which is the object of modelling.

Box 2.3 Steps in health policy design and the modelling process

Step 1: Formulating a health policy goal
Step 2: Modelling the status quo
Step 3: Identifying specific policy options
Step 4: Modelling the policy options
Step 5: Analysing the results of the modelling
Step 6: Implementing the policy option chosen

Notes and references

[1] *Brockhaus Enzyklopädie*, vol. 24.

[2] Most models actually show the correlation between certain determining factors and an observed health status, for example, the presence of a nuclear reactor (and a correspondingly higher level of radiation) and the prevalence of leukaemia. It should be noted that a correlation factor, even a high one, is a necessary but not sufficient condition for causality.

[3] Wolfgang Scholz, Krzysztof Hagemejer and Michael Cichon, *Social budgeting* (Geneva, ILO, forthcoming).

[4] Alexander Preker, L. Brenzel and A. Rattu, *A conceptual framework for project and economic analysis*, HD Network Publication on Health, Nutrition, and Population, Washington: World Bank, 1998.

3 THE MODELLING OBJECT

A country's health system has an effect on its economic growth and labour productivity. This is because the health status of the population affects the work force, which is an important factor in determining its productivity. Productivity, in turn, has a strong influence on economic growth. At a time of rising incomes, ageing populations and urbanization in most countries, the functioning of the health system will have a significant impact on society and its general well-being. Many factors relating to health care services will have a significant impact on morbidity and mortality patterns – these include the type of services provided (preventive, primary care, curative care, etc.), the quantity and quality of these services, the method of their distribution, and the extent of their accessibility by the population. Financing is a critical element determining the quantity, distribution and quality of health services. Financing also has an enormous effect on operational efficiency, and the ability to provide necessary health services according to need rather than ability to pay. Therefore, governments have considerable means to influence the health status of their citizens through their choice of health financing policies.

This chapter describes the *object* of modelling national health care financing systems. (The models themselves will be elaborated in later chapters.) The bases on which models are built will be examined, i.e., statistics on finance and delivery systems and the various accounts which map the financial structure of the system. Before models can be built, a full understanding of the operation of the modelling object is necessary. We will therefore explore the basic characteristics of many forms of health care financing.

Health care financing systems operate within the health care market, and some introductory thoughts on health economics and the relationship between the economy and the health sector are also in order. We will limit ourselves to points that affect the financing system directly. Other concepts of health economics are discussed in Issue Brief 1, which explores, inter alia, the relationships between health care providers, consumers and third-party payers. An understanding of these relationships is essential for modelling health care financing systems.

3.1 THE ECONOMICS AND ECONOMIC ENVIRONMENT OF THE HEALTH SECTOR

Health care goods and services are exchanged on the health care market. There is ample reason to believe that the market is distorted by a variety of factors, most importantly by the asymmetry of information between consumers and providers and by the need to insure against potentially substantial health care costs. These distortions are discussed extensively in the literature of the field. Third-party payment systems, together with inevitably under-informed consumers, lead to a market situation in which providers of care have a dominant influence on the volume and structure of demand. The individual need for health services is highly uncertain, which implies that the demand for services is also uncertain, and possibly difficult to predict. Demand is only an approximate function of need; it also depends on the availability and affordability of services.

As a result, uncertainty and provider dominance are important characteristics of the health care market, and are of utmost importance for the modeller. An understanding of these concepts is crucial in order to understand the dynamics of expenditure on the health care market.[1] Expenditure, meanwhile, is the financing system's object of service. If the modeller does not understand expenditure dynamics, we can safely assume that the model will not adequately reflect these relationships. Such a model would be unlikely to be able to project national or scheme health expenditure in a meaningful way.

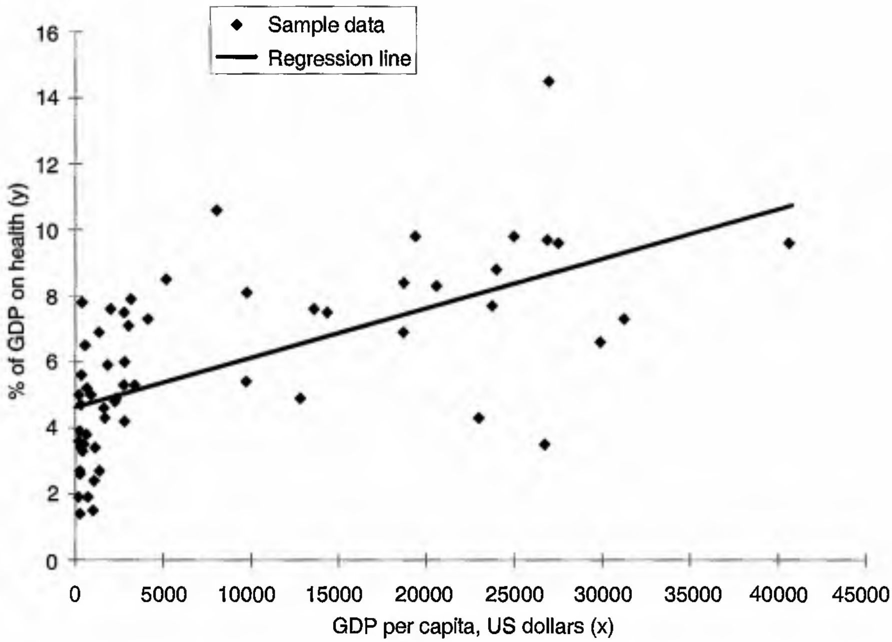
The most important aspect for the modeller regarding health expenditure is that it is highly *income elastic*. It is obviously easy to persuade consumers with incomes increasing in real terms to spend more and more on health care. This microeconomic relationship obviously aggregates into a macroeconomic relationship.

The level of national economic development is also obviously a significant determinant of the level of national health expenditure. Figure 3.1 shows the correlation of national health expenditure as a percentage of GDP, and per capita GDP in US dollars. Although the correlation is clear, many countries appear to lie above or below the expected level. This may be due in part to poor quality and comparability of international health expenditure data.

This figure, in particular the scatter of countries around the regression line, shows that national policy, commitment to health, political and historical factors and other influences result in substantial differences, even among countries within the same region or at similar levels of development. Several observations can be made about overall health expenditure at the national level:[2]

1. *There are great differences in health expenditure between countries.* In Asia, total per capita health expenditures vary from less than US $12 per capita in Indonesia to over US $370 in Thailand.

Figure 3.1 Health expenditure as a share of GDP and per capita GDP in 60 countries in the mid-1990s



2. *Total spending depends on economic output.* Although there are differences, as some countries spend more on health than others, GDP levels are directly related to the level of health expenditures.

3. *As national income rises, the proportion of total health expenditure accounted for by the public sector increases.* For instance, in Africa, on average, 60–70 per cent of health expenditure is accounted for by the private sector. In OECD countries, 60–70 per cent is usually from public sources.

4. *The lower public spending on health in developing countries is the result of a lower share of government spending devoted to health.* In lower-income countries, health accounts for less than 8 per cent of total government expenditure, compared to 10–15 per cent in higher-income countries.

5. *External funding in the form of foreign aid is a major source of financing for health in Africa and some countries in other regions.*

6. *The level of insurance coverage varies widely.* In Europe and the Americas, over 60 per cent of the population is covered by health insurance. In Africa, the percentage is in the single digits.

The level of expenditure on health care in a country depends on many factors, including the need for services (i.e. the existence of medical problems for which there is a useful intervention), the ability to afford care, the efficiency of the financing mechanisms in mobilizing resources, and the efficiency and costs of the health sector. It is important to understand that the level of health spending is a matter of policy and choice, although it is constrained by the wealth of the country and other priorities competing for use of the country's resources. One main factor that determines the choices made on the level of health spending is income. The proportion of a country's income spent on health care tends to be around 2–4 per cent in countries with very low incomes, around 5–7 per cent for medium-income countries, and up to 13–14 per cent in the richest countries. Some countries are clearly above or below what would be expected, such as Japan, which has a low level of national spending relative to income. (For more details on national health spending, see the International Reference Statistics, Annexes A and B.)

There is some evidence that the type of financing system affects the level of spending, with lower levels in tax-financed systems and the higher levels where private finance is widely used. It is also clear that many differences in health sector expenditure between countries are the result of very different levels of private spending, over and above that of statutory schemes. It may be that transparency accounts for some of the explanation for the higher spending levels in systems with private and social insurance, with higher contributions clearly related to better access to care.

The effectiveness of the financing system in mobilizing funds is also affected by other factors. For example, payroll-based systems require that a high proportion of the population be engaged in formal-sector employment, with easily calculated incomes and low administrative costs for collecting contributions. As the number of people in this type of employment falls, the efficiency of this mechanism also falls. This reflects current experience in many countries.

The volume of care associated with any given level of spending depends on the efficiency of providers and the extent to which cost control mechanisms are effective. With a system involving third-party payers, there is a tendency for cost control at the point of delivery to be weak; hence, there is considerable variation in unit costs in different countries. While the effective use of technology can help to keep costs down in principle, there is a tendency in practice for new technologies to be introduced without clear advantages in terms of health benefits – simply with higher costs. More detailed consideration of these issues is found in Issue Brief 1.

3.2 NATIONAL HEALTH CARE FINANCING SYSTEMS

All national health care systems are pluralistic, which means they consist of a variety of schemes or subsystems. These schemes are distinguished by their pattern of financing and delivery, the scope of their benefits, and their population coverage. In principle, combinations of the following characteristics are possible:

- Population coverage: full or partial
- Benefit range: full or partial
- Benefit delivery: private sector, public sector, or public/private mix
- Financing: public or private

Within these categories, a number of subcategories are possible. Each national health system is made up of a unique combination of these categories and subcategories.

An important distinction must be made between the financing and delivery of health services. Services may be provided in both the public and private sectors. Thus, it is possible that services would be financed by the public sector, but provided by the private sector. The provision of health services by the public sector may occur at government health facilities or at social health insurance facilities. Private-sector health care providers include hospitals, practitioners, and pharmacies operated by non-governmental organizations (NGOs) or the not-for-profit sector, as well as those operated for profit. Health services may also be provided directly by employers.

However, with respect to financing sources and population coverage, only a few types of health care schemes are typically dominant components of national health care systems. *National Health Service* systems are characterized by public tax financing, a mix of public and private delivery, full or almost full scope (range of benefits) and universal coverage of the population. *Social insurance schemes* combine public contribution financing, public and/or private delivery, usually a full benefit range and less than full population coverage. *Private insurance schemes* in many countries combine partial population coverage, less than full scope, private financing and private delivery. A private insurance subsystem or scheme, however, may also operate alongside a dominant public sector scheme.

Health services may be financed through public or private expenditure. Traditionally, the primary source of financing for the health sector in many countries has been the government, although other sources of financing have more recently increased in importance. Where health services are paid for with taxes or compulsory insurance (through individual and/or employer contributions), they are counted as public expenditure. Private expenditure includes payments by individuals and employers which are generally voluntary, with the rare exception of mandatory health care savings schemes (such as the Medisave system in Singapore). Funding for recurrent operating and long-term development costs for health services may come from any of three primary sources:

1. Public sources of financing
   - Direct government contributions to finance the provision of health services, through national or local budgets
   - Social health insurance, sponsored by the government (may be mandatory)

- Community financing schemes for health services

2. Private sources of financing
   - Direct payment by patients (fee-for-service or other household expenditure)
   - Private, voluntary health insurance (indirect individual and employer payments)
   - Employer-based health insurance
   - Payments by community and other voluntary local organizations that finance health services
   - Health care savings schemes, in which individuals save a stipulated amount each month to cover health care costs in case of need
   - Mutuals or cooperative-based insurance schemes

3. External financing
   - Donor monies for health services (institutional aid, foreign aid or development loans)

It is possible to categorize the various types of health care systems along the main characteristics of their financing dimension. Figure 3.2 categorizes a full range of health care financing options, and includes the main types of health care financing.

One type of financing will generally dominate a national system. The relative importance of each funding source varies dramatically among countries and within regions. In Asia, for example, the percentage of total health expenditure that comes from public sources varies from nearly 22 per cent in India to over 50 per cent in Viet Nam and the Republic of Korea.[3] Table 3.1 provides examples of the public/private mix in health care financing in OECD countries. The table reflects the pluralistic structures of virtually all national health care systems. In the United States, for example, which is generally regarded as having a privately financed health care system, the public share nevertheless exceeds 40 per cent of total expenditure (through the Medicare and Medicaid programmes). Meanwhile, the health care systems of the European Union, which are generally dominated by public financing, still show on average a 23 per cent share of private financing in total health care expenditure.

In sum, the relative proportion of public spending, private spending, external aid and health insurance financing in national health expenditure varies widely between regions and countries. The pluralism of national health financing systems is an important factor to keep in mind, even if this book is primarily concerned with publicly financed health systems. There is interaction between the various subsystems in every national health care financing system. The reason is simple: many providers operate in both the public and the private segment of the market – for example, physicians in public hospitals

Figure 3.2 Categories of health care financing systems

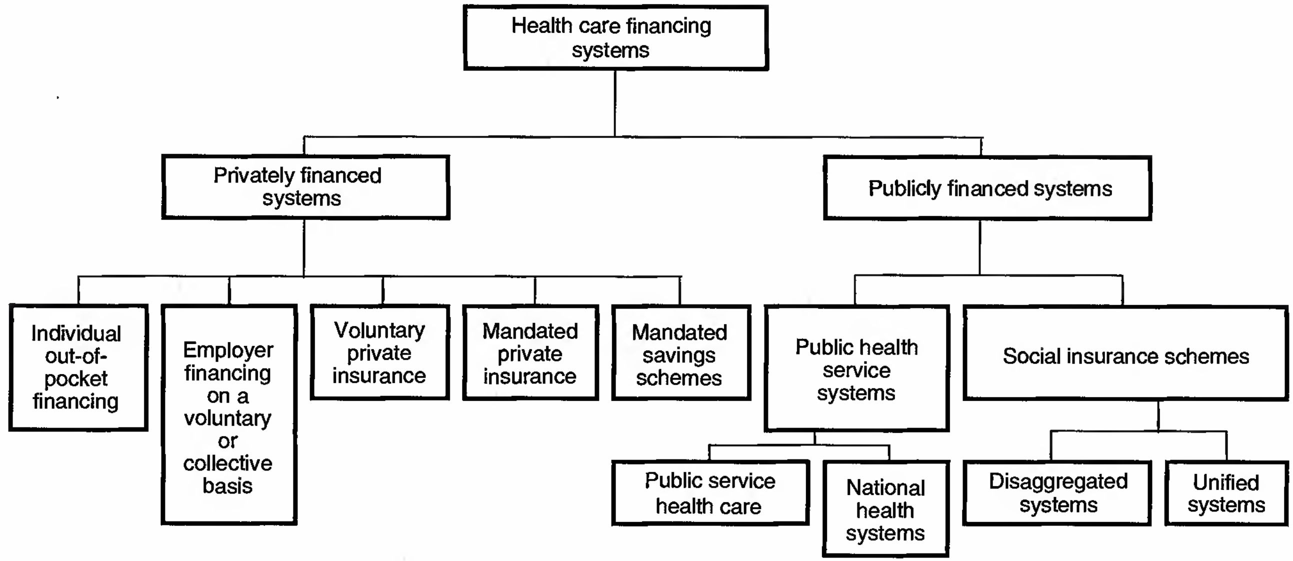


Table 3.1 Financing of health systems in the OECD, early 1990s

	Share of financing (%)				
	Public		Private		Others
	Social security contributions	State	Private insurance	Co-payments	
Belgium	44.6	32.6	5.0	17.8	0.0
Denmark	0.0	86.5	1.3	12.2	0.0
France	66.4	5.9	9.4	17.4	0.9
Germany	66.2	12.0	7.7	12.9	1.1
United Kingdom	7.6	72.7	6.1	13.6	0.0
Greece	42.9	35.6	2.9	18.6	0.0
Ireland	6.4	65.0	10.2	18.4	0.0
Italy	40.3	35.2	4.8	19.6	0.0
Luxembourg	55.0	19.1	8.9	16.9	0.0
Netherlands	63.0	7.3	17.5	12.1	0.0
Portugal	13.3	63.1	3.2	20.3	0.0
Spain	40.2	37.8	5.0	16.9	0.1
European Union (average)	48.0	28.4	7.4	15.8	0.5
Austria	55.6	25.3	6.0	13.2	0.0
Sweden	16.5	68.5	2.5	12.0	0.0
Switzerland	44.8	24.3	7.0	23.5	0.0
USA	18.6	24.8	31.3	22.1	3.2

Source: Basys GmbH (Augsburg, Germany)

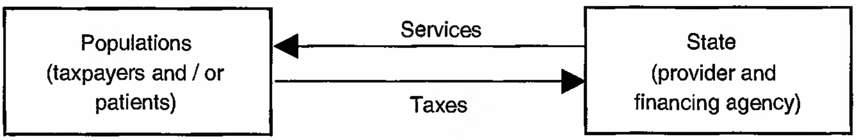
might also see private patients. How these providers behave in one segment of the market, reacting to incentives set (at least in part) by the reimbursement system, has a definite impact on their behaviour in the other segment of the market.

3.3 PUBLIC HEALTH CARE FINANCING SYSTEMS

Publicly financed health care systems remain the backbone of health care financing in most countries. There are basically two approaches to the public financing of health care: the *public health service* approach (including national health service and public service health systems), and the *social health insurance* approach. In the former type of system, the public sector is both the financing agent and provider of health services. In the latter, the government is the financier, but may or may not be the provider. These are the two main paradigms to which the modelling tools developed later in this volume can be applied.

Even if it is often claimed that social health insurance systems are merely a more complex form of public health service, there are crucial differences

Figure 3.3 The bipolar structure of a public health service system



between the two systems in terms of their financial organization, delivery principles and economic concepts. The national health service systems operated in some OECD countries (e.g. Italy, the Scandinavian countries, and the United Kingdom) generally allow for at least some private-sector delivery of care. The still-existing health care systems in Eastern Europe, however, are in practice specialized branches of the public service.

There are two crucial characteristics of public service health systems. First, on the microeconomic level, "the money does not follow the patient." In other words, provider units are financed by budgetary allocation, and not paid for specific services rendered to specific patients. Second, on the macroeconomic level, there is no (or at best a very weak) relationship between the amount of taxes paid by the population and the volume and structure of services delivered each year. This is because the financial resources of the health sector come from general revenues, and are determined by an annual budget procedure in which the health sector has to compete with alternative uses for resources. Therefore, increased overall tax payments do not automatically result in increased allocations to the health sector.

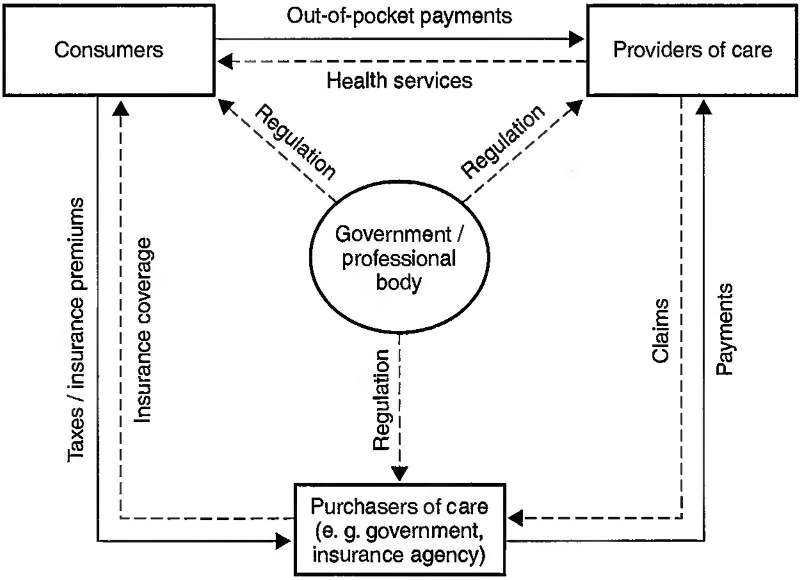
The public health service model is a **defined-income scheme**, where the volume and structure of services available to the public is largely defined by whatever income the public health service can obtain from the general budget. Resources are allocated to different categories of care in different regions through the bureaucratic budgeting mechanism. The structure of the flow of money and services is portrayed graphically in figure 3.3.

Social insurance systems, in contrast, have a triangular structure. This is because there are three key sets of actors (figure 3.4).

From an organizational point of view, the social insurance model differs from the national health service model in two crucial ways: (a) the State is divorced from the financing of care; and (b) there is, in general, a separation of the functions of resource pooling and the provision of care.

While the national health service model involves a defined-income scheme, since the income of the system is determined in the budgeting exercise, the social insurance model involves a **defined-benefit scheme**. This means that the benefits available to the covered population groups are defined (by law). The financing of the system must be sufficient to service the benefit package and the demand exercised under stipulated conditions. To meet these requirements, social insurance schemes have these characteristics:

Figure 3.4 The structure of a social insurance health care finance and delivery system



Source: WHO, 1994

- Earmarked resources (contributions) that are virtually untouchable by other public institutions
- Compulsory coverage for the total population or for a prescribed subgroup, regardless of individual risk (i.e. nobody may be excluded from coverage due to health status)
- Contributions that are generally a percentage of the insurable income of insured persons, independent of the number of dependants (i.e. contributions are charged according to the ability to pay)

With their different principle characteristics, public service health care systems and social insurance schemes influence the economics of the health sector differently. The role of the covered population as *financiers* and *consumers* of services is fundamentally different under the two models and, to some extent, also under the more specific national health service approach. Contributors under a social insurance scheme will compare their contributions with their potential benefits, and hence have some check on the quality of care lacking under a public service system, even if this check is only indirect. In addition, patients normally have a free (or almost free) choice of providers under the social insurance approach, which is traditionally much more restricted under the classical Central and Eastern European public service approach as well as the national health service approach found in Western Europe. In a situation of oversupply of providers, the ability to choose certainly influences provider behaviour. The financial intermediary (the social insurance system) negotiates contracts with participating providers, and this again influences provider behaviour. A similar impact on the behaviour of providers might be achieved under a national health service system by making certain providers purchase services from other providers under budget restrictions (such as the budgets of primary care providers for hospital services in the United Kingdom). Thus, even if the general financing of the health sector is under a public umbrella, some crucial market tools can be encouraged to function.

Within the structures described above, various forms of publicly financed health service or social insurance are possible. Most social health insurance systems in western industrialized countries have achieved nearly complete population coverage and a fairly comprehensive benefit package.[4] These social insurance systems vary in some ways, however, such as their organization (notably in governance and in the degree of desegregation of social insurance institutions from financing arrangements), and the nature of the relationship between social insurance institutions and providers (notably in the types of contractual arrangements and payment mechanisms used). Table 3.2 presents a short summary of the publicly financed health care systems found in some countries.

3.3.1 Tax-financed systems

The difference between public service health care systems and national health services is that the former are operated as a part of the public service, while the latter uses non-public providers for at least some services. It is clear that a national health service is more complex from a financing point of view than a public service system. We limit ourselves here to a description of the financing of the best-known national health service, the British NHS.

Sources of funds

The British central government provides most of the funds for the NHS. Historically, funds were mainly provided from the National Insurance Fund, which was financed by a levy on payroll. This provided a defined set of social protection services, including retirement and unemployment insurance. The role of general taxation grew in importance in the United Kingdom, and this now represents the majority of central government support for the NHS. The link between contributions to the National Insurance Fund and access to social protection is now weak, and it is reasonable to consider national insurance contributions simply as a tax levied on payroll (indeed, the funds are now managed as general government revenue). Total government spending on health services is set as part of the annual budget exercise, and is normally based on the previous year's budget and any foreseeable problems. There is no formal process linking changes in demographic or needs patterns to the level of spending.

Table 3.2 National social health insurance models

Country	Organizational pattern Financing arrangements	Relationship with providers Payment of providers
Canada	Health insurance system disaggregated into 10 provincial systems, which are generally split into various schemes for hospital and ambulatory care. Financed 50 per cent by the provinces and 50 per cent by the national government. Provincial share may be collected through contributions or taxes, but taxes are prevalent (in all provinces except Ontario, Alberta, and British Columbia).	Ambulatory care: Contracts with physicians practising privately, on a fee-for-service basis. Hospital care: Contracts with public and private hospitals on a budgeted basis.
Costa Rica	One nationwide system (the Social Security Fund), with decentralized management. Financed by employer contributions (9.25 per cent of payroll), employee contributions (5.5 per cent of earnings), a state contribution (0.25 per cent of covered earnings), and subsidies for the coverage of indigent groups.	Services are delivered predominantly in facilities owned and operated by the scheme.
France	Centralized system. Disaggregated into a general system, six special systems for individual professional categories, and two systems for self-employed persons. Financed by employers (12.8 per cent of total payroll) and employees (5.6 per cent of earnings) in the general system. Additional income from quasi-tax surcharges on tobacco, alcohol and motor vehicle insurance. Co-payments are traditionally high, but may be covered by mutuals (mutual insurance schemes).	Ambulatory care: Contracts with physicians in private practice. Payments made as reimbursement to patients, who pay doctors on the basis of a nationwide fee-for-service schedule. Overbilling for some doctors permitted. Hospital care: Public hospitals paid directly by insurance system on a budgeted basis.
Germany	Decentralized system of more than 1,200 sickness funds, grouped in local, professional, enterprise and substitute funds regulated by a common federal legal framework. Financed by individual fund-specific contribution rates of employers and employees (average 6.8 per cent each of covered earnings).	Ambulatory care: Contracts with private physicians on fee-for-service schedule applicable nationwide. Hospital care: Hospital budgets.

Table 3.2 (Continued)

Country	Organizational pattern Financing arrangements	Relationship with providers Payment of providers
Sweden	Funding mainly from taxes raised by local governments, with a contribution from central government. Provision of care mainly by local government providers.	Mainly direct provision by local government, but some care under contract with public and private providers. Physicians are mainly salaried.
United Kingdom	Most funds provided by central government from general taxation. Commissioning of health services by local health authorities, covering approximately one million people.	Hospital and community health services supplied mainly by government-owned providers on contract to health authorities. Contracts are normally on a cost and volume or cost-per-case basis. Primary care doctors are independent and paid mainly per patient, but other physicians are salaried. A small amount of care is provided under contract by private for-profit and not-for-profit providers.

Fees and co-payments are charged on a small number of items, such as prescription medicines, but there are exemptions or reductions in these co-payment amounts for people with low incomes or high levels of need. Full-cost fees are charged for dentistry and optometry services for those able to afford them, but altogether over 90 per cent of NHS resources come from central government sources.

Allocating NHS resources

Resources are allocated to the eight administrative regions in the NHS using a weighted capitation formula. The size of the local population is the main factor, but this is weighted to take needs into account, mainly using standardized mortality ratios as a proxy. The same approach is used to calculate appropriate budgets for local health authorities, but a shift is occurring from the current budgeting method to one based on a formula. As a result, many districts are either below or above their targeted level of funding.

Paying for services

Primary care services are provided by general practitioners (GPs), who contract with the district health authorities to look after the needs of patients who register with them. The main funding for registered patients is paid on a capitation basis, but some specified services (mainly screening and health promotion) attract additional payments from health authorities. GPs are private contractors, and are not employed by the NHS. Nurses and other health care professionals working in primary care are employed mainly by local NHS employers, but some are employed by GPs.

Secondary and tertiary services are commissioned by district health authorities (or by other commissioners using budgets devolved by the authorities). Contracts for services are a mixture of block contracts (which specify availability, such as for emergency services), cost and volume (specifying the amount and the total payment), and cost per case.

3.3.2 Systems financed through social insurance

Social insurance health care schemes are much more complex in their financial structure than tax-financed schemes. This section describes three essential characteristics of health financing through social insurance that are important to the modeller. The first deals with the organization of social insurance as an institution within a society, the second is the nature of the flow of funds within this institutional structure, and the third is the interrelationship between the social insurance scheme and the economy.

Organization of social insurance

A statutory health insurance system can be organized as a single scheme or as a number of individual schemes covering different population subgroups with a varying degree of independence. Although the degree of disaggregation of the financing system is not merely a question of organization, it has definite financial and economic consequences.

A system with several individual schemes might experience varying contribution rates between separate funds, depending on differences in benefit experience, prices for services, and efficiency. In most cases, a single fund seems to be more equitable and probably involves lower administrative costs. Nevertheless, there can be good reasons for establishing more than one unit. First, in many countries, the supply of medical services varies widely: high-tech treatment or medicines in capital cities may contrast with low technology health care in rural areas. In a uniform one-scheme system, the lower-income population in rural areas may end up financing more advanced care elsewhere, without being able to enjoy its benefits. Here, local schemes may be more equitable. Second, disaggregated, pluralistic funds might result from specific national historical developments. If they do not compete with each other (for example, in profession- or enterprise-based schemes), they may be acceptable even though the principle of solidarity is practised within a smaller group than the population as a whole.

Financial transfers from "richer" to "poorer" schemes may also make a system more equitable without dismantling existing pluralistic financial and administrative structures. Such **financial equalization mechanisms** can be powerful (but ones for which the effects are unclear) instruments in public financing. If they are used to level contribution rates across all funds to an average rate, they avoid the apparent inequities that might be associated with multiple rates. However, they might also create a de facto subsidization of the better off by the poor (such as in a uniform single system), or effectively eliminate incentives for individual funds to be efficient in their management or administration. It could be more advisable to provide specific equalization mechanisms for specific risks. In the German Statutory Health Insurance System, for example, the financial burden on individual schemes of health expenditures for pensioners is "equalized". Similar mechanisms could be envisaged for other risks, such as renal dialysis or AIDS cases.

By its very nature, a pluralistic system tends to create competition between individual schemes, which try to attract as many contributing members as possible. Such competition on health insurance markets might have positive effects in terms of efficiency and responsiveness to consumer demands, inter alia, through the careful negotiation of contracts with providers. Competition, however, also calls for careful regulation, in order to avoid potential negative side effects. The most common risk affiliated with unregulated competition between schemes is **adverse selection** exercised by the schemes. Just as in private insurance systems, the schemes may try to enroll only persons with low health risks, leaving the higher-risk population without coverage.

Further, because contributions are related to earnings, funds can lower their contribution rate or raise their quality of benefits by selecting high-income members. Thus, every fund is interested in improving benefits selectively for high-income groups, and in excluding low-income groups from coverage. Even if the schemes are obliged by law to accept every applicant, they can influence their average contribution income by using selective marketing instruments. This may result in separate high-quality funds and low-quality funds for specific groups of the population.

On the delivery side, while competition between different providers for social insurance contracts might well help contain the price of health care, such competition also has its down side. The problem with competition (on both the financing and delivery markets) is that it is not exclusively a price competition, but rather is also based on quality. (Indeed, this may even be the overwhelming deciding factor in most cases.) Quality is often equated with price. In fact, schemes have been found to compete for specific providers in order to enhance their own competitiveness in relation to insured persons by "offering" provider services which are perceived to be of higher quality. Competition between schemes for specific providers can be identified as one of the causes of the cost explosion in certain western industrialized countries. Higher prices were adopted as an instrument to increase service quality. Schemes with low incomes accepted that they had to increase their fees and quality standards in order to close the gap with "high-quality", high-income schemes. High-quality funds did the same, in order to preserve their competitive edge.

The flow of funds

All health care financing schemes, and social insurance schemes in particular, are characterized by the specific way in which funds flow into, or are expended from, managing institutions or organizations. The following sections describe the source of funds for a social insurance scheme, and the characteristics of its main outflows. The sources of funds are contributions and other cash income, and most income is used to finance benefits – i.e. to pay providers for their services.

The financing system

An understanding of both the expenditure and income sides of the national social insurance system is crucial for the modeller of the system, as is an understanding of the **financing system**. The financing system describes how resources are collected and managed, so that they are liquid when needed. It is the core of the financial structure of a social insurance scheme. It determines the level of contributions that are used to finance the benefits of the scheme – i.e. whether (or what level of) reserves are set aside in order to meet future liabilities, or whether the scheme "lives" on the basis of its short-term financial equilibrium.

The financial systems used in social insurance financing differ in general by the degree to which they accumulate capital. The cases range from **pay-as-you-go** (PAYG) or **assessment premium** systems, which accumulate no technical reserves other than a limited contingency reserve, to **fully-funded systems**, which try to build up reserves that are sufficient at any point in time to cover all future obligations of the scheme. Therefore, if the operation of the scheme were to be arrested suddenly, the accumulated reserves would still be enough to service all future benefit obligations resulting from entitlements accumulated under the scheme until that very moment. Between the extremes of assessment and full funding, there are a number of intermediate systems of financing. These can be grouped under the heading **partial funding**.[5]

The financing system adopted is usually different in each branch of social insurance, especially for short-term and long-term benefits. Medical care is generally considered to be a short-term benefit, similar to sickness cash benefits or unemployment benefits.

Short-term benefits are payable per case for a limited period (generally not more than one year). These schemes are characterized by an annual expenditure in a **stationary state.** In a stationary state, a scheme has reached its normal state of operations – i.e. it no longer experiences special transitory effects caused by the introduction of new regulations or new categories of insured persons. A stationary state is relatively stable, when expressed either as a proportion of annual insured earnings or as an average amount per insured person. Unlike long-term benefit schemes, where the pensioner population and their benefit entitlements build up over a period of decades as the scheme matures, entitlements to beneficiaries under short-term benefit schemes must be serviced almost instantaneously from the introduction of the scheme. (There are some exceptions, such as waiting periods – for example, three months after a person joins a scheme.) Hence, short-term benefit schemes generally have no long maturation period of low expenditure, during which a sizeable reserve can be built up. This is one reason why most short-term benefit schemes are financed on an assessment premium basis (better known as a pay-as-you-go premium basis).

A pay-as-you-go system is an unfunded financing system – i.e. there are no long-term technical reserves. In principle, all benefits and administrative costs paid within a defined period of time (generally one year) are financed from the scheme's income in that same period. A small contingency reserve is normally maintained to cover unforeseen expenditures.

With respect to financial management, pay-as-you-go systems are in theory relatively easy to administer, as only few (or no) assets have to be managed. The contribution rate is also relatively simple to calculate, since only the expenses of the following budget year and expected income of the insured population subject to contribution have to be estimated.

The sources of income

The decision to install a pay-as-you-go system implies that capital revenues can be neglected. Hence, the principal sources of revenues of compulsory health insurance are:

- contributions by employers
- contributions by insured persons
- state subsidies
- miscellaneous income (e.g. from cost-sharing at the point of delivery).

Contributions

Contributions by employers and employees are, as a rule, related to wages or earnings, although flat-rate contribution rates have sometimes been applied. Earnings subject to contributions are very often limited to a proportion of income not in excess of a prescribed ceiling.

The principle of solidarity in financing health care is inherent in earnings-related contributions. In contrast, risk-oriented premium systems exclude any subsidization of high-risk or low-income groups by high-income groups; in these systems, solidarity is reduced to the subsidization of ill persons by the healthy.

A ceiling on contributions could be considered adverse to the principle of solidarity. But without a ceiling, the acceptability of a scheme may be reduced. If high earners perceive the difference between contributions and expected benefits (i.e. the share of contributions used for cross-subsidies) to be too high, they may consider the contributions to be a tax, rather than a premium paid in exchange for benefits. In any case, the ceiling should be dynamic – it should be adjusted each year at least in line with the rate of change in average incomes. Otherwise, an increasing share of total earnings would be exempted from contributions over the years, as incomes rise.

Despite often heated political debates on the subject, the distribution of the contribution burden between employers and employees is, in the long run, not really essential. As discussed below, employers' contributions are a part of their labour cost, just as wages are. Employees' behaviour on the labour market is also more influenced by disposable income, after taxation and contribution payments, than by gross wages. In the absence of wage regulations (e.g. minimum wage standards), and neglecting the issue of tax levied on the contributions, the question of distributing contribution payments between employees and employers does not make any economic difference. It is generally decided according to local tradition and political constellations.

In some countries, there are currently discussions on collecting contributions based on total income, rather than exclusively on wages. This may be more equitable, but would also entail administrative problems. Contributions could be related to income as declared to the taxation authorities. This is the practice in some countries, such as New Zealand but, in many cases, declared non-wage income is by its nature and origin very different from wages. It is in many cases irregular and unpredictable, and would require a two-stage collection mechanism: one for wages on a regular monthly or weekly basis, and one annual consolidation once tax returns are filed.

In the case of self-employed persons, negotiated fixed rates most likely have to be established, because it may be impossible to obtain accurate information of the income of the self-employed and achieve acceptance of the principle that the self-employed should pay both the employers' and the employees' contribution calculated or determined on the basis of declared earnings. It should also be borne in mind that among the self-employed, there are not only high-income groups (self-employed professionals and businessmen) but also small artisans, small shopkeepers, street vendors, and others who have a limited capacity to pay substantial and regular contributions.

Whatever the method of calculating contributions, the principle of equity in the social security context means that all members are entitled to the same benefits. Thus, although there may be some general limitations on the volume of specific benefits, there is basically no link between the amount of contribution paid and the benefit entitlements of individuals covered by the system. To the extent that the social security programme is spread among population groups, over various geographic regions or industrial sectors, its economic viability as a whole will benefit from inter-community subsidization. Compulsory contributions from insured persons and employers are, as explained earlier, related to earnings (or sometimes charged at a flat rate).

As a rule, individual rates disregard the number of dependants who are also entitled to medical care by virtue of the contribution of the insured person.

Equal contribution rates regardless of family size are often questioned when a health insurance scheme is first developed. However, in view of desirable social solidarity between large families with often low per capita income and single persons and small families with (as a rule) higher per capita income, this concept has become an accepted principle of health insurance within the framework of social security. Similar reservations have been voiced regarding cross-subsidization between different income groups, such as higher urban regular wage earners and lower income (often seasonal) rural workers. A national social security programme generally aims at a triple cross-subsidization:

- from the healthy to the ill
- from high- to low-income persons
- from single persons and small families to larger families.

Contributions to social health insurance systems are generally calculated on the basis of the principle of **collective annual equivalence**. This principle means that the amount of contributions collected in one period should be equal to the expected amount of benefit expenditure, plus administrative expenditure, and plus (or minus) necessary changes in contingency reserves. The total level of contributions required depends on variables such as:

- the scope, nature and price of benefits provided
- the amount of administrative cost
- the level of earnings on which contributions are calculated
- the participation of the State in the financing of the scheme.

Contribution rates are calculated on the basis of statistical and financial information relevant to the "population" covered by the system. (The calculation of contribution rates is probably the most prominent use of the models developed in this volume.) Short-term assumptions are generally applied to the main variables, since compulsory health insurance is financed on a pay-as-you-go basis. Contribution rates are revised on a regular basis, in the light of actual financial experience (at least every three to five years).

Many alternative contribution bases have been discussed in recent decades to reduce the supposed negative effects of social insurance contributions on employment levels. One proposal which received significant attention was linking employer contributions to value added. Under this proposal, employer contributions would no longer be calculated on the basis of wages alone, but would be extended to include (or even be replaced by) the value added of individual firms, including amortization and profits. If the total contribution to a scheme were to remain constant, broadening the base would imply a reduced rate of contribution. The supporters of alternative systems maintain that they would encourage employment, since they would enable social charges to be apportioned more equitably between enterprises. Thus, labour-intensive enterprises would no longer be "penalized" in comparison to enterprises which are highly mechanized.

Such alternative methods may reduce the effect of contributions on the capital/labour ratio, and may be advantageous in times of high unemployment, but they do not represent the best method for health care financing in "normal" periods. High labour costs may induce higher labour productivity and incomes as well as unemployment; reducing them through the methods described above could encourage the preservation of labour-intensive plants with poor productivity. There is no reason to assume that other methods of financing health care have advantages over earnings-related contributions in the long term. Autonomous financing systems, such as social insurance schemes, can only work on the basis of a stable, reliable legislative foundation that includes regulations on their sources of income. It is not possible to change contribution methods in line with short-term business cycles.

Another reason to be sceptical about alternative non-wage-related financing systems is their potential negative impact on public acceptance of the system. If sufficient resources for financing health care can be obtained through taxation, a national health service can be financed and there is no good reason for a social insurance fund. A social insurance system can secure additional resources only if the contributions are accepted as the "price" paid for specific benefits and are not perceived as another general tax.

Subsidies

The "public" and statutory nature of social insurance does not necessarily imply government participation in its financing, as social security is normally "self-financed" through regular contributions from wage earners, their employers and the self-employed. In practice, however, legislation often does provide for government subsidies or contributions, depending on the extent of the national commitment and the ability of employers and employees to sustain the scheme financially.

The most widely held view is that when population coverage is low, government subsidies are less justified than in the case of nationwide programmes with broad coverage. The equity of using general revenues only for the benefit of a limited section of the population appears questionable. In addition, the real state of public finances often makes it unrealistic to rely on government subsidies, especially in developing countries. Indeed, the opposite is more likely to be true, as ministries of finance may see the flow of statutory social insurance contributions as a means to increase the "budgets" of ministries of health.

Assuming that population coverage is comprehensive, however, government participation in health insurance financing may be justified for two primary reasons. First, the insurance scheme must accept to cover all those within the defined population group. There is no basis for rejecting an applicant with a history of previous illness, a chronic disease requiring constant care, a high risk of illness, or a large number of dependants. Schemes might also have to accept persons without incomes for free insurance coverage. Second, the benefits will inevitably include medical care in fields that were once considered a public responsibility, such as the handling and treatment of certain infectious diseases and mental health.

There are often considerable indirect subsidies for social insurance systems. Where the employer or employee contribution is tax-deductible, a substantial part of the cost is in effect transferred to society. This can be viewed as a concealed state subsidy to the social insurance scheme. Hidden subsidies might also occur when the scheme buys services from government facilities at subsidized prices. In some cases, subsidies can even be negative. If the prices that the scheme pays to public hospitals exceed the unit costs, the surplus enables the government to provide care to non-covered persons, for example, to the unemployed or to those employed in the informal sector, at a low price or entirely free of charge. Although this procedure helps provide care for the poor, it may also reduce the public acceptance of the system. It would be better to insure these groups at a low flat rate, paid or subsidized by the government.

Miscellaneous income and co-payments

Miscellaneous income of a compulsory health insurance scheme might consist of various items, such as income from the investment of contingency reserves, fees charged for the sales of services to other financing subsystems, charges to other social security systems for administrative assistance, fines for delayed contributions, etc. All of these are, in general, of minor financial importance.

One of the most prominent (and most debated) forms of non-contribution income are the charges that patients may be required to pay at the point of delivery, such as a flat-rate sum for each prescription, for each pair of spectacles, or for each call at the hospital. Such charges are traditionally referred to as **cost-sharing, co-payments**, or **user charges**. There is, however, abundant literature on their application and suitability in private health insurance systems (particularly in the United States).

Whatever the effect of such charges on consumer and provider behaviour under compulsory health insurance, however, this type of income is less relevant and accounts only for a minor part of the annual revenue or indirect savings of a compulsory contributory scheme. It is a complex mechanism, and raises specific questions of principle, law and economics when applied under social insurance.

All forms of co-payments reduce the solidarity in the system to some extent: they shift part of the financial burden from the healthy to the sick. However, they also have two further basic functions: they are designed to *increase revenues* and *decrease expenditures*. Cost-sharing at the point of delivery is questionable when introduced only in order to raise additional revenues. It can be justified more easily as a means to prevent abuse or misuse of care, which is otherwise (seemingly) free of charge to the insured person. This disincentive must be handled with great care, however, with respect to its likely effects on the low-income population. For the poor, cost-sharing may have adverse long-term financial consequences. It could easily prevent people who should be treated for illness or injury from utilizing services at an early stage, and hence aggravate their health problems – which will then have to be treated later at a much higher cost. Research has also shown that patients are equally deterred from using services with a large impact on health as they are from using services that bring smaller health gains. Some forms of co-payments might be very efficient, however, if they are designed to help steer the "patient flow" through the least-cost channel in the delivery system. One example is the so-called **circumvention fee**, which is payable if patients in non-emergency cases "circumvent" lower levels of care (e.g. the general practitioner) and go without referral straight to higher levels of care (e.g. to specialists).

The outflow of funds: Paying for service delivery

Health care financing schemes generally have two main categories of expenditure: administrative costs and medical benefits. In the latter category, medical services may be purchased from providers (i.e. provided indirectly), or delivered in the scheme's own facilities (i.e. provided directly).

All health care financing systems incur administrative costs, even if they are not directly visible. Particularly in public service health care systems, the administrative cost structure of the scheme may lack transparency. These schemes are administered by ministries of health, and costs for the provision of services are incurred in various institutions and facilities, such as the supervising ministry, the health section of the ministry of finance, other ministries, and a whole hierarchy of health care facilities, each with its own administration. In social insurance schemes, these administrative costs are (or at least should be) visible in the scheme accounts. The level of administrative costs varies greatly, and depends on the complexity of the benefit package, the system of reimbursement for services, the means of contribution collection, and the maturity of the respective scheme (young schemes generally require more administrative input than mature schemes). Administrative costs can be a frequent source of waste, and when they exceed 5–10 per cent of total benefit outgo, an in-depth audit of administrative practice is always warranted.

The bulk of the funds of a social health insurance scheme should be spent on the purchase or direct delivery of benefits. A critical determinant of benefit expenditure is the way providers of care are paid by the scheme. The following sections explore some alternatives in provider payment systems, which are largely independent of the type of financing system. Virtually all of these systems could be applied within national health service systems as well as in private health insurance schemes.[6]

Payment mechanisms determine the amount of financial flows from third-party payers or patients (or both) to providers of care, in exchange for health care services. Essentially, the mechanisms define two critical items:

- the unit or basket of services for which a provider is paid per individual payment
- the price of the unit or basket.

The units or baskets used as a basis for payment exhibit a wide variety of aggregation. Sometimes they include all services rendered by a provider in a given period of time, such as one month in the case of payment by salary, or three months (or more) in the case of providers receiving budgets, such as hospitals. At the other end of the spectrum, payment may be for a single act performed by a professional, for example for an injection under a fee-for-service system. Prices might be implicitly or explicitly negotiated, they might be related to costs, or they might reflect other objectives such as deterring or encouraging utilization. They may also be linked to the quantity of units or baskets of services provided.

Table 3.3 lists the most common "pure" forms of payment mechanisms and their most common applications, in an ascending order of aggregation:

Payment methods are usually an element in the "service contract" between third-party payers and providers, but contracts generally regulate more than just payment issues. There may be various combinations of payment systems and relationships between payers and providers. One example of a mixed payment arrangement would be a doctor who receives a salary, but who is an employee either of the payer (e.g. the social insurance scheme) or of an institution which provides services to the payer (e.g. government health care units). If this doctor is employed directly by the payer, the scheme may contain additional rules and incentives, apart from the payment system, to ensure that quality and efficiency standards are met. For example, there may be rules on the minimum number of patients to be treated in a given period of time, a maximum average cost per patient, or rules regarding professional advancement. If the doctor were employed by a provider that supplies services to the payer (such as a hospital), the payer would have to develop other means of influencing the provider, which in turn would have to develop internal procedures to ensure that standards are maintained.

Pure payment methods are rarely found in health care systems. In most cases, several payment methods are combined to form a more or less complex payment system. There are two general categories of payment systems:

- In an indirect delivery system, different payment methods can be used at various "levels". For example, where an insurance scheme pays a public hospital, and the hospital pays individual providers (e.g. doctors), the hospital might be paid by budget or by daily charge, while the doctors are paid by salary or on a fee-for-service basis.
- Combined methods are also found within a single level of contractual relations. For example, a budget may be paid for primary care, but special

Table 3.3 Pure payment methods and their application

Payment mechanism	Definition of unit (service basket)	Paying the		
		Hospital	Health centre	Individual provider unit
Fee-for-service schedule*	Single act	✓	✓	✓
Case payment	Patient cases, according to a fee schedule	✓	✓	✓
Daily charge	Patient day	✓		
Flat rate allowance (bonus payment)	For certain investments (for example)	✓	✓	✓
Capitation	All potential services for one person during a defined period	✓**	✓	✓
Salary	A period of work (month)			✓
Budget	All services provided in a given period	✓	✓	

Notes: * Includes price lists for pharmaceuticals and medical appliances. Price lists can be "positive", "negative", or "comparative".

** So far, capitation hospital payments occur in only a few countries (e.g. Thailand).

services not covered by the budget may be paid through additional fees, according to a fee schedule. Fee-for-service payments may also be restricted by a budgetary cap. Per diem charges in hospitals may only cover current variable costs, while investments are reimbursed through lump-sum payments, possibly split between different payers.

Combined payment systems are used to avoid the apparent weaknesses of pure payment methods. Since an understanding of the mechanisms of provider payment systems is of crucial importance to the modeller, the main strengths and weaknesses of pure provider payment methods are discussed in more detail in Box 3.1.

The fee-for-service system is used to pay outpatient providers, for example in Australia, Belgium, Canada, France, Germany, the Republic of Korea, New Zealand, Norway, and the United States; it is also an option in Sweden. The cost-boosting effects of this system have become apparent in many of these countries. Even a very simple fee schedule with differential payments only for visits and consultations can lead to a high level of use of services, and consequently to high costs. This is because doctors can encourage a patient to make repeated visits over the course of an illness. In Ireland, where such a fee

Box 3.1 "Pure" methods of paying health care providers, and their strengths and weaknesses

Fee-for-service

Fee-for-service payments have three main characteristics:

1. *Definition of a list of services.* The initial problem in a fee-for-service system is the description of the units of services for which the providers are individually paid. These are listed in an official **list of services**. This list can either be defined through negotiation between providers' organizations and health care funds, or administered by an independent authority. The list must be updated regularly, in line with developments in medical technology and practice as well as in consideration of the financial resources available. However, frequent or numerous changes may complicate the handling of payment procedures.
2. *Determination of the price of a specific service unit.* The prices for units of care may be the result of negotiations, set by an independent authority or, in extreme cases set directly by the social insurance schemes. The list of services and corresponding fees is called a **fee schedule**.
3. *Definition of special rules and restrictions.* Each fee schedule must be accompanied by instructions for its use, defining specific aspects of delivery, billing and payment. There may be quantity restrictions, e.g. limits on the number of units paid per treatment, per case or for a period of time. There may also be regulations concerning the conditions for payment or non-payment of fees. An annex to the fee schedule might list services which are not paid for if billed simultaneously (such as a consultation fee and fee for a specific treatment), or services that are only paid for certain categories of patients (such as children). Other services might be paid only if billed in connection with a specific diagnosis, or only if approved by the fund's management.

There are at least three central disadvantages of a fee-for-service payment system.

1. Creating and maintaining a fee schedule is complex and requires considerable administrative capacity, as do payment calculations and billing control.
2. Fee-for-service payments encourage a greater quantity of care.
3. Inadequate absolute or relative prices in a fee schedule might create distortions in medical practice, e.g. by moving provider behaviour towards high-profit items on the fee schedule (which is often the case for laboratory and diagnostic services).

One advantage of the fee-for-service method is that it will hardly lead to an undersupply of services. However, international experience has shown that fee-for-service systems require very sophisticated calculations if these calculations are not exact, resources are wasted and desired distributive effects are not achieved. Generally, a fee-for-service system requires supplementary mechanisms, such as total expenditure ceilings and quantity restrictions.

Case payment

Case payments may be made to providers (e.g. to doctors or health centres in primary care) on a fixed basis (or flat-rate-per-case payment system) per patient contact, or according to specific fees for the treatment of specific illnesses, as classified by a **list of diagnoses**.[7] Under this type of payment system, morbidity risk is born by the payer, while the provider bears the risk of expenditure per case. If the rate per case is uniform, total expenditure (for a category of services, such as treatment by GPs) is the product of the number of cases and the per case rate. If the rate varies by diagnosis, expenditure is also determined in part by the morbidity structure. The risk of varying treatment costs per diagnosis is then borne by the provider.

When looking at provider incentives, the case payment method has crucial advantages over the fee-for-service method. Providers cannot influence their income by supplying "too many", or "incorrect", or "inefficient" service packages. Their net income can be maximized only by minimizing treatment costs with respect to the given morbidity structure.

The case payment method, however, has at least two disadvantages. First, there is no incentive for providers to ensure a minimum standard of quality, since quality will usually increase costs. Thus, strict quality control procedures are necessary. An element of competition between providers might be helpful to ensure quality. If patients can choose between providers, the providers are forced to ensure a certain standard demanded by the patients. Competition between providers as a quality-enhancing mechanism has clear limitations, however, due to the patients' lack of information and limited ability to pass an educated judgement on the quality of care they are receiving. Thus, additional quality control mechanisms must be installed by the payer. Second, adverse selection of patients can be a problem. If primary care is paid according to a flat-rate structure, providers have an incentive to transfer patients to specialists or hospitals. This risk can be mitigated, for example, by including the average costs of specialist care and (if necessary) fees for specialist care in the per case payment. The unit providing primary care would then pay the specialist. Similarly, hospital and drug expenditures may be paid by the primary care provider.

Payment through fees related to diagnoses are a sophistication of the crude case payment method. Prerequisites for a functioning diagnosis-related payment system are a precisely defined system of diagnosis classification and a limit on the number of items on the fee schedule. The larger the number of items on the schedule, the greater room providers have to influence the diagnosis of a case to change their income. Diagnosis-related fee systems might be successfully applied in hospitals, if the diagnosis is made before the patient is transferred to the hospital. Even in this case, however, alternative or additional diagnoses may emerge during the patient's hospital stay.

Per diem fees

Per diem fees (daily charges) are used in hospitals, either to pay for the entire service package delivered per day of stay, or for restricted packages complemented by additional charges for special services. This system has two main problems. First, a hospital can (and, according to experience, tends to) influence the length of a patient's stay. Generally, the marginal cost at the end of a hospital stay – the cost produced by an additional day – is less than the average daily cost. If charges are the main source of funds, the daily charge must cover at least the average daily costs. The hospital therefore makes a (marginal) profit by extending the average length of stay at the end of a treatment. Additional contractual regulations are necessary to eliminate this incentive, e.g. by instituting a restriction on the number of billable days, in total or per case.

A second problem is that the daily rate must be negotiated. If the rate is calculated by the hospital – even by a non-profit hospital – the hospital might finance inefficient equipment or treatment procedures. The health care scheme needs a basis for its own calculations, with at least the following information:

- A classification of contracted hospitals by level of care (ranging from general secondary care facilities to tertiary care facilities such as university hospitals)
- A minimum infrastructure standard for each class of hospital (e.g. equipment, patient / staff ratios, or minimum number of departments)
- A calculation scheme providing guidance on which per diem fees are considered reasonable for each class of hospital, including variables such as infrastructure, wages, and price levels in the area.

The cost structure of an individual hospital is difficult to calculate or determine from the "outside", especially for insurance schemes which might not even have access to tax data or other government data sources.

Capitation

The capitation payment method is generally used in primary care, especially for private providers (general practitioners).[8] Under this system, a flat-rate fee (perhaps differentiated by age and sex of the covered persons) is paid for every covered person enrolled with an individual provider. This fee covers all care that covered persons require during a defined period of time. Generally, covered persons can choose from among more than one provider. (If they were allocated to providers by an administrative procedure, there would be no difference between capitation and budget payments.)

In a capitation system, morbidity risk is borne by the providers, at least in the short run. The system can calculate a fixed amount of expenditure per insured person and per period. Economic disadvantages of this method are in general the same as under a flat-rate-per-case payment system. Given a defined list of patients, the net income of providers is maximized by minimizing their production costs. Thus, quality control (e.g. on the equipment used in provider facilities) and competition among providers are necessary to ensure a minimum quality standard.

The capitation method is often combined with bonus and fee-for-service elements, in order to steer provider behaviour to less costly health-promoting activities, such as preventive care.

Bonus payments

Bonus payments are global, flat-rate payments made to providers for executing specific duties, or as reimbursement for the purchase and operation of a particular piece of equipment. They are often used to complement capitation methods.

Budgeting

Under this method, a generally prospective budget is fixed for a provider unit (usually a hospital). The budget is meant to cover all expenses over a defined period (usually one year). Under certain limiting conditions (e.g. with respect to unexpected changes in the caseload), the provider can maintain possible profits, but must also shoulder potential losses. Budgets are usually re-negotiated annually.

Morbidity risk as well as variance in treatment costs are borne to a large extent by the provider, and the cost of the scheme is fairly predictable in the long run. The potential for manipulating the mechanism is limited to the re-negotiation process. Quality control mechanisms are necessary under budgeting systems to ensure minimum standards of quality.

Salary

Salaries are usually paid for a certain period of time and a certain number of working hours. The income of a salaried provider, therefore, does not depend on the volume or structure of services provided, or the number of patients treated in a given period of time. To a large extent, it does not even directly depend on the quality of treatment.

The provider is paid for supplying labour. The employer is responsible for demanding services, i.e. for ensuring that the provider is employed during working hours. The employer might also decide on treatment patterns and intensity, as well as on the technology employed.

In fact, employers normally do not have the means to control the provider's behaviour completely. Providers, like all professionals, have room for discretion with respect to the services they supply, following their own preferences and judgement. Salaried providers normally do not have financial incentives to treat more than a minimum number of patients, or to achieve more than a minimum standard of quality. However, the employer might influence the provider's behaviour through a system of evaluation and promotion, or by offering bonus payments. Ethics and professional reputation might also be variables that figure prominently in the provider's behaviour. As a result, the influence of the salary payment system on quality is ambiguous.

Summary: Incentive structures in payment systems

The following table shows the incentive effects generally attributed to the various systems discussed above, with respect to several variables of crucial importance for the modeller. Providers are assumed to attempt to achieve maximum (or target) income. No hypothesis is made with respect to non-financial behavioural incentives.

Under a fee-for-service mechanism, there is an incentive for providers to maximize total services and to prefer services with a high profit margin. Under the case payment and daily charge methods, providers will normally attempt to maximize the number of paid units (cases or days of stay), and to avoid costly treatment. The effect of these methods on the quality of care is ambiguous, as efficient early treatment or secondary preventive measures might be substituted for long-term treatment in the case of daily charge payments.

Bonus payments are generally used to spur certain activities. The size of the effect of bonus payments is difficult to identify as they vary based on the purpose for which the bonus is paid.

Under the budget and salary payment methods, there is no first-level direct incentive for providers to increase quantities or the intensity of care. Rather, the opposite is true. Long-term strategic considerations, however, might result in certain incentives to increase the number of patients for competitive reasons. The number of cases or patients is often used to demonstrate the demand for the services of the facility or of an individual provider.

Table B3.1 Incentive structure of payment mechanisms

Payment mechanism	Quantity of services		Structurel composition of services provided	
	Number of patients	Number of billable units of care	Number of acts • per unit • per patient • per period	Cost-boosting substitution of high-profit for low-profit services
Fee-for-service	+	+ +	+ +	+ +
Case payment	0	+ +	–	+
Daily charge (per diem fee)	+	+ +	–	–
Flat rate (bonus payments)	?	0	?	0
Capitation	+ +	0	–	– –
Salary	–*	–	– –	0/+
Budget	–*	0	– –	– –

Note: * Refers to first-level direct effects.
+ + = Strong incentive to increase activity
+ = Incentive to increase activity
0 = Neutral incentive or not applicable
– = Incentive to decrease activity
– – = Strong incentive to decrease activity
? = Inconclusive incentive effect

schedule is still applied for the poorer half of the population, the visit rate is 11 per year, compared with 4.5 in the United Kingdom.

Where the fee schedule is complex, as in Germany or the Republic of Korea, and claims can be made for over 2,000 individual acts, it is inevitable that some procedures will be more lucrative for the provider than others. Thus, there are incentives for doctors to overuse these procedures, examples of which are the high use of diagnostic tests identified as a particular problem in Belgium and, in Germany, doctors who purchase a piece of equipment and use it as much as possible in order to recover the investment quickly.

High costs under a fee-for-service system are the result of doctors' claims for services, with repeat visits possibly also leading to further prescriptions. In Germany, about two-thirds of visits are doctor-induced, compared with one-third in the United Kingdom. It may not be coincidental that a study of all member states of the European Union showed that the number of prescriptions per covered person was twice as high in countries where the doctor was paid on a fee-for-service basis than in countries where doctors are paid on a capitation basis.

Salaries represent the most common way of paying doctors in inpatient facilities. Salaries are also used for primary health care in health centres, clinics and dispensaries (e.g. in Finland, Greece, India, Indonesia, Portugal, Spain, Sweden and Turkey). Quality deficiencies are observed in some of these systems. In the worst cases, services can degenerate, with such symptoms as consultations that are too short, an absence of friendliness, and long waiting times (because doctors arrive late and leave early). The capitation system of payment has long been used in a pure or modified form for paying general practitioners in Denmark, the Netherlands, Thailand and the United Kingdom. It is also used by some health maintenance organizations in the United States.

Generally, doctors become accustomed to the way they are paid, and seldom want it changed. British general practitioners have long fought against being salaried, and have rejected the paperwork and greater competition which would be involved in a fee-for-service system. Doctors in Australia, France, Germany and New Zealand, meanwhile, fought early battles to prevent or abolish capitation payment, and strongly prefer fee-for-service payments.

Hospital payments per itemized bill are used in different variants, for example, in the Republic of Korea, Thailand (except for the newly introduced social security system, which operates on a capitation basis), and under some subsystems in the United States. In the Republic of Korea, itemized billing is combined with a per diem rate. Per diem fees are used in most Western European countries. In this case, charges are negotiated, and daily charges are different for all hospitals. Where this system operates, increasing per diem fees generally mean that hospital expenditures increase faster than average health expenditure. It also has been observed that the length of hospital stays is approximately twice as long in European countries with per diem systems as in the United States. Insurance schemes have implemented methods to monitor the length of patient stays.

Payment by budget is often used in direct delivery systems, for example, in India and in several countries in Latin America. There has been a relatively recent broad move towards hospital budgeting in classical social insurance schemes, however, such as in Belgium, France, Germany and the Netherlands.

The economic impact of social health insurance

Compared to a national health service, the installation or operation of a social insurance health care system may raise overall health expenditure, improve the quality of health services, and improve the performance of health manpower. It also has direct or indirect effects on the national economy, which we will now discuss.

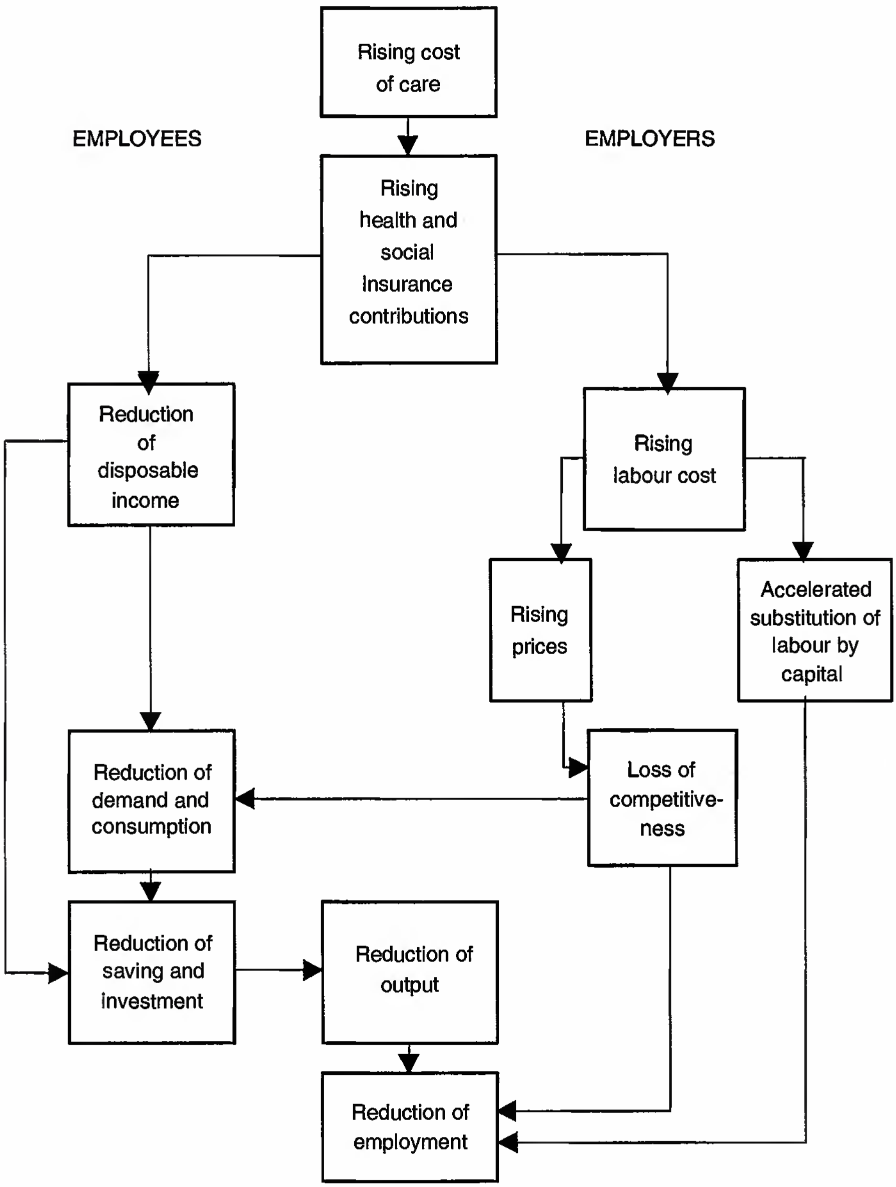
Social health insurance in most countries constitutes one branch of the overall social insurance system, which generally also includes pension insurance, health insurance, an employment injury scheme, and unemployment insurance. In Western Europe, these schemes together generally consume over 20 per cent of GDP. Hence, their potential influence on the economy is considerable. Within general social insurance, health insurance has probably experienced the largest expenditure increases over the past two to three decades in most countries.

A major societal investment in social justice and peace is indicated when 20 per cent or more of GDP is spent on social insurance benefits. The benefits of social insurance generally help to maintain social consensus in democratic societies, by limiting the potentially negative effects of wide income differentials on the level of poverty and equal opportunity within the country. Social peace, in turn, is a crucial prerequisite for a high level of productivity within the workforce, and thereby for economic well-being. High and efficient health spending clearly also will have a positive effect on the productivity of workers, leading to increased economic output, but might also affect employment. We know very little about the actual size of these effects. Debates on the economic effects of social insurance and social security financing, however, often ignore the basic necessity for social and health investment in the society and workforce. Policy makers and modellers in the social security field should be aware of the effects that changes in social security financing trigger in the economy.

The economic impact of health insurance schemes are traditionally discussed in terms of the negative impact of high costs and hence high social insurance contributions on the economy. The exact nature and size of the impact of social insurance contributions on the economic circuit is unknown. There is reason to believe, for example, that in loose labour markets with high unemployment, social insurance contributions are in fact borne by workers, regardless of their nominal split between employers and workers. In such an environment, social security contributions may simply reduce disposable wages. Employers would only accept a certain amount per worker as a part of labour costs; high or rising social security contributions would simply be financed above this amount by lower wages. In tight labour markets, this might be different. Since the importance of the effect of social contributions is unknown, modellers often have to resort to sensitivity tests of various hypotheses, through the assumption of alternative elasticities at some of the crucial logical links in the reasoning depicted in the model.

Employee contributions basically influence their disposable income and saving behaviour. Employers' contributions have an impact on labour costs, which in turn influence prices. Prices influence consumption, consumption influences economic output and hence employment. At the same time, higher labour costs accelerate the substitution of capital for labour, with net negative effects on employment. The entire circuit of effects of rising health care costs and social insurance contributions, and their logical order in terms of traditional "push-pull" economics, is displayed in figure 3.5. For the sake of simplicity,

Figure 3.5 Expected macroeconomic effects of rising health care costs under a social health insurance scheme.



no distinction is made between the effects of a first-time introduction of a social insurance premium and the effects of an increase in the amount of existing premiums. The effects are treated as consequences of the size of the burden placed on incomes and payrolls, rather than as consequences of the nature of the burden itself. If a health model is to be linked to a national economic model, all these effects will impact on the economy. The repercussions sent through the economic circuit will in turn impact the health care system.

The academic debate on the economic effects of social health insurance continues. However, some tentative conclusions can be drawn here. Rising burdens of social security contributions apparently do have some effect on the macroeconomic circuit in the short run. The size of this effect depends on the general state and structure of the economy and may at best be estimated using a fairly elaborate econometric model, which must be developed for each individual country. There is good reason, however, to believe that the net effects are much less dramatic than often assumed.

Long-term effects may be even less relevant. Social insurance schemes, including health insurance schemes, are redistribution mechanisms. As long as the redistribution is efficient (i.e. there is no waste in terms of transaction costs, such as wasteful administration), they do not add cost to the production process, but merely achieve an interpersonal and inter-temporal distribution of income.

There is also reason to believe that any economy on open world markets tends to achieve equilibrium labour costs (the sum of wages plus non-wage social charges, including social security contributions) that are determined by the productivity of labour alone. How much of this total labour cost is paid in wages, and how much goes to redistribution, depends on societal consensus. Global long-term employment and other economic effects do not appear to be of major relevance, as long as the size of the wage component remains acceptable to the active members of society.

Nevertheless, inefficiencies in transfers can jeopardize the social consensus. The widespread use of patient co-payments in health sector reforms of the 1970s and early 1980s in many OECD countries might serve as an indication of such a loss in consensus. Health care schemes, for many reasons (such as their difficulties in containing and controlling costs), are most prone to inefficiencies when compared to other social security schemes. They do not only redistribute income from the rich to the poor and from the healthy to the sick, but also from employees and employers to providers. Excessive provider incomes are an obvious symptom of systematic inefficiencies. Control variables need to be controlled, an important example of which is provider incomes in health finance systems. This is uncomfortable news for governments that wish to withdraw, at least partially, from the financing of the health sector, since it indicates that the final responsibility for the social health care financing system cannot be left to non-government public institutions that have no comprehensive authority to regulate the sector.

3.3.3 Privately financed care

As mentioned previously, the private financing of health care can take the form of direct purchases or co-financing (co-payments) of direct purchases. It can also take the form of private pre-financing arrangements, such as private insurance or mandatory savings. Co-payments and other out-of-pocket purchases are income-elastic. This also applies in principle to the other forms of private coverage (except, of course, to the forced savings option).

Private insurance is the most important element in the area of private financing, and operates on a strict risk-sharing basis. Private health insurance financing has no income-redistributive elements. Contributions or premiums are, in principle, calculated on the basis of the assessed risk of the individual. Therefore, in theory only individuals with equal risks pay the same premium. Thus these persons share the risk that one or more of them will become ill and incur cost for medical treatment. Generally, risk is approximated through disaggregation of premiums by age and sex. Age- and sex-specific premiums might be augmented if the covered person has a specific health risk. In extreme cases, coverage might be denied altogether. (The calculation of the premiums under private insurance is the subject of Issue Brief 3.)

In most countries where private health insurance schemes operate, they represent a secondary (or second-tier) form of insurance. In some countries, they operate for entire enterprises on the basis of group insurance plans (e.g. in the United States). They may also operate as the main health care financing tier: where membership in a private insurance scheme is mandatory, the State supervises the industry, and insurance schemes are forced to practice open enrolment (the most prominent example of such a system is Switzerland). In any case, due to the need for private insurance schemes to make a profit, and their resulting endeavours to select good risks while leaving high-risk persons uncovered, private insurance alone can never be an option as the main tier of a national health care financing system.

One final system of private financing that has been mentioned but not yet described in operational terms is **individual contingency funding**, in the form of mandatory savings for health (as in Singapore's Medisave system). Stated simply, this system establishes a contribution-like deduction from employees' wages and salaries on a regular basis, specifically designated for use only in cases of health contingencies. This system differs from the social security model and the private insurance model, in that there is not even the private insurance-type sharing of risks, nor any other form of sharing between members of the scheme. The limit of coverage for the individual member is determined by the available balance in the individual account. This solution may seem attractive to those who feel they contribute too much within solidarity-based systems – usually young persons, who have a lower morbidity risk and no family, and can reasonably assume that they have many years of accumulation ahead of them before they might need to use the contingency fund. The down side of this system is that it ignores the imponderable element of morbidity, and will provide no solution for the seriously ill once the balance in the personal account is exhausted. This system also blocks the resources of the healthy in earmarked and unaccessible accounts, while care for the sick must be financed exclusively from their own resources. This might help to boost national capital markets, but makes no sense if one perceives national health financing as a societal task.

3.4 SUMMARY

Modelling is not performed in a vacuum, using only available health statistics and financing information. It considers the broader context, including the economics of health care, the relationship between the economic environment and the health care system, and the structure of the health care financing system. Several conclusions can be made about these factors:

1. **The economic environment has an impact on the health care system.** This is because it influences the amount that a society can afford to spend on health, the number of persons with access to the health system, and the quality of care provided. The relationship and positive impact of health expenditure on the general economy is less clear, owing to the difficulty in quantifying and clearly identifying the causal relationships.

2. **All countries have pluralistic health care systems.** The forms that publicly financed health systems take are summarized in Box 3.2. Alongside these forms are privately financed elements of the overall health system. These subsystems interact, and models of public health systems must also take account of private-sector developments, because these will influence the financial situation in the public sector.

3. **Modelling of national health financing requires a detailed flow-of-funds analysis.** Such an analysis is needed to fully understand the underlying flow of patients through the system and the financial incentives which determine the supply, demand and distribution of health services. This understanding is critical to the modelling process, and will be further developed in Part II. Only if such an understanding exists will the model be reliable.

Box 3.2. Forms of public health care financing systems

1. Tax-financed public provision of services
2. Systems financed through social insurance
3. Privately financed care
   a. with publicly provided services
   b. with privately provided services

Notes and references

[1] These aspects are explored in more depth in Issue Brief 1.

[2] William Newbrander, Jonathan D. Quick and C. Waddington, "Drug financing strategies", in Jonathan D. Quick et al., *Managing drug supply: The selection, procurement, distribution, and use of pharmaceuticals* (West Hartford, Cimmerian Press, 2nd edition, revised and expanded, 1997).

[3] William Newbrander (ed.), *Private health sector growth in Asia: Issues and implications* (Chichester, John Wiley and Sons, 1997).

[4] One example of a country where this has not yet been completely achieved is the Netherlands, but this will change after the implementation of current reform proposals.

[5] For a brief explanation of the different financing systems applied under social security, see Warren R. McGillivray, "The economics and financing of social security", in: *Social security: Principles and practice* (Bangkok, ILO, 1985).

[6] Some statements in the following descriptions of payment mechanisms are quoted from a communication of an ILO drafting committee member of a WHO working group on the subject of "Evaluation of recent changes in the financing of health services", Geneva, 1991.

[7] The first major payment system based on diagnoses (DRGs, or diagnosis-related groups) was developed by researchers at Yale University during the 1970s. The system has been in use for the reimbursement of hospital care for Medicare patients in the United States since October 1983.

[8] An exception is the new social insurance scheme in Thailand, where inpatient and outpatient care are also covered.

PART II

MODEL BUILDING

DATABASES

4

The process of governance of a national health care system or scheme includes quantitative reporting on its operations and performance. The public, government and legislators must be informed about the performance and financial status of the national system. Similarly, the governors, stakeholders and financiers of specific health care schemes must be informed about the present or recent financial and delivery performance of existing schemes, as well as about the expected future performance of existing or new schemes.

In the case of the national system, regular statistical, financial and/or accounting reports must be submitted either to the government or to a supervising agency. In the case of individual schemes, financial studies on probable future developments must be produced (in actuarial terminology, these would be called **actuarial valuations**). Proposed new schemes, meanwhile, require feasibility studies, which in turn are based on projections – i.e. on some form of modelling.

In addition to their role as a tool for stakeholder or government supervision of present performance, retrospective statistical and financial reports as well as certified accounting data are the quantitative basis for most prospective valuations and studies. In most cases, these reports will contain all data necessary for a financial or actuarial valuation or a feasibility study.

Health care financing models, such as those used in any public expenditure system, require a well-defined set of data. There can be no model without data, and models are always only as good as their database and the assumptions made (the principle is called GIGO: garbage in-garbage out). Ideally, the structure of the model determines the width (the range of expenditure and income items covered) and the depth (the degree of detail or disaggregation) of the database compiled for each model. This is how the database for a model is developed – in theory, at least.

In practice, the availability of data often defines the structure of the model, a phenomenon every modeller will encounter. Academic debates among modellers and general textbooks on modelling often concentrate only on the theoretical, mathematical structure of models, but do not respond to problems in modelling caused by limitations of or deficiencies in data. However, in practice the availability of data often drives the process. In our experience, about 90 per cent of all technical difficulties encountered by modellers stem from data problems, and as a rule, the data situation is never perfect. Data are either unavailable, incomplete, aggregated in the wrong way, misleading, or they simply do not speak to the matter at hand.

Data problems are encountered more often than one might imagine. In some countries, voluminous statistical yearbooks and accounts have at times been filled with data for data's sake. For example, there may be absolute data in billions of currency units describing expenditure on certain categories of care, or data in millions of physical units on health infrastructure (e.g. hospitals or hospital beds, documented by region), or "utilization" data such as the number of physician contacts by region. In many cases, these data do not "speak": pure data often mean nothing, if they cannot be related to past experience or explanatory variables. Absolute expenditure figures mean nothing, if they cannot be expressed in real terms and related to past developments. Utilization volumes in a region mean nothing, if they cannot be related to population figures in the same region.

In-depth knowledge and understanding of the availability, quality and meaning of data that are or should be available for a model is the first prerequisite for any practical modelling exercise. This chapter is an attempt to guide the modeller through essential sources of data from which to collect and compile a database for a meaningful financial model of a health care system. (In the next chapter, we discuss how to develop the data framework for the model.)

There are two sets of data sources for any financial model: statistics and accounts. There can be no data framework for a model without meticulous statistical and accounting analyses.[1] Proper accounts and clear statistics are important inputs for governance (i.e. supervision, management and administration) of any health care system or scheme; models are only one of many tools used in the governance process. However, it is often the modellers who discover holes, gaps, inaccuracies and inconsistencies in both accounts and statistics; their task is to relate accounts to statistical information and subject both to tests of comprehensiveness, clarity and plausibility.

When new schemes are introduced, it is essential that the modeller or financial analyst also advise the government (or the scheme's management) on setting up an adequate accounting and statistical framework. A blueprint for the statistical reporting framework can be deduced from the *suggested model data framework*, described in Chapter 5.

4.1 HEALTH ACCOUNTING

In health accounting, we distinguish between two major levels of aggregation: the national level and that of the individual scheme. While scheme-based accounting is an established procedure in many countries, and although some form of national health accounting also exists in many countries, internationally compatible national health accounting standards are still in the early stages of development.

There has been movement recently to establish internationally comparable National Health Accounts (NHA). But although there are agreed definitions and methods for creating national accounts under the System of National Accounts (SNA), there are no fully agreed definitions and methods for NHA. The Directorate for Education, Employment, Labour and Social Affairs of the OECD (ELSA), in consultation with its Employment, Labour and Social Affairs committee, is presently undertaking pioneering work to develop a standard framework for national health accounts.[2] The following sections on health accounts follow the logic developed by the OECD.

4.1.1 Health and national accounting

Better information on the financing of the health sector is essential not only for analysing and monitoring the present situation, but also for making policies and decisions for the future. As no health care system is an economic island, its financial situation cannot be understood properly without referring to its economic environment. Particularly, in order to understand the quantitative side of national health care (such as the structure of national expenditure and financial resources), financial information must be interpreted within the context of the national economy.

Since national health expenditure is financed out of a country's GDP, the financial affordability of health care in a country largely depends on its economy, even if there is societal consensus and political acceptance on bearing the cost of health care. As GDP is the most common measure of a nation's income, the percentage of GDP spent on health care reflects the income contributed and consumed by the health sector in the economy. GDP is thus considered a good indicator of the affordability of health care as well as the sector's impact on the economy as a whole. National health expenditure must therefore be measured in the same way as GDP – or at least the measurements must be compatible with GDP measurements.

The System of National Accounts (SNA, referred to above) provides a comprehensive and consistent picture of the entire economy, including certain key aggregate statistics (including GDP). Many of the basic decisions made within the SNA on the classification of economic activities, transactions, products and institutions are logical starting points for the development of national health accounts.

4.1.2 Health and social accounting

Social transfers account for an increasing share of GDP, and social spending is often the largest category of expenditure within government budgets. It is therefore necessary for governments to develop global steering mechanisms for social expenditure, to ensure that scarce resources are allocated most efficiently and effectively.

Social accounting provides a detailed summary of social expenditure and income used for its financing. Accounts are maintained on various institutions within a country, as well as on the government as a whole and the private sector. Although the exact procedures and contents of social expenditure accounting differ from one country to another, the core elements are as follows:

1. Employment-related social security expenditure
   - pensions (paid by various institutions or by the government)
   - short-term benefits
   - health care
   - unemployment benefits
2. Publicly financed social security expenditure
   - family benefits
   - health care
   - social assistance
   - tax benefits
3. Private-sector or collective-agreement-based social protection expenditure
   - occupational pensions
   - other enterprise-based social benefits.

Social accounting provides a fundamental quantitative basis for the analysis of current financial structures, as well as for the construction of models that support the political decision-making process where social policy and national financial planning meet.[3]

In principle, national health accounts are included in and form a part of social accounts, although health accounts reveal more details on the financial structure in the health care sector and cover a wider range of financial transactions (e.g. direct payment by patients to doctors, or individual contributions to non-mandatory private health insurance schemes). Since cross-analysis and cross-checking of expenditure and income between health care and social expenditure accounts is important, it is desirable that their account systems be compatible with each other. Compatibility also allows data on health expenditure to be included in social expenditure analyses.

4.1.3 National health accounts

Though no single form for national health accounts has been fully accepted internationally, there are some principles which may serve as guidelines for national health authorities and modellers alike. If no national health accounts exist in a country, modellers of the national health system must also construct simplified accounts as a starting base of data for the model. If national health accounting exists, then modellers need to understand why the accounts were constructed as they were, and must base their models on the definitional structure of these accounts (this topic is covered in more detail in Chapter 5).

Adequate financing structures are one of the main factors determining the success of health care systems. For good health policy analysis and formation, reliable and complete information on health financing is necessary. Crucial information includes:

- *Global cost*. How much in total is spent on health care over a period of time?
- *Functional breakdown*. What kind of health care is provided?
- *Provider characteristics*. Who are the major providers of care?
- *Financing sources*. What are the major sources of funds?

To answer these questions, the OECD System of Health Accounts (SHA) has been developed as a summary of transactions according to their key dimensions, foremost sources, and the uses of health funds. The SHA is a powerful tool for the financial analysis of existing health care systems; however, it has its limitations as well. As national health accounts under the system are based on global figures, they cannot be used for micro-simulations of system changes (e.g. the financial effects of an ageing population). Nor do they answer questions on the quality of or access to health care.

Matrix formation of accounts

Although there are some differences between the SNA and the SHA, certain accounting practices and conventions regarding national income are common, such as those relating to double measurement. The SNA usually takes the form of two-dimensional tables (T-accounts). As health financing plays an important role in determining the allocation of expenditures and the behaviour of providers and consumers, it is important to understand its patterns in detail. In other words, financial flows in the health care sector need to be analysed by carefully investigating the relationships between sources of financing and uses of funds. A matrix presentation of financial flows, capable of describing interactions along different dimensions, is generally recommended for national health accounts. This is especially true where pluralistic health financing structures are found – and such structures are becoming more common both in developing and in industrialized countries. Financial analysis is especially important in countries with lower levels of national income, health expenditure and health status, because the efficient utilization of scarce resources in the health care sector can have a significant impact on crucial health outcomes.

The matrix approach also improves the accuracy of estimates by allowing the cross-comparison and cross-checking of data in two dimensions (e.g. it checks on providers and on financing sources). Estimates of private health care expenditure are especially improved by using a matrix approach, as this category has traditionally been underestimated through non-matrix approaches where the institutions themselves have provided much of the data used. Finally, the matrix approach is helpful in discovering missing data, because cells may be left empty in the matrix.

Dimensions of health expenditure

The dimensions for any matrix of financial transactions in the health care sector should be clearly defined. The OECD's SHA approach is organized around three basic dimensions of health care:

- *Functions*: What are the types of goods and services provided?
- *Institutions*: Where does the money go (i.e. to what providers)?
- *Sources of funding*: Where does the money come from?

Each of these dimensions is then further specified in the International Classification for Health Expenditure (ICHE), which names them as follows:

- Functions and activities (ICHE-HA)
- Institutions of health care providers (ICHE-HP)
- Sources of health funding (ICHE-HF).

Box 4.1 describes the OECD's disaggregation of the above dimensions.

Other dimensions for classification

The three dimensions described above often appear in analyses relating to the "resources and uses" of health care. However, other classification schemes may also be useful, such as:

- "Line-item" expenditure categories (e.g. by salary, equipment or pharmaceuticals)
- Socio-economic breakdowns (e.g. by income groups, age or sex)
- Geographic breakdowns.

Necessary characteristics of health accounts

According to the OECD analysis of the SHA, necessary characteristics include the following:

- comprehensiveness
- consistency
- international comparability
- compatibility
- timeliness
- precision.

Comprehensiveness means that the SHA should include the entire field of medical care activities, regardless of the individual health care programmes that may apply to a certain activity. *Consistency* implies that data should be consistent over time, as well as internally consistent. Consistency may be attained by making data collection more robust against changing national definitions over time, and by reporting on the production, consumption and financing of medical care in such a way that gaps and deficiencies may be identified and improved upon.

Common definitions, methodologies and practices in the construction of accounts, for example, common functional boundaries of health care, are

Box 4.1 The OECD definitional breakdown of national health accounts

Functions and activities of the health care system

The health care system (the OECD uses the term medical care system) of a country consists of the sum of institutions and individuals pursuing the following goals through the application of medical knowledge and technology:

- promoting health and preventing disease
- curing illnesses
- enhancing the quality of life of persons affected by chronic illnesses
- enhancing the quality of life of those with health-related impairments, disabilites and handicaps
- reducing premature mortality
- care of the terminally ill
- administering health programmes and funding.

The medical care system can be divided into a set of core functions, according to the International Classification for Health Expenditure's function component (ICHE-HA).

Table B4.1a ICHE-HA functional classification of medical care

ICHE-HA code	Description
HA.1–4	Core functions of medical care
HA.1	Personal medical services
HA.2	Distribution of medical goods
HA.3	Collective health services
HA.4	Health programme administration, health insurance
HA.5–9	Health-related functions
HA.5	Investment in medical facilities
HA.6	Education and training of health personnel
HA.7	Research and development in health
HA.8	Environmental health
HA.9	Administration and provision of health-related cash benefits

These one-digit functional classifications are extended to two- and three-digit levels, representing subcategories. (For more detailed explanations of classification categories and subcategories, see OECD, *Principles of health accounting for international data collection* (preliminary paper, Paris, OECD 1997), Chapters 2 and 7.)

Table B4.1b ICHE-HP classification of providers of medical care

ICHE-HP code	Description
HP.1	Institutions providing inpatient care
HP.1.1	Acute care
HP.1.2	Rehabilitation, convalescence and other continuing acute care
HP.1.3	Long-term care, including medical nursing homes
HP.1.9	Other institutions providing inpatient care
HP.2	Institutions providing outpatient care
HP.2.1	Offices of physicians/family doctors
HP.2.2	Offices of dentists
HP.2.3	Offices of other specialists
HP.2.4	Hospital outpatient departments
HP.2.5	Integrated care institutions providing outpatient services
HP.2.6	Paramedical practitioners
HP.2.9	Other institutions of outpatient care
HP.3	Ambulance care and rescue
HP.4	Medical laboratories
HP.5	Retail sales and other providers of medical goods
HP.5.1	Producers of medical appliances, dentures, etc.
HP.5.2	Dispensing chemists and other retail sales of pharmaceuticals
HP.5.3	Retail sales of optical glasses
HP.5.9	Other retail sales of medical goods
HP.6	Public health administration and insurance
HP.6.1	Government administration and insurance
HP.6.2	Social security schemes
HP.6.3	Other social insurance
HP.6.4	Other (private) insurance
HP.6.9	Other health administration
HP.7	Other institutions providing health services

The ICHE provider component does not distinguish between public or private ownership or control, size or legal status of providers, or regional coverage (community hospitals, state or national centres). Additional breakdowns according to these dimensions, however, can provide useful insights, according to the needs for analysis in a given country. For more technical details, definitions and explanations, see OECD, *Principles of health accounting for international data collection* (preliminary paper, Paris, OECD 1997), Chapters 3 and 8.

Classification of medical care financing

In a multi-payer health care financing system, there are several levels at which the sources of funds can be categorized by tracking expenditure flows to the upper stream. There are two important levels – financing units that incur expenditure (intermediary financing agents) and units that ultimately bear expenses (ultimate financing agents). For example, even though health insurance schemes (intermediary financing agents) incur the expenditure directly, the expense is borne in the end by households (ultimate financing agents). The level of financing agent used as a dimension in the "uses and resources" matrix approach depends on the purpose of analysis. Although the analysis of interactions between uses and resources is often the most important for health accounting, financial flows between ultimate and intermediary financing agents are also of interest.

The OECD has developed a financing component to the International Classification for Health Expenditure (ICHE-HF). The components of the ICHE-HF are as follows:

Table B4.1c ICHE-HF classification of medical care financing

ICHE-HF code	Description
HF.1	General government financing of medical care
HF.1.1	Territorial government
HF.1.1.1	Central government
HF.1.1.2	State/regional/provincial government
HF.1.1.3	Local/municipal government
HF.1.2	Social security schemes
HF.2	Private-sector insurance schemes
HF.2.1	Private social insurance schemes
HF.2.2	Other private insurance
HF.2.3	Private households' out-of-pocket payments
HF.2.3.1	Cost-sharing: social security
HF.2.3.2	Cost-sharing: private social insurance
HF.2.3.4	Cost sharing: other private insurance
HF.2.3.9	Other out-of-pocket payments
HF.2.9	Other private financing agents

For details, definitions and explanations, see OECD, *Principles of health accounting for international data collection* (preliminary paper, Paris, OECD 1997), Chapters 5 and 9. More detailed classification may be necessary. For example, data might be investigated for each relevant ministry, social insurance scheme, etc. More detailed treatments of insurance and social insurance are described in United Nations, *System of National Accounts 1993* (New York, United Nations), Annex IV.

essential to allow *international comparability*. Methodological *compatibility* with the SNA is a prerequisite for calculating meaningful expenditure ratios, such as the ratio of health expenditure to GDP. Compatibility of definitions and concepts with other existing statistical systems of the United Nations and other international organizations (e.g. UNESCO, the WHO or the EU) is also important.

Timeliness means that data should be available no later than twelve months to two years after the time period they describe. *Precision* means that the data and figures are as correct and inclusive as possible, and can be relied on as a representation of reality in the health sector. These two requirements are often in conflict when large amounts of data and a large number of surveys need to be combined in estimates. It is therefore recommended that projection models be used to provide preliminary estimates in order to fill the time lag in the delivery of the statistics.

Data sources

In constructing National Health Accounts (NHA), the choice of data is a determining factor of their usefulness in analysis and policy making. Three aspects of data sources need special consideration:

a. Types of data, e.g.
   - budget documents
   - insurer files
   - provider records
   - personal or household records
b. Reasons for data collection, e.g.
   - administrative purposes
   - tax or other legal purposes
   - research purposes
c. Level of data, e.g.
   - event level
   - individual level
   - provider level

Although the availability of data and the feasibility of collecting data and conducting surveys depend on the situation in a given country, the use of as many data sources as possible is recommended. Cross-checks on the data should also be performed in order to make estimates more accurate and reliable. Each type of data has its own advantages and disadvantages. For example, budget documents are the only sources of information on public health spending which are easily accessible, and they are also the least susceptible to undercounting; however, they do not cover all spending, and they often include spending outside the scope of the analysis or scheme being examined. When dealing with data in the construction of the NHA, it is important to pay attention to these characteristics. It is not intended, however, to analyse all the pros and cons of individual types of data here.[4]

4.1.4 Scheme-based accounting

Scheme-based accounting systems follow generally established accounting procedures (explained in detail in Issue Brief 2). Here, we will simply list the types of information that scheme-based accounts usually yield for the modeller. These include the following:

- income and expenditure account
- balance sheets
- other management accounts.

The *income and expenditure account* shows the results of financial operations carried out over a specific period of time – i.e. the (accounting) surplus or deficit for the period. The *balance sheet* shows the financial position at a particular point in time – i.e. assets and liabilities as of a certain date. The balance sheet is derived from the income and expenditure accounts, and it incorporates information on accruals, depreciation and stock balances.

If the scheme involves a substantial amount of capital expenditure, a separate *capital expenditure account* is generally maintained to record any such expenditure incurred since the beginning of the financial year. Each major item of expenditure is shown separately, and should be analysed by category (e.g. purchase of property, office equipment, medical equipment). In addition, many schemes produce *management accounts*, which:

- support the monitoring and evaluation of the scheme's finances (used together with the income and expenditure account)
- enable a more detailed understanding of the financial status of the scheme by providing an analysis of costs.

The contents of management accounts will depend on the nature of the scheme, but might include tables on expenditure for certain types of care (primary care, hospital care, etc.). Such tables might also be classified into broad components, or by geographic region, or may include breakdowns of the average cost per visit or per insured person.

4.2 HEALTH STATISTICS

In discussing data that can or must be derived from health care statistics, the distinction between accounting information and statistics is not always clear, and information from the two sources overlaps to some extent. We will distinguish them by stating that health accounts map the expenditure and revenues of a health care system or scheme in detail, thus providing a snapshot at a certain point in time, or over a series of points in time. Statistics, on the other hand, usually aggregate accounting data into summaries of expenditure and revenue.

4.2.1 Sources of statistical data

Statistics on health (whether national or international) normally include both statistical information on the health status of the relevant population, and information on the performance of the health care system or scheme. Statistical data follow a certain hierarchy, from the international, to the national, to the scheme-based level. The modeller is likely to need data from all levels. The following section describes the hierarchy of data on health care systems, core information for modelling, and key sources for such information. It also sets out some basic techniques for handling statistical data.

4.2.2 The hierarchy of health statistics

Heath statistics are compiled at the international level, notably by the WHO and the OECD. National-level statistics are generally collected by ministries of health, generally in conjunction with national statistical offices.[5] At the scheme level, data are gathered by public and private health care financing systems, such as national social security systems or by individual schemes.[6] In many countries, a regional or local level of data is found between the national and the scheme level. All these data are of potential interest to the modeller. Table 4.1 summarizes the nature and hierarchy of the various sources of statistical data on health and health care.

The most comprehensive international information on health and health care issues is provided by the WHO *Yearbook on Health Statistics*. However, the data in this publication, as in every international publication, are only as good as their sources at the national level. The volume therefore includes a warning about the quality and comparability of the data used. More detailed information, but on a much smaller selection of countries, is contained in the OECD health care database, which is regularly updated and available on diskette. It contains data on health status, infrastructure, utilization and expenditure. The ILO *Cost of Social Security* inquiry provides aggregated figures on health expenditure. The World Bank *World Development Report* likewise provides aggregate health care expenditure and access data. Generally, none of these international data sources is based on specific surveys; rather, all reflect national data collected in a specific aggregation by the international publishing agencies. Despite their deficiencies, international data serve an important purpose for the modeller, as we will see later.

National statistics contain data on health status and on the cost and operations of the national health care delivery system. Health status data primarily serve as a quantitative basis for identifying potential deficiencies in a country's health care delivery system, determining health policy targets, and monitoring the performance of overall national health policy. Health status data have only an indirect relationship to financial modelling; they are rather the province of epidemiological analysis in most cases. However, within the context of

Table 4.1 The hierarchy of health statistics

Type of statistics	Contents	Published by
International health statistics	Internationally comparable data on: • Health status indicators • Health care infrastructure and staff (e.g. number of hospitals, hospital beds, practising physicians, other health care staff) • Utilization of health care services (e.g. inpatient admission rates, outpatient contacts) • Indicators of variations in medical practice (e.g. mean length of hospital stay) • Prices of selected health care goods and services • National health expenditure, potentially by category of service	• WHO (*World Health Statistics*) • OECD • EUROSTAT • World Bank (*World Development Reports*) • UNICEF • UNDP (*Human Development Reports*) • ILO (*Cost of Social Security*)
National health statistics	Similar to the above items, but at a greater degree of disaggregation	Ministries of health, national statistical offices, statistical yearbooks, health reports
Regional and district health statistics	Essentially the above items, but further disaggregated, normally to the community level	Regional health authorities, district health authorities, ministries of health
Scheme-based data	According to the coverage of the individual scheme (e.g. contributors and covered dependents): • Utilization rates (for different categories of care) • Unit cost (prices) per unit of care • Expenditure (total and per category of care) • Financial sources or revenues	Individual health care schemes (e.g. social insurance schemes).

national health policy formulation, these tools complement each other. Epidemiological models might be used to predict the development of national health status, while financial models will predict the cost to the taxpayer of health care systems needed to handle the expected health status.

Some other national-level statistical data are also used in preparing financial projections. This is especially true of demographic data, such as population, vital statistics, and morbidity. Population statistics, of course, are used for many purposes besides their health sector applications, but nevertheless are a crucial input in any modelling process. They are used to calculate important health outcomes, for example, life expectancy. Also important is data on the distribution of population by age, sex and region, which are usually obtained from census results, residence registration records or periodic household surveys (often conducted on a regular basis, e.g. every five years).

Vital statistics, such as on live births and deaths, are used in calculating mortality and fertility rates. They are generally aggregated in groups by sex, region and age (or age of mother, in the case of fertility data). Both overall population by age group and population by single ages are useful for the modeller. Key indicators of health outcomes, such as life expectancy and

Box 4.2 Statistical flows in the German health care system

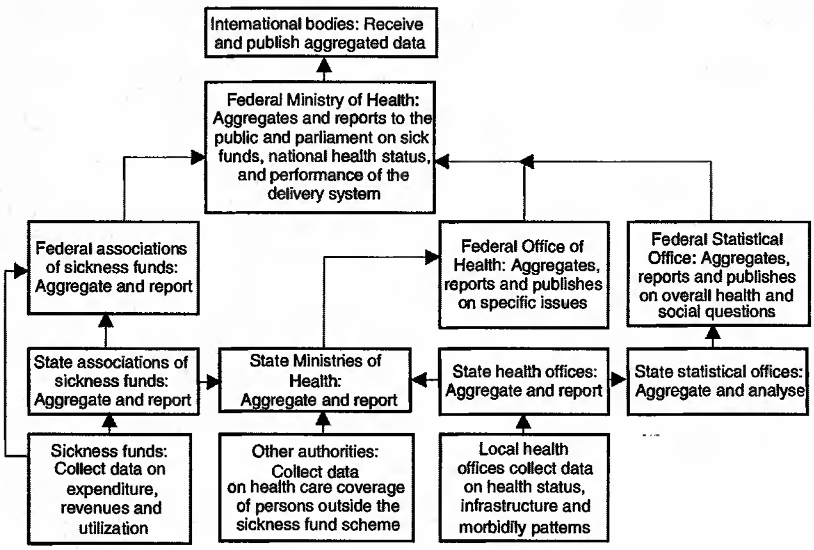
Germany is a federal state, with a statutory health insurance system consisting of more than 1,200 sickness funds. The funds are independent of the state, but supervised by the Ministry of Health.

Public health care data, such as health status indicators and data on morbidity and infrastructure, are collected at the community level by local health offices and reported to the health office in the respective federal state. These offices, in turn, report to the state-level ministries of health and statistical offices. State health offices report to the Federal Office of Health, which in turn informs the Federal Ministry of Health and the Federal Statistical Office. The Federal Statistical Office publishes data on the national health situation in various publications. The distribution of publishing competences between the Federal Ministry of Health, the Federal Office of Health and the Federal Statistical Office is not always clear. Essentially, the Federal Ministry of Health decides which data may be reported by whom at the federal level.

Expenditure and revenue data pertaining to the covered population under the statutory health insurance scheme (about 90 per cent of the total population) is reported by the individual sickness funds to their state association (or to the federal association, in cases where no state association exists). These associations, in turn, inform the state ministries of health. State associations report to the federal association, which reports to the Federal Ministry of Health and the Federal Statistical Office. The Federal Ministry of Health processes a very detailed annual statistical and financial report on the statutory health insurance system.[7]

Data on health care expenditures for non-covered persons (those earning more than the income ceiling of the statutory health insurance scheme who have opted to leave the scheme or who never were eligible to join: local, state and federal civil servants; and social assistance recipients) are reported by communities or public employers to the state ministries or to the Federal Ministry and the respective statistical offices. The Federal Ministry publishes a compendium of data on the health care system three times a year, including basic quantitative information on the overall national health care system.[8] The Federal Ministry of Health is responsible for the submission of data to international bodies (e.g. WHO, EUROSTAT, OECD). Figure B4.2 represents a simplification of the complex flow of statistical information.

Figure B4.2 The flow of data in the pluralistic health care system of the Federal Republic of Germany



infant mortality rates are computed with the help of mortality rates by age and by sex.

Unless there is a single, uniform and comprehensive national health care delivery and financing system, national statistics on health care operations and delivery are inevitably an aggregation of data obtained from individual health care schemes. Box 4.2 describes the complex data flow and statistical reporting process in a federal state with a pluralistic health care system, dominated by a classical Bismarkian system of social health insurance – in the Federal Republic of Germany.

4.3 CORE STATISTICAL DATA AND DATA SOURCES FOR FINANCIAL MODELLING

As images of the financial structure of national health care systems or their components, financial models map the financial transactions related to the health care delivery system. Their "mapping depth" is, however, normally limited;

they generally do not try to model the reasons certain services are used based on population morbidity structure, neither do they attempt to explain the reason for the existence of a certain morbidity profile. Financial models usually *observe* that certain population subgroups use a specific set of goods and services, that these services have a certain price, and that the combination of utilization and price leads to a certain amount of expenditure. Expenditure is then projected into the future, according to certain rules. Indeed, the model itself consists of the rules according to which this projection occurs.

As we have seen, financial models may also have a structural hierarchy, parallel to that of statistical sources, up to the national level. Just as national expenditure and revenue statistics are built upon an aggregation of scheme-based or regional data, national models or national health budget models are built upon an aggregation of data and projection results of sub-models that describe regional health care delivery and financing systems, or a set of individual schemes. Essential data for the modelling process, therefore, must be collected at the scheme level, regardless of whether scheme models or national models are built. There are four types of data that are needed for any modelling process:

a. *Coverage data* describe the size and structure of the population which finances (or pays contributions to) the scheme, and of the population which is covered (or entitled to benefits) under the scheme.
b. *Utilization and infrastructure data* describe:
    - the infrastructure of the medical delivery system in the country or scheme (e.g. the number of hospitals by category, number of beds, number of outpatient care units, staffing ratios for inpatient and outpatient care units)
    - the pattern and intensity of the utilization of the infrastructure by the covered population.
c. *Price data* on health care goods and services describe the cost to the scheme for services provided to the covered population over a certain period of time, whether these costs are directly incurred or purchased from providers (e.g. through capitation payments, wages or salaries).
d. *Expenditure and revenue data* describe the financial situation of the system or scheme by aggregating all expenditure and revenue items.

This last item must be obtained from scheme-based accounts, which means that scheme-based accounts also serve as a compatibility check for statistical data obtained from national statistics. If, for example, the product of statistically observed per capita utilization rates, times the number of the covered population, times the price per unit do not tally with the benefit expenditure in a certain category of services, then analysis of the statistical sources is necessary to clarify the reasons for the discrepancy. Discrepancies are not necessarily the result of statistical errors; there might also be systemic reasons. For example, the time frames for statistical reporting might not always be identical with those for accounting (i.e. the fiscal year). Or, utilization rates might be based on the number of services rendered, while respective accounting expenditure figures might only refer to services actually paid during the observation period.

Even within each health care financing scheme, statistical information has a hierarchy. The primary source of information for the core data areas listed above are the annual reports of the schemes. These reports often indicate which statistical information is actually collected within the scheme and is available to be accessed by the modeller. Reports often combine accounting and statistical data, and are usually intended for use by either the general public, stakeholders or the scheme's supervising agency. Note that the data in annual reports often have a public relations aspect, and may only contain highly aggregated and selected information. If annual reports are complemented with data from statistical reports, together these sources might fully cover the information needs of the modeller. However, in many cases more specific information, or information in a different form of aggregation, may be needed.

Obtaining these additional data may require going into the bank of "process data" which a scheme collects. Process data generally originate from the operative or financial transactions of the scheme. For example, a physician who is paid by a third-party payer on a fee-for-service basis will have to report to the payer in some way that patient X received treatment Y or diagnostic service Z. The third-party payer will then pay the provider, but will also book this transfer in his accounting system and place the invoice as well as the evidence of payment on the patient's individual record. All these activities create evidence in the form of process data. The records of individual patient services delivered and financed can thus be used to establish statistics on age-specific utilization of services.

4.4 DATA HANDLING FOR MODELLERS

Once the sources of data are identified, the modeller needs to understand how the data of various sources are "handled" – i.e. how existing data are checked and how a statistical database is completed if existing statistical sources are incomplete. We begin with the problems that any data collection process might encounter.

4.4.1 Data problems

As a rule, data are never perfect; this is one of the basic facts of modelling. While there can be no model without data, there is also rarely a complete absence of data. Data are not only the basis of modelling, they are also the basis for policy decisions. If modellers are asked to model certain "how much" questions, this generally means that policy decisions are imminent. Models are likely to improve the quality of the decisions, but it is unlikely that the absence of a model – due to a modeller's refusal to work on the basis of insufficient data – will stop a policy decision. The decision will in this case simply be made on a less-informed basis. Are no models better than models that operate on a deficient database? We do not think so. Even imperfect models force policy-makers to think about their policy problem in a systematic way; they must also acknowledge that they are taking decisions on the basis of a deficient database, and that they explicitly accept the risks that entails.

Whenever decisions with financial repercussions are made in a national health system, models can be constructed, however imperfect they may be at first. There is very rarely an excuse to do nothing. Remember that modelling involves a continuous process of improvement – once a first model is constructed, the model itself serves as a diagnostic tool for the progressive improvement of the data and information base.

Building an ideal data framework for any model in the field of social protection will thus require compromises and a certain amount of ingenuity to fill data gaps with estimates and assumptions. If the modeller is not ready to make these compromises and assumptions, he will most likely have to give up modelling. The base of data for health care models, as with all models in the social protection sector, usually suffers from one or more of the following problems:

- *Incorrect or inaccurate data* may result from incomplete or incorrect recording of elementary data in scheme records, or the incorrect aggregation of data. This often happens when national data are not fully reported (e.g. with some schemes or regions missing), or if they are simply treated incorrectly in the collection process.
- *Incomplete data* are found when data frameworks and reporting practices within the national health system simply are not comprehensive – i.e. when they do not report on the set of activities of a national health care system or a specific scheme in a logical way. In the case of national health care systems, for example, data on administrative costs within the government are often not available.
- *Missing data* may be a problem because the national health statistical system or the system of the institution in question simply does not report a specific item which the modeller considers vital (e.g. the per diem costs of patient stays in a hospital may not be disaggregated into staff and non-staff costs).

4.4.2 Filling data gaps

Missing data are by no means a rare phenomenon. In most cases, data gaps result from the fact that the standard data framework of a scheme or system is not geared to answer the questions that modellers are asked. If, for example, the modellers are asked to calculate the potential savings to a scheme from increased co-payments of persons under retirement age, but the data framework of the scheme does not report utilization by age, then a gap must be filled. There are essentially four ways to fill a gap.

1. *Initiating new statistical coverage.* This is the ideal solution. The modeller describes exactly what data are required and how they should be collected by the scheme or the system. He would then simply wait until the first statistical observations are available, on the basis of a full report of all relevant events. This requires time, and might not always be possible. However, there are situations where an additional statistical data collection is a prerequisite to any further modelling.

2. *Sampling.* Missing statistical data can also be replaced by drawing a sample from the process data of the scheme or the system. Alternatively, if the information needed is not registered in the form of process data, then a special survey may be organized to gather the needed information. Such a survey normally involves sending out questionnaires to a sample of insured persons, providers or other stakeholders in the system. In many cases, however, process data samples will be possible. This involves selecting a specific number of personal files of insured persons, either from an electronic database or in hard copy form. The crucial question here is the sample size necessary to provide reliable information. Sampling techniques are described in many statistical textbooks.[9] For our purposes, it is sufficient to cite the standard formula for the size of a sample, when the underlying distribution is assumed to be a normal distribution:

(Formula 4.1)

$$n = z^2 \delta^2 / e$$

where:

n = Required sample size
δ = Assumed standard deviation
z = Normal deviation from the mean under an assumed level of reliability
e = Absolute maximum deviation of the estimated mean from the real mean under the assumed level of reliability.

The value of δ might be estimated separately in a small pre-sample. The value for z can be obtained from a standard table for a normal distribution of type N (0,1). For an example of the application of statistical sampling to a missing data problem, see Example 4.1 later in this chapter.

3. *Assumptions.* Surveys take time and cost money. Often, neither is available. In this case, one might replace statistical data with a set of

Example 4.1 Demoland 3: Deriving utilization rates through samples

In our continuing example of the country Demoland, our modellers now need to estimate the total expenditure of the SHI scheme on hospital care. In order to make this estimate, they need data on the average number of hospital days per covered person. Fortunately, the personal file of each covered person contains the number of hospital days claimed and reimbursed per year. This information is not available in electronic form, and a manual sample of files of covered persons must therefore be drawn.

We assume that the distribution of the per capita number of hospital days is normal, around a given mean. From experience and international data, we know that an average will be between 1.5 and 3 days per capita per year, and that the standard deviation should be around 1.5. We want an estimate with a reliability of 99 per cent, that lies within a range of the true value ±0.1 days. We look up the value of z (see Formula 4.1) in a standard table, and find that the value 2.57 corresponds to a level of 99 per cent reliability. Based on Formula 4.1, the size n of the sample can be calculated as:

$$n = (2.57^2 \times 2.5^2)/0.1^2 = 1486$$

Thus, it would suffice in this case to draw a sample of about 1500 covered persons. There are 13.5 million persons covered under the SHI, so this is roughly equivalent to 0.1 per cent of the total. The value obtained from this sample would be an estimate of the average number of hospital days for all covered persons, i.e. across all age groups and both sexes.

If we also need to derive an age profile for hospital utilization rates, then we would have to draw a *stratified sample*, that is, i samples for i age groups. The size of the individual samples would also be calculated on the basis of Formula 4.1, but we may expect that the standard deviation would be smaller within each age group than across all age groups. Let us assume that the standard deviation of the hospital utilization rate within the individual age groups is about 0.5. The size of the "small" samples n_i would then be about 165, which means that the size of the total stratified sample would be about 1650 for ten defined age groups.

alternative assumptions, which show to what extent the uncertainty of the variable might influence the overall model results. In our Demoland case (see also Example 4.1), one might test alternative assumptions of hospital days, varying between values 10 per cent lower and 10 per cent higher than the value actually expected. At the same time, one might request that the scheme begin collecting the missing data on a routine basis for future analyses. The assumptions would then be replaced by actual observed data as soon as they become available.

4. *The use of proxies and the role of international data.* In many cases, not even educated guesses are enough to permit scheme-specific assumptions.

This is often the case in new schemes, where nothing is known about the possible behavioural reaction of the covered population or providers to certain scheme provisions. In this case, we might use international experience as a proxy. International data are provided in the statistical annex to this volume, inter alia for this purpose. This is a fairly risky procedure, as no data are completely compatible between countries. It may be seriously misleading, for example, to use hospital utilization rates of a country with a tax-financed national health insurance scheme to estimate utilization rates in a country with a social insurance scheme that covers only a part of the population and where hospitals are paid on the basis of itemized bills. The choice of an international pattern as a substitute for national data requires careful analysis of the benefit provisions of the comparator countries or schemes, and in any case a sensitivity test should also be carried out to assess the risks embodied in the substitution. However, in many cases there is no alternative; this is particularly true when the modeller is operating under time pressure.

4.4.3 Data plausibility and reliability

All data need to be examined before use, and nothing can be taken for granted. Simply taking data as reported by systems or schemes into a model without trying to understand what the data actually mean inevitably leads to major errors. For example, physician contact rates of 15 or more per capita per year could be observed in many Central and Eastern European schemes in the early 1990s, while OECD standards would suggest normal rates of about four to five contacts per year. If such values were accepted into a model without critical analysis, then errors might result, especially if one were to take the referral rate to hospitals and specialists from another source. (As it happens, the high contact rates reported in Central and Eastern Europe resulted from the fact that under the former command economies, the rationing of goods and services by various means was one element of demand steering. To prove eligibility for some social benefits, the endorsement of a physician was needed. Such administrative tasks accounted for a substantial part of physicians' working time, and thus also explained the high physician contact rates observed.)

Data must be examined along at least two dimensions. The first of these is *plausibility*. Are the figures quantitatively realistic in relation to the number of covered population, previous values of the same data series, data from other schemes or countries, or other related statistics? The implausibility of the physician contact rates above derived from the fact that no countries in other regions had similarly high rates. Plausibility controls are indispensable, but they require experience and a thorough knowledge of the modelling object. An experienced modeller will be able to tell whether data are "right" or "off". The only substitutes for experience are international data sets and data sets from previous years for the same scheme or system. Such data allow for comparison with the current data set for plausibility.

The other dimension according to which data should be examined is *reliability*. The reliability of data may be in doubt if its source is either unclear or questionable from a systemic point of view. A data source might be questionable if its information is derived from a small or biased sample. The above-mentioned high physician contact rates could also have resulted, for example, from a sample in a region with a high prevalence of heavy industry, and a consequentially heavily polluted environment.

4.5 SUMMARY

Statistical frameworks and scheme accounts usually represent the maximum level of disaggregation for any financial model of a national health care system or individual health care scheme. The existence, comprehensiveness and compatibility of both is a prerequisite for any meaningful modelling. There will always be missing data; it is the responsibility of the modeller to decide whether the data gaps can be filled, or whether modelling is impossible. The modeller might have to aggregate accounting and statistical data, but all models should follow the basic structure of national or scheme-based accounting and statistical frameworks. If a model follows a different accounting structure than that used in the health care system itself, the usefulness of the model is at risk, because users might not be able to reconcile the model results with the observed information base.

Box 4.3 Handling missing, incomplete or inaccurate data

- **Develop system to gather the data.** This method is the best if sufficient time and resources to gather the original data needed.
- **Gather a sample of the data.** If accuracy is important for filling the gaps, but time and cost are a consideration, this will provide a second-best alternative to developing a system to gather all the data needed.
- **Make assumptions to develop substitutes for the data.** If time and cost are a consideration and a sample cannot be drawn, common knowledge of the situation from health workers or others may provide some basic data, although the reliability of that data will be suspect.
- **Use proxy data from similar countries.** In the absence of data, information from other countries on utilization, health financing, or other data may be used as a proxy. This assumes that the comparator countries have similar economic circumstances and health systems. Using proxy data is inexpensive, but it is also less than an ideal basis for filling data gaps since it does not precisely reflect the local situation.

It also facilitates the modelling process if forecasting techniques are based on data observed and reported within the standard statistical monitoring of the scheme. If one were to resort to data obtained from a specific survey without initiating a modification of the statistical framework, then the modelling exercise might not be repeatable without future ad hoc surveys, and the model would only be of limited use as a routine management tool.

The modelling of financial systems should not be a one-off event. If a model is constructed to respond to a specific question, it is obviously of limited use; the time and effort spent on it depreciate quickly. Modelling should be a process and a permanent tool for financial governance. Managers or supervisors of national health care schemes should have permanent access to standard forecasts of the financial situation. For a model to be a permanent tool in financial management, it must be compatible with the national statistical and accounting frameworks.

This implies that the educational process concerning model building and implementation should always begin with a review, and possibly a proper design, of national statistical and accounting practices. Modellers should be prepared to advise the government as well as health planners and managers not only on models and modelling, but also on the proper compilation of statistics and accounting information. They could also provide guidance on proper formats for annual reports to supervisors and stakeholders. Modellers should train their counterparts on using model results in the corporate budget planning process, and reporting them in a format that facilitates the preparation of feasibility studies.

Notes and references

[1] Further details on accounting methods are found in Issue Brief 2 in this volume. In addition, the annex contains a wealth of international reference statistics that are relevant to some of the issues discussed in this chapter.

[2] OECD-ELSA Working Party on Social Policy and ad hoc meeting of experts in health statistics, *Principles of health accounting for international data collection* (preliminary paper, Paris, OECD, October 1997).

[3] For a more detailed description of accounting formats, definitions of terminology, and the structure of social budget models, see ILO, *The Cost of Social Security, Nineteenth International Inquiry* (Geneva, ILO, 1997); and ILO, *The ILO Social Budget Model* (Geneva, ILO, 1996).

[4] See note 2 above.

[5] Examples include: US Department of Health and Human Services (Health Care Financing Administration), *Health Care Financing Review, Annual Supplement*; Bundesministerium für Gesundheit (Germany), *Daten des Gesundheitswesens* (several issues); Ministère du Travail et des Affaires Sociales (France), *Annuaire des statistiques sanitaires et sociales*; UK Department of Health, *Health and Personal Social Services Statistics for England.*

[6] Example sources of data at the scheme level are: Régie de l'assurance-maladie du Québec, *Statistiques annuelles*; Bundesministerium für Gesundheit (Germany), *Die gesetzliche Krankenversicherung in der Bundesrepublik Deutschland im Jahre 1994*; US Department of Health and Human Services (Health Care Financing Administration), *Health care financing: Program statistics, Medicare and Medicaid data book*; National Federation of Health Insurance Societies (Japan), *Health insurance and health insurance societies in Japan 1997.*

[7] See, for example, Bundesministerium für Gesundheit, *Die gesetzliche Krankenversicherung im Jahre 1994* (Bonn, Bundesministerium für Gesundheit, 1995).

[8] See, for example, Bundesministerium für Gesundheit, *Daten des Gesundheitswesens*, various issues. (Bonn, Bundesministerium für Gesundheit).

[9] See, for example, Lawrence L. Lapin, *Statistics: Meaning and method*, p. 202, New York, Harcourt Brace Jovanovich, 1975.

5 THE MODELLING PROCESS

As we saw in Chapter 2, when modellers are confronted with a certain health policy goal and a strategy for its implementation, the first major milestone in the modelling process is the construction of a status quo model for the health care scheme or system in question, capable of analysing any envisaged policy options. The status quo model is created in a six-step process which is outlined below and which will be utilized when concentrating on the model-building process in this chapter.

5.1 THE SIX STEPS OF THE MODELLING PROCESS

The following sub-sections will discuss the six steps, some of which may be started before the previous steps are fully completed:

1. determining the scope of the model (national system or scheme)
2. defining the logical structure of the model
3. establishing the data framework and legal description
4. mapping the model mathematically
5. calibrating the model
6. sensitivity testing.

5.1.1 Determining the scope of the model: National health system or individual scheme

Depending on the questions asked by health policy makers, the first decision in the model-building process concerns the scope of the model. The modeller must decide whether it is necessary to build a model of the entire national health system (as in Example 2.2), or whether a model for a specific scheme would suffice (as in Example 2.1). This decision is crucial, as the design of the model should not close the door either to future disaggregation or to future inclusion of the model in a larger context. It should always be possible, for example, to include the model of a specific scheme into a model for the respective national health financing system. It should always be possible, in turn, to include the national health budget model into the national social budget model.

National health budgets are a composite of the budgets of various health care schemes. As seen in Chapter 3, no national health care system consists of only one scheme. Not even the public service health care schemes of the former socialist countries in Central and Eastern Europe were as monolithic as the regimes perhaps would have liked to think. All public service schemes are complemented in *de facto* terms by official or unofficial private financing arrangements.

Information on the national budget can be aggregated in two basic ways: in an income and expenditure statement, or a functional and institutional matrix. The *aggregated income and expenditure statement* encompasses the entire national health care system; a blueprint for such a statement is provided in table 5.1. The national health budget presented in Example 2.2 (for Demoland) follows a similar structure. The advantage of such an aggregation is that the time dimension of national health expenditure and its financing pattern can be represented in one statement.

The last line is called a **balancing item**, because it generally only represents the mathematical difference between the income and expenditure of the national health budget, which results from statistical inaccuracies. A national health care budget is not normally expected to be in deficit. Any deficit is usually covered by public funds, increased out-of-pocket outlays or contributions; however, there have been exceptions. In some Central and Eastern European countries, some local government health facilities went into deficit after the hasty introduction of health insurance schemes, and some of these were covered through loans from local banks. Likewise, social insurance schemes that have exhausted their reserves and are not in a position to cover emerging deficits through asset liquidation might temporarily have to resort to borrowing, but are expected to rectify the situation within a very short period of time. In an aggregated income and expenditure statement, this type of negative current balance would result in a negative balancing item, but such situations are rather rare. On the other hand, the balance would rarely be positive, since national health services and private out-of-pocket financing operate by definition on a PAYG basis (which means that annual expenditure is covered by annual income). Income received in excess of expenditures would not result in positive current balances of social and private insurance schemes, because they would simply be absorbed by the expenditure item "transfers to reserves".

The second method of presenting a national health budget is to organize it in the form of a *functional and institutional matrix*, in which the rows represent expenditure and revenue items within the national health care delivery system, while columns represent the various institutions within the national health care financing system, such as the social insurance scheme, the national health system, the private insurance industry, employer-based health care, and

Table 5.1 An aggregated national health income and expenditure statement

Item	Year(s)
Expenditure in the health care sector	
1. Expenditure in government facilities (only government-financed expenditures)	
1.1 Central government	
1.2 Local government	
2. Social insurance expenditure	
2.1 Social health insurance scheme(s)	
2.2 Health expenditure of other social insurance systems	
3. Private expenditure	
3.1 Private insurance expenditure	
3.2 Expenditure within other private arrangements	
4. Other expenditure	
5. Transfers to reserves	
Total expenditure	
• In absolute terms	
• As a percentage of GDP	
Income and receipts of the health care sector	
1. Government financing	
1.1 Central government	
1.2 Local government	
2. Social security contributions	
2.1 Employer contributions	
2.2 Employee contributions	
3. Private financing	
3.1 Private insurance contributions	
3.2 Out-of-pocket payments	
4. Withdrawal from reserves	
5. Other financing	
6. Receipts from abroad	
Total income and receipts	
Balancing item	

so on. Table 5.2 contains a typical blueprint for the matrix representation of a national health care budget.

Some types of schemes included in table 5.2 might be linked financially – i.e., there might be transactions between different schemes that do not affect the overall level of health expenditure. Examples of such financial links between schemes include:

- financial equalization or other cross-subsidies

	or public service health care scheme	scheme	(military, etc.)	industry	care schemes		arrangements	
Expenditure								
Benefit expenditure								
ambulatory care								
hospital care								
dental care								
pharmaceuticals								
other care								
Administrative expenditure								
Transfers to reserves								
Transfers to other schemes								
Other expenditure								
Total expenditure								
Revenues								
Income from general revenues								
including subsidies								
Income from earmarked taxes								
Income from social security								
employer contributions								
employee contributions								
Imputed employer contr.								
Transfers from reserves								
Transfers from other schemes								
Private out-of-pocket financing								
including co-payments								
Total revenues								
Balancing item								
Reserves at end of year								

- common use of provider networks
- mutual recognition of acquired rights
- common administrative structures
- common legislation for benefits and financing.

All these links give rise to explicit or implicit transfers between schemes, and they may or may not limit the modeller's degree of freedom. For example, several health care financing systems might be interlinked by means of a financial equalization mechanism (for example if, as in the case of Germany, the financial risk of health insurance for pensioners is spread across the more than 1,200 sickness funds). In this case, modelling the finances of one scheme or group of schemes might not be sufficient to map the scheme's real financial situation.

This brings us back to the question of selecting the modelling object which means, in effect, deciding whether to model either the complete matrix (as in table 5.2), or just one or more of its columns. Tables 5.1 and 5.2 may also serve as frameworks for the organization of the financial output tables of the model, whether it seeks to map an entire national system or a single scheme.

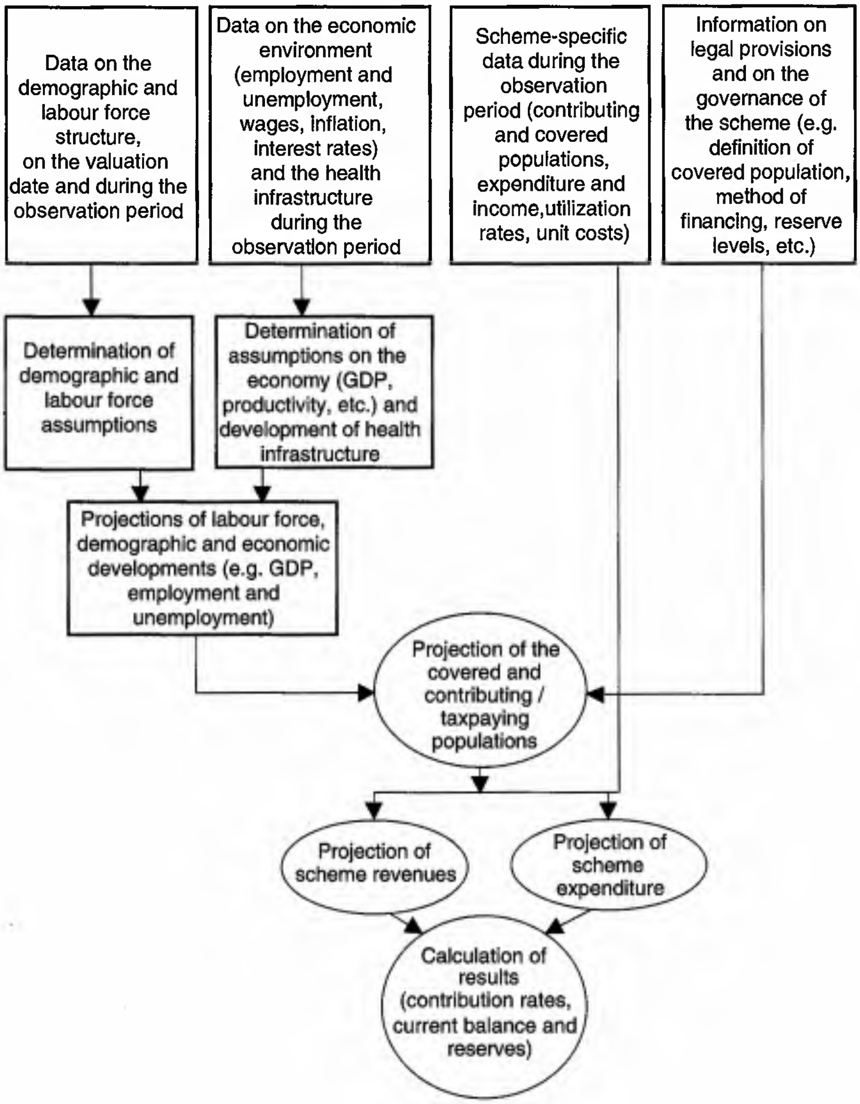
5.1.2 Defining the logical structure of the model

The second step in the model-building process is to define the logical structure of the model. It should be capable of answering the "how much" questions related to the health policy goals and strategies, the consequences of which the modellers have to analyse. This is usually done by creating a flow chart that depicts the logical relationships between the data and information needed as inputs for the model, the structure of model calculations, and the desired model output. Since we have already identified the basic factors determining health expenditure and revenues (in Chapter 2), it is enough here to map only those relationships between determining factors that can actually be modelled. Figure 5.1 shows a standard logical flow chart for a health care financing scheme with relatively wide population coverage. If one were to model an entire health care budget, some parts of the structure would have to be repeated to permit the simultaneous mapping of the various sub-components of the national system. But, for the sake of clarity, the following figure limits itself to a mapping of the logical structure of a single typical scheme (such as a social insurance scheme, or a scheme financed through earmarked taxation).

5.1.3 Establishing the data framework and legal description

Models can be built only on sound quantitative and qualitative information regarding the functioning of the modelling object – the health care financing scheme or system. The information base on the operations of the scheme or system consists of a data framework and a legal description.

Figure 5.1 A standard flow chart for a financial model of a health care scheme



The data framework

The third step in the modelling process begins with the production of an annotated list of the necessary data for the model. This list enumerates the required data items, but it also explains the disaggregation and time frame for each item. The list will be used as a guideline and a checklist by those responsible for data collection. The contents of the list normally vary from scheme to scheme. The most extensive data frameworks are needed for national health budget models. A data list for such a model could be similar to that presented in table 5.3.

The list below is, of course, only an initial approximation of a data framework. In many cases, it will have the character of a wish list rather than of a realistic enumeration of available data. With this information, a meaningful model of the national health care financing system could be built, but as stated not all of these data will be available, since the data situation is never perfect.

The sources of data collection are first of all those described in Chapter 4, i.e. the various levels of accounting information and statistics available in the country. The lack of reliable data and data deficiencies present a major challenge for modellers. First, expenditure data are frequently not available, especially regarding private spending. Public expenditure information is often incomplete, lacking accurate data on local levels of government and external donor assistance, both of which may account for a large share of total expenditure. Even worse, reliable information is often not available on the sources of financing or the actual types of services purchased by certain third-party financing systems (e.g. disaggregations of hospital costs, diagnostic services, clinics, public health, pharmaceuticals and supplies). Second, data on health service activities are even more rare and unreliable. In many countries, policy makers do not have any means of identifying patients who use health services or the activities of the staff who provide them. The use of performance indicators and clinical guidelines is still not widespread in developing countries.

Without such data and standards, it is difficult for policy makers to assess the performance and efficiency of the national health care system or of individual schemes. Many countries are pressing ahead with complex and costly health care reforms, without knowing either their starting point or how to quantify the impact of the reform on health or on other economic sectors. As spelled out in Chapter 4, the modellers might have to design methods for the substitution of missing data – either with assumptions based on international or other experience, samples, or with data gathered in small surveys conducted especially for this purpose.

The legal description

At the same time that the data framework is being constructed, a description of the legal provisions which govern the operations of the system or scheme must also be established. These legal provisions govern two main aspects: the provision of benefits and the nature of the scheme's resources. Both of these categories of information are needed to model the present and future functioning of the scheme. A blueprint for the legal description is provided in table 5.4.

Table 5.3 A typical data list for a national health budget model

1.	**Demographic and houschold data**
(D1)	Population by age and sex for single age groups 0 to 100 in the start year
(D2)	Mortality table by single age and sex
(D3)	Fertility rates by single ages (females aged 15 to 50)
(D4)	Net international migration by age, sex, and single age groups 0 to 100
(D5)	Population forecast used by the government
(D6)	Number of households by size
(D7)	Number of households by per capita income
(D8)	Household income composition by household size
(D9)	Structure of household expenditure by household size
2.	**Employment and labour force**
(E1)	Labour force participation rates (or labour force), by single age cohort (or groups) and by sex
(E2)	Employment by age, sex, and main sector (agriculture, industry, services, and by public and private sector)
(E3)	Self-employed by age, sex and main economic sector
(E4)	Unemployment by age and sex
3.	**Economy and government expenditure**
(EG1)	GDP in constant prices by main economic sector for at least 10 observation years
(EG2)	Forecasted growth rates, if possible until the end of the projection period (according to medium-term government plans), and if possible by economic sector
(EG3)	Monthly consumer price index (CPI) for at least 10 observation years
(EG4)	Monthly GDP deflator for at least 10 observation years
(EG5)	Interest rates (market)
(EG6)	Average monthly earnings and wages by economic sector and for the economy as a whole
(EG8)	Primary income distribution in the economy for at least three observation years
(EG9)	General government consolidated account data for at least three observation years
(EG10)	Government budget data for the first projection year (in the same breakdown used in EG9).
4.	**Health care**
4.1	**National health care infrastructure**
	(The following data are needed separately for public and private infrastructure. Public infrastructure might be further separated into ministry of health (MOH) and public non-MOH categories.)
(H1)	Number of hospitals
(H2)	Number of hospital beds
(H3)	Number of ambulatory clinics / health centres
(H4)	Number of employed physicians
(H5)	Number of other health care staff
4.2	**Government health care scheme (expenditure of MOH)**
	Accounts
(H6)	Complete accounts for MOH
(H7)	Budget of MOH for the first projection year
(H8)	Income of government facilities from patients' co-payments
(H9)	Transfers from other schemes
(H10)	Other MOH expenditure

Table 5.3 (Continued)

	Functional expenditure and utilization
(H11)	Ambulatory care expenditure
	(H11.1) Staff cost
	(H11.2) Non-staff cost
(H12)	Total number of ambulatory care cases
(H13)	Number of cases per capita by sex (active age group, younger age group, and pensionable age group)
(H14)	Expenditure on hospital care
	(H14.1) Staff cost
	(H14.2) Non-staff-cost
(H15)	Total number of hospital days
(H16)	Number of hospital days per capita by sex (active age group, younger age group, and pensionable age group)
(H17)	Dental care expenditure
	(H17.1) Staff cost
	(H17.2) Non-staff cost
(H18)	Total number of dental care cases
(H19)	Number of cases per capita by sex
(H20)	Pharmaceutical expenditure
(H21)	Total number of prescriptions
(H22)	Number of prescriptions per capita by sex
(H23)	Other benefit expenditure
4.3	**Other public schemes (military schemes, etc.)**
	(*mutatis mutandis, same breakdowns as above*)
4.4	**Social insurance scheme**
	Accounts
(H24)	Income and expenditure statements, balance sheets
(H25)	Initial reserves
	Expenditure side
(H26)	Ambulatory care expenditure
(H27)	Total number of ambulatory care cases
(H28)	Number of cases per capita by sex (active age group, younger age group, and pensionable age group)
(H29)	Expenditure on hospital care
(H30)	Total number of hospital days
(H31)	Number of hospital days per capita by sex (active age group, younger age group, and pensionable age group)
(H32)	Dental care expenditure
(H33)	Total number of dental care cases
(H34)	Number of cases per capita by sex
(H35)	Pharmaceutical expenditure
(H36)	Total number of prescriptions
(H37)	Number of prescriptions per capita by sex
(H38)	Other benefit expenditure
(H39)	Administrative expenditure
(H40)	Transfers to other schemes
(H41)	Transfers to reserves
	Revenue side
(H42)	Number of contributors to scheme

Table 5.3 (Continued)

	Revenue side (Continued)
(H43)	Average insurable earnings per contributor per scheme by age and sex
(H44)	Number of dependent spouses and children per contributor by age, sex and scheme
(H45)	Other income
(H46)	Co-payments
(H47)	Investment income
(H48)	Public subsidies
4.5	**Private health insurance, charitics, employer-based schemes and other private arrangements** *Except for income side, same breakdowns (if applicable) as under social insurance*

The initial data framework and legal description are modified during modelling, in an iterative process. Not all the data which are on the initial "wish-list" of the modeller will be available. Likewise, the understanding of the legal provisions governing the provision of benefits and the revenue collection process will increase during the actual process of modelling, and hence the initial legal description of the scheme will be subject to change throughout the modelling process. The data framework and legal description are two important outputs of the modelling process, and are an indispensable part of the reports prepared on the modelling exercise (e.g. actuarial valuations regarding health care schemes, or financial analyses of national health care budgets). They are part of the documentation of any model.

Table 5.4 The core contents of the legal description of the scheme

1. **Population coverage**
   - 1.1 Population groups/institutions financing the scheme
   - 1.2 Population groups eligible for benefits under the scheme
     - 1.2.1 Population groups covered without financing obligations (children, dependent family members, etc.)
2. **Bcnefits provided**
   - 2.1 Type and extent of benefits provided to covered persons
   - 2.2 Eligibility conditions (for each type of benefit)
3. **Pattern of delivery and remuneration of providers**
   - 3.1 Type of participating providers and relationships with them (e.g. physicians, hospitals; under global contract, owned or employed by financing agent, etc.)
   - 3.2 Remuneration of providers (fee-for-service, capitation, budget, etc.)
4. **Financing rules**
   - 4.1 General method and sources of financing (contributions, general taxes, earmarked taxes)
   - 4.2 Actuarial equilibrium (definition of the level of reserves to be maintained during a defined period)
   - 4.3 The determination of the contribution rate or tax rate, if applicable

5.1.4 The mathematical mapping of the model

Once the basic model structure is determined, the mathematical formulation of the model can begin. This essentially requires the translation of real-world observations of the demographic, economic, expenditure and revenue structure of the model into mathematical equations. The mathematical formulations might range from fairly simple extrapolations of past observations into the future, to much more complex analyses. (Chapter 6 will introduce some specific methodologies).

The processes of model formulation and design as well as of data collection interact with each other. If we begin to map certain provisions of the scheme in mathematical terms, we might discover that the necessary data are not available. This could influence or change the design of the model, or it might require another approach to data collection. For example, there might be a situation where a model design is dependent on an estimation of ambulatory care, based on the number of physician contacts. If the data collection process reveals that these data are not reported on a regular basis or are not obtainable, the modeller would have two options:

- Changing the model design (e.g. by basing the calculation of ambulatory care expenditure on the number of bills, rather than the number of physician contacts)
- Modifying the data collection process (e.g. by obtaining the required statistical data through an *ad hoc* sample survey, either with assumptions based on international or other experience, samples, or with data gathered in small surveys conducted especially for this purpose.

5.1.5 Model calibration

Even the best model design will lead to systemic deviations of the projected results from observed reality. There may be many reasons for this. The model design might be fundamentally wrong – or, more frequently, reality is influenced by a much more complex set of mutually interacting factors than the model is capable of mapping fully. In this case, the model results will differ systematically from observed results. Observed results are in part influenced by random variables, however, whose effects vary within a certain probable range, and can never be predicted exactly.

The ideal way to identify and correct systemic errors are full-blown ***ex ante* projections**. In these, the modeller projects the financial development of the health care system for a period in the past, and compares the model results with actual observations. In this way, systematic differences may be discerned between the projection and reality. This is a very complex exercise, since it does not suffice simply to run the *ex ante* projection – systemic errors have to be isolated from random errors (e.g. those resulting from unforeseen health events, such as a flu epidemic of extraordinary size during the period in question). The model must also be adjusted to correct for any legal or governance rules that were different in the past period, which can be a very complex undertaking.

Once the systemic effects have been isolated in the *ex ante* projection, the model specifications are changed, or the model results are "fine tuned" to make the projected values for the past period fully compatible with observed results. Changing the model presupposes that the modeller can identify the source of a specific systemic error; however, this is often not the case. Relationships on the health care market are so complex that in many cases it is impossible for the modeller to identify all important factors of influence. Model results can be "fine tuned" by applying adjustment factors to projected expenditure or income (or specific elements of expenditure or income), so that they agree with observations. This procedure may lead to a variety of calibration or adjustment factors. For a specific category *i* of care, contribution, demographic characteristic, etc., a projection may be modified as follows:

(Formula 5.1)

$$\mathrm{pf_i} = \sum_{a=1}^{b} \frac{[\mathrm{NOV_i(t)/PV_i(t)}]}{b-a+1}$$

(Formula 5.2)

$$\mathrm{PVA_i(t) = pf_i^{*}PV_i(t)\ for\ t \in \{b+1, \ldots, c\}}$$

where:

$\mathrm{pf_i}$ = Adjustment factor
$\mathrm{NOV_i(t)}$ = Normal observed value of an income, expenditure or demographic estimate of category i during a past projection period (test period) in year t, where the results have been corrected for any known extraordinary effects during the test period
$\mathrm{PV_i(t)}$ = Original values of the same variable, without correction
$\mathrm{PVA_i(t)}$ = Adjusted value
$\{a, \ldots, b\}$ = Past projection test period
$\{b+1, \ldots, c\}$ = Future projection period

The application of the adjustment factor $\mathrm{pf_i}$ implicitly assumes that if the systemic average deviation was x during the past projection period, then the future average systemic deviation (in relative terms) will also be x.

There is nothing wrong with using such factors. The only obstacle to determining the proper adjustment factor is that past projections might be too difficult to map. In effect, one would have to establish a synthetic database for the start year as well as for each year of the projection period. One look at table 5.3 is enough to tell the modeller that this will take considerable time.

In practice, a more pragmatic solution is often adopted. We simply start the projection one year earlier – i.e. on the basis of the start year $t_2 - 1$ (where t_2 is the last observation point of the observation period), then compare projected values and the values observed in t_2. This comparison is then used to derive adjustment factors, under Formulas 5.1 and 5.2. As said earlier, the projection of the medium-term future will normally be repeated each year, which permits continual adjustment and improvement of the projection basis, and with it the adjustment factors. This future-oriented approach allows substantial retroactive simulations to be avoided. While the result is initially less reliable, after four or five years at the latest the iterative improvement of adjustment factors and projection methodologies should result in the same reliability as when *ex ante* projections are used.

5.1.6 Last but not least: Sensitivity testing

Sensitivity testing can also be used to check the reliability of model results. Its main purpose is to demonstrate to users of the model (i.e. to decision makers) the relative importance of certain factors in the financial equilibrium of the system. For each sensitivity test, the value of one parameter is changed. A new model result is obtained based on the changed factor, and the outcome is compared to the status quo projection. One standard sensitivity test is on alternative assumptions of economic growth. Various economic or demographic assumptions are also important (e.g. alternative mortality or migration rates, or different values for variables that drive certain categories of health care expenditure). Sensitivity tests might also identify possible areas for the application of cost containment or more general reform measures.

Sensitivity testing can be used to demonstrate theoretical effects, when it is not possible to observe these effects statistically (e.g. income elasticity of health care utilization). One might assume different elasticities to observe the effect of alternative assumptions on the overall financial status of the scheme. Even if the modeller is uncertain about real income elasticity, the model can demonstrate how important this elasticity could be in financial terms. This is another way models can help avoid political mistakes, and is another key use for modelling.

5.2 METHODOLOGICAL PHILOSOPHY AND PRINCIPLES: SIX GROUND RULES

This section explores some basic characteristics of the health care market, and deduces six ground rules for modelling methodology.

Uncertainty is a basic characteristic of the demand for medical services.[1] The structure and volume of demand (the most important determinants of health expenditure levels), are not only determined by uncertain morbidity rates, but also by behavioural factors on the demand and supply side, by technological and economic factors, and by the ability of patients to pay for services. The prices of health care goods and services (the second most important determinant of health expenditure), also depend on behavioural, economic and technological factors. Exogenous factors such as behaviour, technology and economic developments are most often unpredictable, and thus uncertain from the analyst's point of view.

Furthermore, the quality and reliability of projections also depend on two crucial parameters:

- The quality of data and information available on the system
- Knowledge of how the system works, especially regarding the determinants of price and demand for certain goods and services.

As already mentioned, data, information and knowledge will often be deficient, incomplete and sometimes unreliable. This applies to systems in developing and developed countries alike, even though the degrees of uncertainty and lack of information might be different. These basic and obvious deficiencies have consequences for modelling techniques applied to health care financing systems, and these consequences can be summarized in six principles, covered in following sections.

- Limited projection periods
- Necessity of scenario analyses
- Robustness and recursiveness
- Respect for the natural limits of disaggregation
- Compatibility with accounting systems
- Macro-level consistency.

5.2.1 Limited projection periods

In view of the uncertainties of modelling, projections of health care expenditure should not be made for more than a *medium-term projection period* (a maximum of four or five years), other than for purposes of pure demonstration. Projections should be based on experience over a certain observation period. The system's financial performance during the observation period is studied, and an attempt is made to extract a standard pattern. This standard pattern serves as a basis for projections and simulations (even if the relationships between financial performance and underlying factors are not fully understood). Again, in view of inherent uncertainties, the observation period should be at least twice as long as the projection period.

5.2.2 Necessity of scenario analyses

To achieve a fair assessment of the future financial development of a system, projections should always include a number of scenarios that differ not only in key input variables (such as GDP or wage developments), but also in their assumptions regarding structural parameters that describe the utilization and cost of health services. In addition, where interactions between the political, economic and health status environment and the health system are not fully understood, the uncertainties should be acknowledged and managed through the testing of a variety of alternative scenarios. These could include, for example, expenditure levels under "optimistic", "pessimistic" and "realistic" assumptions on the utilization of health services. There could also be different assumptions on the future number of insured persons. This type of scenario analysis will map out a "channel" of potential results, and is a necessary tool in assessing the reliability of projections. More sophisticated stochastic projections could also be used to replace the deterministic scenario approach; however, due to their complexity, stochastic models are not often used.

5.2.3 Robustness and recursiveness

Robustness is a key characteristic of any model operating in an uncertain environment. Whenever possible, statistical observations during an observation period should be kept as a benchmark for projected future developments. Projections based on rates of change in existing expenditure and revenue levels are often more reliable than fancy behavioural models which aim to explain a certain expenditure level. There is too great a risk that such models will produce results which do not agree with observed reality. The purpose of modelling is to keep the model as close as possible to real-world results, not to design methodologically sophisticated mathematical mappings. Good governance remains the ultimate purpose of modelling. This can only be assured through the use of realistic, pragmatic and understandable financial models.

Intertwined with the problem of uncertainty, the problem of stochastic dependence or independence is of particular relevance to health insurance models. Utilization frequencies or costs in one category of benefits might be dependent on the respective values in other categories of benefits. The frequency of hospitalization and of prescriptions for medications, for example, are not likely to be independent of the frequency of outpatient visits to general practitioners. Furthermore, prices and frequencies within the same category of service might also be interdependent. Without system-analytical research, these interdependencies are difficult to detect and include in the model.

In order to avoid major errors that could result from the negligence of such interdependencies, a recursive modelling approach is suggested. **Recursiveness** is characterized by the fact that observed *starting values* for a given base year (e.g. frequencies or costs per benefit) are taken as base values, and projected iteratively year by year. Projected values are thereby anchored to observed values. The following formula illustrates this approach:

(Formula 5.3)

$$BE(t) = f(BE(t-1), \Delta det_1(t), \ldots, \Delta det_n(t))$$

where:

$BE(t)$ = Benefit expenditure in year t in a given category of services.
$\Delta det_n(t)$ = The change in the i-th factor out of n factors $det_n(t)$, which determines the development of the benefit expenditure in year t of the projection period. Assumptions concerning $det_n(t)$ are derived from values obtained during the observation period.
$BE(0)$ = Observed value of expenditure in a given benefit category in the start year of the projection. The actual statistical value might be adjusted for singular financial effects of the start year. Thus, BE(0) might be considered as "normal" in the respective category.

Projections based on observed "normal" values do implicitly take into account interdependencies between different categories of benefits. Even if the projection ignores these dependencies in its explicit formulation, the resulting errors over a fairly short projection period will be less than those which can result from unanchored projections.[2] Modelling, especially in a field where many of the underlying structures are not yet fully understood, must depend on iterative procedures.

5.2.4 Respecting the natural limits of disaggregation

Financial and actuarial models differ from each other, inter alia, in their *degree of disaggregation.* No general rule stipulates an optimal degree of disaggregation, there is only a limit beyond which disaggregation makes no sense. Generally, we can say that a model should continue to be disaggregated as long as the quality of the projections can be enhanced by the additional modelling work. Each step of disaggregation allows, in principle, the incorporation of additional information. It might be assumed that each piece of additional information might increase the quality of projections, although this is not mathematically certain.[3]

Health insurance models can generally be disaggregated along the following three dimensions:

- categories of benefits
- subgroups of the protected or insured population
- age and gender groups.

For example, there may be cases where only one equation for ambulatory care is possible. In other cases, it might be possible to split this category of benefits into services provided by general practitioners and those provided by specialists.

Moreover, specific equations might be feasible for different subgroups of the covered population. The natural limit of disaggregation is reached when the next disaggregation step would require information which is no longer statistically available, and would have to be assumed. Thus, the maximum degree of disaggregation is determined by the availability of data.

5.2.5 Accounting compatibility

The two basic representations of the national health budget (the aggregated income and expenditure statement and the functional and institutional matrix) largely follow standard health accounting formats as developed by the OECD, even if their breakdown is simplified for the purpose of financial modelling. It is important, however, that the accounting structure of any model be compatible with the accounting framework of the respective national health budget or scheme budgets.

If the structure of the model does not follow national practice, policy makers would find it impossible to relate model projections to the accounting categories they are familiar with, and would therefore find it difficult to identify areas for concrete policy action. Any model that does not relate its results to tangible areas for potential intervention loses much of its relevance for governance. Despite possible methodological merits, a sophisticated projection method for a particular basket of goods and services that refers to items not used in national or scheme-based accounting systems might be completely useless for health policy planners. For example, information on rising global ambulatory care costs would not be very useful, if the costs could not be allocated to specific accounts that would permit targeted policy intervention (e.g. general practitioner or specialist care or laboratory services). Policy intervention could consist, for example, of changing the parameters for the remuneration of specialists or general practitioners.

5.2.6 Macro-level consistency

All models of health care financing systems or major schemes must be consistent with the demographic and economic framework within which the system operates. (This principle is incorporated into the standard informational flow chart in figure 5.1.) As we have seen, health care financing systems react to macroeconomic variables, such as wages, unemployment, prices and inflation; they also react to changes in the demographic environment. Therefore, health care financing cannot be dealt with in isolation. In the past, for example, actuarial models often predicted the number of insured persons in isolation from developments on the labour market, which ultimately determines the potential maximum number of insured persons. And while medical inflation might always be higher than general inflation, this does not mean that the remuneration of medical professionals and the price of medical technology develops in isolation from average remuneration or the CPI. The relationship of health care parameters to the general economy must be built into the models.

5.3 A TYPICAL MODEL DESIGN

This section describes the basic model design for an individual scheme. Individual schemes are considered to be components of a national scheme. The scheme used here as an example is a social insurance health care scheme. The advantage of using a social insurance scheme as an example is that all elements on the expenditure side can be used, in principle, for the modelling of other types of subsystems of a national health care financing system. At the same time, it allows the exploration of the concept of contribution financing – probably the most complex financing technique in the health sector – and related modelling implications.

Before a typical design for a social insurance model is presented, it is worthwhile to recall the basic financing principles of a social insurance scheme. The principles presented below have a bearing on the presentation of the model's final results.

5.3.1 The basic financing principle of a social insurance scheme

Private insurance schemes or other non-statutory risk sharing arrangements should abide by the strict principle of *individual equivalence*, which stipulates that the present value of the average expected expenses incurred by an insured person throughout the period of insurance should equal the present value of the average sum of expected contributions.[4] In other words, financial resources are pooled in private arrangements for one purpose only: to organize an interpersonal transfer of resources from persons who do not need specified benefits to those who do, e.g. from the healthy to the sick in the case of health care.

By contrast, social security schemes (contribution-financed social insurance schemes or public health systems financed by earmarked taxes) operate generally on the basis of a somewhat less stringent principle of *collective equivalence.*[5] This principle holds that the present value of a scheme's expenditure in a defined period (i.e. benefits and administrative expenses during that period) should equal the present value of income of the scheme during the same period. This definition leaves room for some social transfers: the better-off might subsidize the poor, the younger generation might subsidize the older generation, or single persons might subsidize families. These transfers reflect the principle of social solidarity, on which social insurance schemes – such as tax-financed health systems – are built.

The basis for any model is the financial equilibrium of the system modelled – expenditures must match incomes. We return to the fundamental equation discussed earlier, Formula 2.1. We can modify that formula to cover a period longer than one year (until year T), as follows:

(Formula 5.4)

$$R(0) + \sum_{t=1}^{T} CR(t) * TAB(t) * v^t = \sum_{t=1}^{T} TE(t) * v^t$$

where:

R(0) = Reserves at the end of year 0
CR(t) = Contribution rate in year t
TAB(t) = Total insurable earnings (or assessment base) in year t
v^t = Discount rate v(= 1/(1 + i)), to the power of t
TE(t) = Total expenditure in year t.

This equation reflects the principle of collective equivalence, and is valid for all funding systems, including pay-as-you-go systems, fully funded[6] systems, and any form of intermediate funding. However, long-term equilibrium does not automatically guarantee solvency at each specific point in time. The rules and regulations of the scheme have to ensure that contribution rates under the different financing options provide enough cash flow to cover current benefit expenditure at each point in time. In any case, most health systems are financed on a pay-as-you-go basis.

5.3.2 The predominant financing method: Pay-as-you-go (PAYG)

Health care benefits are by nature short-term benefits, which as a class are generally financed by annual assessment premiums, also called pay-as-you-go (PAYG) premiums.[7] Virtually all social security health care systems today are financed on a pay-as-you-go basis. This means that the *T* in Formula 5.4 would be equal to 1. The necessary contribution rates are fixed at the beginning of a defined period, in such a way that total income can be expected to cover all costs of the scheme for the same period (generally one year). This means that, except for limited contingency reserves and more or less accidental surpluses, no major reserves are set aside.

Contingency reserves are usually fixed as a certain multiple of the so-called normal amount of total annual expenditure or benefit expenditure. The size of this multiple, called the **funding ratio**, depends upon the size and experienced stability of benefits and of the insured population. With a larger insured population, the average benefit expenditure per insured or covered person is generally more stable, as is the calculated contribution rate. Therefore, in a large scheme, the funding ratio can be relatively small.

While the level of reserves in private insurance schemes is usually calculated using a formula based on risk theory and past benefit experience, the exact funding ratio in social insurance schemes should be determined in a risk assessment process. This process occurs in at least two stages. First, an estimate of the potential maximum difference between an increase in benefit expenditure and an increase in total insurable earnings is required. Second, a realistic period must be estimated for the upward adjustment of the contribution rate, in case benefit expenditure shows an unforeseen rapid increase during a financial year or other assessment period. (A simple technique to assess necessary reserves is described in Chapter 6.) The funding ratio is generally smaller than one – i.e. the scheme would have reserves of less than one year's benefit expenditure. Contingency reserves of individual sickness funds within the German Statutory Health Insurance System are required by law to be at least equal to the amount of one month's expenditure. In the Netherlands, contingency reserves maintained by the General Fund (Algemene Kas) were until relatively recently on the order of 6 per cent of expected annual expenditure. In France, the reserves of the general scheme are supposed to be on the order of 10–12 per cent of annual expenditure.[8]

Over the past two decades, the process of fixing contribution rates in many countries has become a matter of macroeconomic reasoning, overall fiscal policy considerations and day-to-day political bargaining. Long-term considerations generally do not play a major role in the process of setting the contribution rate.[9] Despite discussions by many researchers,[10] it seems that no system is currently accumulating even minor technical reserves in order to smooth out the expected financial burden caused by the expected ageing of populations after the turn of the century.[11]

The widespread experience of rising health care contribution rates over the past one or two decades might have caused some reluctance to "overcharge" today in order to smooth out the future contribution burden. There is a notion that health care costs need to be controlled first, before dealing with future problems. Today, it seems that all monies accumulated in health care schemes are inevitably spent, although not necessarily in an efficient manner.

Health insurance policies in western industrialized countries have become *revenue-oriented.* This means that scheme incomes are explicitly or implicitly limited, and that schemes are expected to adjust their expenditure to their available resources. Thus, management and political efforts concentrate on cost containment.[12] In political terms, cost containment is often synonymous with preserving a certain level of health care expenditure as a percentage of GDP, or maintaining a stable contribution rate in terms of a percentage of gross wage incomes. Longer-term financing strategies are not often developed. From the modelling point of view, it makes little difference whether cost containment policies need to be devised and tested, or whether long-term contribution rates need to be calculated. The modelling requirements are the same.

5.3.3 Model structure

The model for a social insurance scheme follows the logical structure mapped out in figure 5.1. While social insurance models may vary in their details, most of them will have a similar basic structure. This section will describe a typical model structure, as used by the International Financial and Actuarial Service of the ILO. Each health insurance model should have the following four main modules:

1. An *economic and demographic module* that provides a projection and simulation of the population, labour force, employment levels and other economic data that are needed as input for the calculation of expenditure and revenues of the scheme.

2. An *income module* that projects the assessment base for contributions, using the economic and demographic data supplied by the above module, together with assumptions regarding the contributor and compliance ratios of the contributing population.

3. An *expenditure module* that projects expenditure in various benefit categories, administrative expenditure, and other expenditure on the basis of the projection of the covered population (i.e. the eligible population) and assumptions or projections of future utilization and cost developments.

4. A *result module* that calculates the annual balance of income and expenditure, and calculates necessary contribution rates.

5.3.4 The economic and demographic module

If the health insurance scheme is supposed to cover a sizeable portion of the overall population, all model-building must start with a general population projection. The term "sizeable" is intended to mean that as long as the scheme does not determine the covered population on the basis of some systematic characteristic (e.g. membership in a certain profession), and the covered population can be regarded as a random sample of the total population, the total population should provide the demographic framework for the model's projections. Scheme demographics (the number of contributors and beneficiaries) will have some relationship to the demographic development of the total population. In small schemes that cover only a minority of the overall population (e.g. a specific region or professional group), population developments should be based on estimates of new entries and exits. However, we assume here that the scheme has wide population coverage. Demographic projections for the short- to medium-term are normally available from national statistical offices. If such forecasts are not available, standard UN or ILO models can be used to generate such forecasts. (The relevant methodology is described in Chapter 6.)

The next step is to estimate the labour force and employment in the country, which is the basis for estimating the number of contributors. This is normally done by multiplying the population in active age groups by labour force participation rates. These are also normally available from statistical offices or ministries of labour.

The economic module is normally built on four sets of exogenous assumptions for the projection period, which can be obtained from national development plans or national macroeconomic models. These are assumptions regarding future:

- real economic growth rates
- labour productivity
- wages as a share of GDP
- inflation rates (CPI and GDP deflators).

Other categories of assumptions are possible, but it is important for all assumptions to be compatible, both with each other and with the macroeconomic forecasts used by the government. If there are good reasons for deviating from "official" assumptions, these reasons should be stated, and deviating assumptions should be analysed in alternative scenarios.

Based on these exogenous assumptions, total employment, unemployment and average wages can be calculated (see Chapter 6). Depending on the degree of disaggregation into subgroups of insured persons, estimates of employment may need to be broken down into categories such as employees, self-employed persons, or even categories according to employer or industrial sector. If the projection period is relatively short, employment structure may be held constant over the entire period. Alternatively, differing growth and labour productivity rates in different sectors need to be applied in order to estimate employment by sector.

5.3.5 The income module

Total revenues of a scheme are the sum of contribution income, transfers and subsidies, investment income and diverse other revenues. Contributions usually account for the bulk of income, with the other types of revenue of lesser importance.

Contribution income

The first step in estimating the total revenues of a scheme is determining the size of the contributing population and the assessment base for the payment of contributions. The assessment base is the total of all income subject to contributions.

Contributors. The contributing population might consist of the following major categories of contributors:

- employed persons

- self-employed persons
- contributing pensioners
- contributing unemployed persons
- voluntarily insured persons.

Once the size of these groups within the total population has been identified, the modeller determines or assumes a contributor ratio – a proportion of these groups that actually contributes to the scheme. This ratio could be split into a contributor ratio (the share of persons within each group that should pay contributions according to law) and a compliance or registration ratio (the share of those who should, in theory, be contributing that actually pay contributions or are registered under the scheme).

The population groups above might also be disaggregated further. Certain groups, such as farmers, craft workers, pensioners or people in certain regions might enjoy special benefit or contribution provisions. The accuracy of the model increases if these groups are treated separately. Table 5.5 shows some groups which might receive special handling. However, since the rules governing their contribution obligations or benefit entitlements might be different, modellers might encounter methodological or data problems that require a specific adjustment to the projection methodology. In some cases, these problems might even make a disaggregation meaningless, even though it would be desirable in theory.

Assessment base. A basic element of all contribution-financed systems is the assessment base. This is the total amount of earnings of insured persons which are subject to contributions. If contribution rates for various insured subgroups are not the same, then different assessment bases also have to be established. Normally, however, one would expect that a social insurance scheme would have a uniform contribution rate, and that total contribution income could be calculated by multiplying the contribution rate by the assessment base. The assessment base consists of the sum of all incomes subject to contributions, in all covered population subgroups.

It is not sufficient here to use the average wage in the economy as the average assessment base for employees, or the average pension as the average assessment base for pensioners, because a portion of earnings or pensions may not be subject to contributions. For example, persons with a wage lower than a stipulated amount may be exempt from contributions, while earnings above a certain ceiling may not be subject to assessment. Pensioners, meanwhile, may be exempt from contributions altogether.

Modellers normally take account of these effects by introducing a "catchment factor". The total earnings of an insured group are multiplied by this factor in order to arrive at the potential full assessment base. In addition, the full amount theoretically subject to contributions might be multiplied by a compliance rate, which reflects the proportion of insurable earnings that are

Table 5.5 A possible disaggregation of the insured population

Group and subgroups	Modelling problems due to data or information deficiencies
Regions	• Differences in infrastructure, income levels, morbidity without equivalent statistical information
Employed persons	
• Industrial workers (by industry)	• Different utilization rates and utilization baskets, which might not be identifiable statistically
• White-collar workers	• Different utilization rates and utilization baskets, which might not be identifiable statistically
• Agricultural workers	• Numbers often unknown, no information on earnings. Utilization rates and structure probably not reported.
• Casual workers	• Number and compliance uncertain, earnings difficult to assess. Utilization rates and structure probably not reported.
• Persons at sea	• Number and compliance uncertain, earnings difficult to assess. Utilization rates and structure probably not reported.
Self-employed persons	
• Farmers	• Earnings difficult to assess, utilization rates and structure probably not reported.
• Craft workers	• Number and compliance uncertain, earnings difficult to assess, utilization rates probably not reported
• Small-business owners	• Number and compliance uncertain, earnings difficult to assess, utilization rates probably not reported
• Other independent workers	• Number and compliance uncertain, earnings difficult to assess, utilization rates probably not reported
Special groups	
• Civil servants	• Utilization rates probably not reported
• Military	• Number probably unknown, utilization rates probably not reported
Economically inactive persons	
• Pensioners	• Ability to pay
• Unemployed persons and persons • with disabilities	• Utilization rates and structure probably not reported
• Social aid recipients	• Utilization rates and structure probably not reported
• Students	• Utilization rates and structure probably not reported
• Persons in training	• Utilization rates and structure probably not reported

actually reported for contribution purposes. Under-reporting is a widespread phenomenon, especially in groups with highly fluctuating incomes, such as farmers and certain categories of the self-employed.

From a financial point of view, under-reporting of earnings is a more serious problem than low registration. People who do not register do not attract any benefit payments. Thus, they do not show up on both sides of the equation (see Formula 5.4). Unless non-registration is seriously biased towards higher-income groups that are net subsidizers of other groups, those who are not registered do not pose a problem for the financial equilibrium. Under-reported income, on the other hand, means that people are not paying their dues in full, but at the same time are enjoying full benefit protection. This could lead to financial problems if the effect is not properly anticipated through modelling.

Other income

There are a number of income categories that are normally of minor importance. These include transfers, co-payments, and other income. *Transfers* may come from the following sources:

- the government budget, in the form of general or specific subsidies
- other social insurance schemes
- the international community.

There are no fixed rules for the projection of these income categories. There are also often hidden transfers, which are not always easy to identify, for example:

- windfall profits
- common use of infrastructure (e.g., if the scheme uses government facilities at fees which do not cover all costs)
- double-benefit entitlements (which might lead to a situation where members use facilities that are not reimbursed by the scheme, e.g. government facilities).

Co-payments are made at the point of delivery of services. The following forms of co-payments are common:

- flat rate (e.g. per day, per item, per prescription)
- percentage (of the price or fee)
- payments by the patient for charges in excess of certain ceilings (fixed by health insurance)
- exclusion of certain benefits (equivalent to a 100 per cent co-payment for these items of care).

The following table relates the various types of co-payments to various categories of care. Combinations of co-payment types within one category of care are possible. A special characteristic of co-payment income is that the amount can only be calculated after the expenditure under the respective category of care has been estimated.

Co-payments for excess charges and excluded items may be combined with a total annual ceiling on co-payments per insured person, or with ceilings which depend on a means test. This might be necessary in order to protect chronically ill or low-income persons. Many models simply calculate total co-payments as a fixed proportion of total benefit expenditure, multiplying the latter by a factor

Table 5.6 Common forms of co-payments and their usual use

	Ambulatory care	Hospital care	Drugs	Medical aids and prostheses
Flat rate	Per visit or per stay	Per day or per stay	Per item or per prescription	Per item or per prescription
Percentage	Of fee	Of fee	Of price	Of price
Excess	Fee fixed by health insurance	Fee fixed by health insurance	Fee fixed by health insurance	Fee fixed by health insurance
Exclusion	Certain treatments	Private rooms or other items	Less important drugs, such as those not included on a list of essential drugs	Dentures, glasses, or other items

equal to the ratio of co-payments to total benefit expenditure during the observation period.

Other income may include sales, reimbursements and interest received on financial reserves. The significance of such income depends on the design of the scheme, but it may be substantial if a scheme runs its own facilities and charges for their use, if one scheme provides services on behalf of another scheme, or if the scheme has substantial reserves. The amount of these types of income is usually simple to calculate.

5.3.5 The expenditure module

Total expenditure in a health care scheme usually consists of three major elements: benefit expenditure, administrative costs, and other expenditure. This final category is usually quite heterogenous, and varies considerably between schemes. It is normally only a tiny fraction of total expenditure, however, and may be modelled in a fairly crude way (e.g. as a fraction of benefit or administrative expenditure). Administrative expenditure is normally projected using a factor that reflects administrative staffing levels, and a cost factor that reflects wages and prices. The main modelling problem is presented by the projection of future benefit expenditure.

The estimation of benefit expenditure implies the estimation of the covered population, which is different from the contributing population. The covered population includes all persons who are entitled to benefits. This normally includes people who do not contribute, such as covered dependants and perhaps people who are unemployed or have left the scheme, but whose benefit entitlements have not expired. There are essentially two ways of calculating the total number of covered persons. Either one calculates a *dependency factor* to be applied to the contributing population, or one calculates a *coverage ratio* to be applied to the total population.

The next step is to disaggregate the benefit package for projection purposes. The most common disaggregation would be:

1. Ambulatory care
   - provided by general practitioners
   - provided by specialists
2. Inpatient care
   - in general hospitals
   - in special hospitals (e.g. tertiary care institutions)
3. Pharmaceuticals
4. Dental care
5. Medical technology (prosthetic devices)
6. Other benefits.

Generally, the expenditure in each category of care is projected by multiplying a **utilization rate** (number of units of care or cases per capita) by the unit cost and the number of covered persons. Bear in mind that perhaps not all covered persons are entitled to all benefits.

The concept of the **unit of care** deserves special attention. The unit reflects a uniform, indivisible element of provider activity (e.g. an injection). It usually is a basket of goods and services provided to patients. A hospital day, for example, is a basket of services, consisting of various nursing and catering inputs, medical technology inputs, as well as physician services. If the unit of ambulatory care is defined as a physician contact, then this unit also reflects a basket of goods and services. It therefore does not suffice to project the cost per unit with the general price index. A special price index must be established for every category of care, reflecting the relative share of staff and non-staff costs in each basket, as well as medical content and technological changes which affect the capital-to-labour cost ratio in the basket. The establishment of these cost indicators is one of the major challenges of the modelling exercise (and is further discussed in Chapter 6).

In an existing scheme, necessary data on utilization and unit costs may be obtained from statistics and accounts. It is more difficult to calculate the potential costs of a scheme in the planning stages. In this case, one cannot draw on observed scheme experience. There are only two sources of information that might substitute for such experience. First, it might be possible to draw on the experience of other domestic schemes which service a similar population. This could be done with examples from the relevant national health service or employer-based schemes. This type of substitution is particularly useful when the new scheme is designed to replace an existing one (e.g. a national health service). However, it should be borne in mind that new benefit entitlement provisions and perhaps more attractive benefits might actually increase utilization rates. Second, it might be possible to create assumptions on future utilization on the basis of international experience. This is highly risky, and should only be applied until the first scheme-based experience data are available. National data always reflect national performance, behaviour, benefit provisions, entitlement conditions, organizational aspects and infrastructure conditions, all of which are rarely similar between countries. However, in many cases, this approach cannot be avoided. The statistical annex to this volume provides typical international utilization data, which can be used to build preliminary utilization assumptions.

As will be seen in the next chapter, the general rule for the calculation of expenditure in different categories might be modified in line with actual modes of provider payment systems.

5.3.6 Results

Once income and expenditure have been calculated, the central results are easily derived – the income and expenditure balance, as well as the required contribution rates. The critical indicator is the necessary PAYG cost, which can be estimated on the basis of the basic formula (Formula 2.1). In older schemes, a comparison of the PAYG rates projected for the individual years of the projection period with the last observed rate will serve as a crude plausibility control of the results. In new schemes, other forms of plausibility control should be applied; there are too many sources of potential errors in any model to leave the results unchecked. (Examples of specific plausibility controls are also provided in Chapter 6.)

5.3.7 The core structure of the model design

The basic model structure for any social health insurance scheme can be summarized in 12 structural equations. These are summarized in Box 5.1 on pages 126–127 and represent the skeleton of the mathematical mapping of the financial structure in a model of a health insurance scheme. The equations are grouped according to the appropriate module. (For simplicity of notation, disaggregations by sex and age have been omitted.)

In the above notation, variables in capital letters are expressed in financial terms (i.e. in currency units) or in numbers of persons. Variables in small letters describe behavioural or governance parameters. All of these structural equations, of course, must be extended and disaggregated for any specific application. As a rule, all of the above variables are exogenous for the start year of the projection (the last observation year). These exogenous variables will then be projected in a recursive process using parameters which are either assumed or projected. (Chapter 6 covers basic techniques in projection methodology.)

Table 5.7 describes the nature of the projection parameters. The chapter then closes with a revisit to the Demoland example, first introduced in Chapter 2. The somewhat simplistic expenditure and income structure given in Example 2.2 will now be disaggregated, in line with the 12 structural equations.

Variable to be projected	Health care	Demographic	Economic	[illegible]
Economic and demographic module				
• Population		• Fertility and mortality rates, migration		
• Labour force		• Labour force participation rates		
• GDP			• Real growth rates	
• Employment			• Age structure of employment, labour productivity	
• Wages			• Wages as share of GDP	
Iucome module				
• Contributors				• Coverage and contributor ratios for different groups
• Assessment base				• Catchment and compliance rates for different contributing groups
• Other income			• Interest rates, government subsidies, and transfers from other schemes	
Expenditure module				
• Covered population				• Coverage rates or dependency ratios
• Benefit expenditures	• Utilization rates			
• Unit cost	• Health infrastructure and capacity data		• Medical inflation rates, wages of medical staff, technological progress indicators	
• Administrative expenditure		• Inflation rates	• Staff wage rates, inflation rates	
• Other expenditure			• Inflation rates, interest rates	
Result module				
• PAYG cost rate				

Box 5.1 The 12 equations of a basic model structure

The economic and demographic module

1. Labour force

$$LF(t) = POPACT(t) * labfrr(t)$$

2. Employment

$$E(t) = GDP(t)/LPROD(t)$$

3. Wages

$$W(t) = GDP(t) * ws(t)/E(t)$$

The income module

4. Contributors

$$CONT(t) = CONT_1(t) + CONT_2(t) + CONT_3(t)$$

where:

$$CONT_1(t) = E(t) * covr_1(t) * contr_1(t)$$

$$CONT_2(t) = [LF(t) - ET(t)] * covr_2(t) * contr_2(t)$$

$$CONT_3(t) = POPINACT(t) * covr_3(t)$$

5. Assessment base (insurable earnings/assessment base for employees)

$$AB_1(t) = W(t) * catchr_1(t) * compr_1(t)$$

6. Total assessment base

$$TAB(t) = \sum_{i=1}^{3} CONT_i(t) * AB_i(t)$$

(Categories of contributors (i = 1,2,3): employed, unemployed, and inactive persons including pensioners. Assessment bases for unemployed and inactive persons are determined differently, taking into account effects caused by the catchment and compliance factors.)

7. Contribution income

$$CI(t) = TAB(t) * CR(t)$$

8. Total income

$$TI(t) = CI(t) + OI(t)$$

The expenditure module

9. Covered population

$$COVPOP(t) = \sum_{i=1}^{3} CONT_i(t) * depr_i(t)$$

10. Benefit expenditure

$$BE(t) = \sum_{j \in \{\text{categories of care}\}} BE_j(t)$$

where:

$$BE_j(t) = COVPOP_j(t) * ur_j(t) * UC_j(t)$$

11. Total expenditure

$$TE(t) = BE(t) + AE(t) + OE(t)$$

The result module

12. Necessary pay-as-you-go contribution rate

$$PAYGR(t) = [TE(t) - OI(t)]/TAB(t)$$

(i.e. the basic equilibrium formula)

For all above equations:

$LF(t)$ = Labour force
$POPACT(t)$ = Population in active age
$labfrr(t)$ = Labour force participation rate
$POPINACT(t)$ = Inactive population (excluding children but including inactive persons of active age and pensioners)
$E(t)$ = Employment
$LPROD(t)$ = Productivity
$W(t)$ = Average wage in the economy
$ws(t)$ = Wage share in GDP
$CONT(t)$ = Contributors
$CONT_i(t)$ = Contributors in category i of contributors
$covr_i(t)$ = Coverage rate for category i of contributors
$contr_i(t)$ = Contributor rate for category i of contributors
$catchr_i(t)$ = Catchment rate of wages by contribution liability for category i of contributors
$compr_i(t)$ = Compliance rate for category i of contributors
$AB_i(t)$ = Assessment base for category i of contributors
$TAB(t)$ = Total assessment base
$CI(t)$ = Contribution income
$CR(t)$ = Contribution rate
$TI(t)$ = Total income
$OI(t)$ = Other income
$COVPOP(t)$ = Covered population
$depr_i(t)$ = Dependency ratio for category i of contributors
$ur_j(t)$ = Utilization rates for category j of care
$BE(t)$ = Benefit expenditure
$UC_j(t)$ = Unit cost for category j of care
$TE(t)$ = Total expenditure
$AE(t)$ = Administrative expenditure
$OE(t)$ = Other expenditure
$PAYGR(t)$ = Necessary PAYG contribution rate

Example 5.1 Demoland 4: Applying the 12 equations

The decision makers in Demoland would like to see a detailed breakdown of the cost estimate for the coverage of pharmaceuticals in outpatient care (see Example 2.2). The modellers have therefore prepared a breakdown according to the four classical modules for financial models in the health care sector, on the basis of the 12 basic equations given in Box 5.1. They have also assumed that the scheme manages to adjust the contribution rate each year to the necessary level (See table E5.1.).

Table E5.1 Applying the 12 equations

Exemple calculation: SHI Demoland

Cost estimate for the coverage of pharmaceuticals in outpatient care — Technical comments

	1998	1999	2000	2001	2002	How derived	Equation number
Economic and demographic module							
GDP (bn. CU)	337.00	353.85	371.54	390.12	409.63	projected	
GDP growth rate (%)		*5.00*	*5.00*	*5.00*	*5.00*	assumed	
Population (million)	33.70	34.37	35.06	35.76	36.48	projected	
Population growth (%)	*2.00*	*2.00*	*2.00*	*2.00*		assumed	
Children (million)	1617.60	1649.95	1682.95	1716.61	1750.94	projected	
Persons over active age (million)	2.19	2.23	2.28	2.32	2.37	projected	
Labour force (million)	12.64	12.72	12.80	12.87	12.95	projected	1
Labour torce participation rate	*0.38*	*0.37*	*0.37*	*0.36*	*0.36*	projected	
Employment (million)	8.84	9.19	9.55	9.93	10.33	projected	2
Labour productivity (CU '000)	38.12	38.50	38.89	39.28	39.67	projected	
Labour productivity growth (%)		*1.00*	*1.00*	*1.00*	*1.00*	assumed	
Unemployment (million)	3.80	3.53	3.24	2.94	2.62	projected	
Average wage (CU)	22.87	23.87	24.89	25.92	26.18	projected	3
Wages as share ot GDP	*0.60*	*0.62*	*0.64*	*0.66*	*0.66*	assumed	
Income module							
Contributors (million)	4.82	5.17	5.55	5.97	6.57	projected	4
Coverege rete ot employed (%)	*0.60*	*0.62*	*0.64*	*0.66*	*0.70*	assumed	
Contributor rate of employed (%)	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	assumed	
Total insurable earnings (bn CU)	100.00	111.94	125.44	140.50	156.22	projected	5, 6
Catchment ratio	*1.00*	*1.00*	*1.00*	*1.00*	*1.00*	assumed	
Compliance ratio	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	assumed	
Other income (bn CU)							
Income from co-payments (bn CU)	0.35	0.39	0.42	0.47	0.51	projected	
Government subsidies (bn CU)	0.42	0.44	0.45	0.46	0.48	projected	
Contribution income (PAYG-financed, bn CU)	7.68	8.59	9.61	10.76	12.06	projected	7
Total income	8.45	9.41	10.48	11.68	13.05	calculated	8
Expenditure module							
Covered persons (million)	13.53	14.12	14.77	15.46	16.56	projected	9
Dependency rate tor contributors	*2.10*	*2.10*	*2.10*	*2.10*	*2.10*	assumed	
Coverage rete for unemployed	*0.60*	*0.62*	*0.64*	*0.66*	*0.70*	assumed	
Dependency rate for unemployed	*1.50*	*1.50*	*1.50*	*1.50*	*1.50*	assumed	
Hospital benefits							
Hospital days per covered person per year	*2.00*	*2.00*	*2.00*	*2.00*	*2.00*	assumed	

Table E5.1 (Continued)

Exemple calculation: SHI Demoland

Cost estimate for the coverege of pharmeceuticals in outpatient care | Technical comments

	1998	1999	2000	2001	2002	How derived	Equation number
Cost per hospital day (CU)	*258.68*	*272.62*	*286.69*	*301.36*	*309.44*	projected	
Present benefits (bn. CU)	7.00	7.70	8.47	9.32	10.25	projected	10
New pharmaceutical benefit (bn CU)							
Prescriptions per covered person per year	*4.00*	*4.00*	*4.00*	*4.00*	*4.00*	assumed	
Cost per prescription (CU)	19.40	22.31	25.56	29.27	32.91	projected	
Pharmaceutical benefit cost (bn CU)	1.05	1.26	1.51	1.81	2.18	projected	10
Administrative cost (bn CU)	0.40	0.45	0.50	0.56	0.62		
Total expenditure	8.45	9.41	10.48	11.68	13.05	projected	11
Result module							
Required contribution rate (%)	***7.68***	***7.67***	***7.66***	***7.66***	***7.72***	projected	12

5.4 SUMMARY

This chapter has dealt with the basic features of all model-building, including the process, principles and basic characteristics of all health care financing models. It provides checklists that help modellers determine that they are following the proper process, that the modelling approach is consistent with basic modelling principles, and that the basic design of the model does not omit critical aspects of the modelling object or policy questions. The chapter thus provides a procedural and methodological framework of orientation for the modeller.

The modelling process can be summarized in the steps shown in Box 5.2. Not all of these steps are strictly sequential. For example, the determination of the database and the mathematical formulation of the model are often interactive and iterative processes. The philosophy of most health financing models follows six ground rules, also found in Box 5.2.

Model design is an iterative process that respects the above procedural steps and basic methodological principles. For almost any health care financing scheme, the initial model design or the basic structure of the model at each step of the iteration process should consist of no more than 12 basic equations (see Box 5.1), which can be grouped into four modules – the economic and demographic module, the income module, the expenditure module and the result module. These 12 equations are the basic skeleton for the mathematical formulation of any health care financing model. Methodological or factual justifications are required if one of the equations is not used (e.g. in the case

Box 5.2

The six steps of the modelling process

Step 1: Determine the scope of application of the model (i.e., the modelling object).
Step 2: Define the basic logical structure of the model.
Step 3: Establish the data and information base.
Step 4: Establish the mathematical formulation of the model.
Step 5: Calibrate the model.
Step 6: Perform sensitivity testing.

The six ground rules of modelling philosophy

Rule 1: The projection period should generally be limited to the medium term.
Rule 2: Uncertainty about future behaviour and the quality of the initial database require multiple scenario analyses.
Rule 3: The usually imperfect data situation calls for robust and recursive models which "anchor" projection results to observed starting values for statistical data.
Rule 4: The natural limits of model disaggregation should be respected (i.e., disaggregation should usually stop when further disaggregation would replace data with assumptions).
Rule 5: The outputs of the model should be compatible with the breakdown of the accounting framework used in the modelling object.
Rule 6: Model databases and assumptions must be compatible with the demographic, labour force and economic environment in which they operate.

of tax-financed national health service systems, the equation on contribution income would not be used).

Notes and references

[1] The notion of uncertainty in the context of medical care is explained, for example, in Kenneth J. Arrow, "Uncertainty and the welfare economics of medical care", reprinted in Luke and Bauer (eds.), *Issues in health economics* (Rockville, Maryland, Aspen Publications, 1982), pp. 25–54.

[2] An unanchored projection estimates benefit expenditures using determinants based on regression for each year of the projection period, without reference to the actual, most recently observed values of the determinants in the starting year of the projection.

[3] Aggregated expenditure in various benefit categories can be regarded as the sum of the averages of several independent random variables. By breaking the aggregation of a given benefit category into subcategories expressed as random variables and summing up the average in each subcategory, aggregated expenditure might lead to the result already obtained without disaggregation. The underlying stochastic notions are explained in Newton L. Bowers, *Actuarial mathematics* (Schaumburg, Illinois, Society of Actuaries, 2nd edition, 1997).

[4] Expected expenses and contributions are averages based on group expectations. The present value is a lump sum amount at one point in time which is sufficient to cover benefit disbursements for a defined future period. This value is calculated using future interest and mortality rates.

[5] As defined in W. Saxer, *Versicherungsmathematik* (Berlin, Springer, 1955), p. 202.

[6] "Fully funded", in this context, means that the scheme holds, at any point in time, reserves equivalent to the present value of all future benefit payments and all future financial liabilities

which would arise from accrued entitlements of the insured population This would theoretically permit the scheme to be terminated at any point in time, but still allow the scheme to honour all liabilities to the insured population.

[7] Warren R. McGillivray, "The economics and finance of social security", in: *Social security: Principles and practice* (Bangkok, ILO, 1985), pp. 47–61; Warren R. McGillivray, *Approaches to the financing of social security*, paper for ISSA Regional Meeting for Asia and the Pacific on the Financing of Social Security with Special Reference to Long-Term Benefits (Tokyo, 5–7 June 1989).

[8] William A. Glaser, *Financial decisions in European health insurance* (New York, New School for Social Research, 1988).

[9] The political rate-setting process is described in Glaser, ibid, V-16 to V-49.

[10] See, for example, J.M. Schulenburg and P. Kleindorfer, *Wie stabil ist der Generationenvertrag in der sozialen Krankenversicherung* (discussion paper, Berlin, International Institute of Management, 1985).

[11] Results of model calculations concerning the effect of ageing populations in Europe on health care expenditures are described, inter alia, in ILO, *From pyramid to pillar: Population change and social security in Europe* (Geneva, ILO, 1989), pp. 135–140.

[12] An overview of various cost containment measures applied in Europe (until about 1983 – since then, the range of available tools has widened) is given in Brian Abel-Smith, "Cost Containment in 12 European Countries", in: *World Health Statistics Quarterly*, Vol. 37, 1984, pp. 351–362.

CALCULATION TECHNIQUES

6

There are various ways to project and simulate the core parameters of the 12 structural equations described in the previous chapter. We will begin this chapter by describing a set of relatively simple techniques for this purpose. According to our experience, there are very few health care financing models which actually need to use more sophisticated techniques. The techniques presented here are perfectly adequate for the purposes of modelling the expenditure and income of statutory health care systems and calculating the necessary tax or contribution rates for their financing. Some readers of this book may also need to calculate premiums for private health insurance on the basis of actuarial principles. Techniques for this purpose are found in Issue Brief 3. This chapter concentrates on the following techniques and their associated calculation methods:[1]

- *population projections*, which provide the demographic environment for health care models when official population projections are not available
- *income estimates* for the health insurance scheme (as mentioned earlier, health insurance schemes have the most complex income side of all national health care subsystems)
- *expenditure estimates* for the scheme
- *estimates of the required contribution rate* for the social security scheme, including the maintenance of an adequate level of reserves.

6.1 A STANDARD POPULATION PROJECTION METHOD

Population projections generally adopt the *cohort component method.* This may be sketched as follows:

1. The total population of the base year is disaggregated into cohorts according to age and sex.

2. A year-by-year "ageing" of each cohort takes into account death and migration (in the case of national population projections).

3. The number of newborns is calculated by applying fertility rates to the female population in fertile age groups.

The method consists of the equations given below in Formulas 6.1–6.4.

(Formula 6.1)

$$L_{s,x+1}(t) = L_{s,x}(t) * p_{s,x+\frac{1}{2}}(t+\tfrac{1}{2}) + N_{s,x+1}(t)$$

(for $x = 0, 1, 2 \ldots 99$; $t = 0, 1, 2, \ldots$; s = male, female)

where:

$L_{s,x}(t)$ = Population of sex s and curtate age x at the middle of year t [2]

$p_{s,x+\frac{1}{2}}(t+\frac{1}{2})$ = Rate of survival from exact age $(x+\frac{1}{2})$ at the middle of year t to exact age $(x+1+\frac{1}{2})$ at the middle of year $t+1$

$N_{s,x}(t)$ = Net migration (i.e. immigrants minus emigrants) from the middle of year t to the middle of year $t+1$, in the curtate age x at the middle of year $t+1$

We use this equation to estimate the *population* on the left-hand side of the formula, provided that all the values on the right-hand side are known.

Let us define mortality rates in the life table in year t as follows:

$q_{s,x}(t)$ = Mortality rate within a year of persons of exact age x (=integer) at the beginning of year t.

Then *rates of survival* $p_{s,x+\frac{1}{2}}(t+\frac{1}{2})$ are calculated as follows:[3]

(Formula 6.2)

$$p_{s,x+\frac{1}{2}}(t+\tfrac{1}{2}) = [1 - q_{s,x}(t)]/[1 - \tfrac{1}{2} * q_{s,x}(t)] * [1 - \tfrac{1}{2} * q_{s,x+1}(t+1)]$$

The *number of newborns* is estimated by applying fertility rates to the female population in fertile ages (let us assume, ages 15–49):

(Formula 6.3)

$$NB(t) = \sum_{x=15}^{49} f_x(t) * L_{female,x}(t)$$

where:

$f_x(t)$ = Age-specific fertility rates applicable to the period from the middle of year t to the middle of year $t+1$

Subsequently, the population of the group aged 0 is calculated as follows:

(Formula 6.4)

$$L_{s,0}(t+1) = k * NB(t) * [1 - \tfrac{1}{2} * q_{s,0}(t)] + N_{s,0}(t)$$
$$(k = sr/[sr+1] \text{ if } s = \text{male}; k = 1/[sr+1] \text{ if } s = \text{female})$$

where:

sr = Sex ratio of newborns (i.e. newborn males divided by newborn females)

We assume here that the mortality rates $q_{s,x}(t)$ and fertility rates $f_x(t)$ are given. If this is not the case, then mortality and fertility patterns must be assumed using standards patterns, such as those published by the Population Division of the Department for Economic and Social Information and Policy Analysis of the United Nations.[4] The ILO has developed its spreadsheet-based Population Projection Model based on the UN methodology.[5]

6.2 KEY PROJECTION FACTORS

Traditionally, actuaries and financial analysts have calculated contribution income and benefit expenditure by formulating the following basic structure of health care systems (see also the 12 structural equations in Chapter 5).

1. Total insurable annual earnings of the contributors = (average earnings subject to contributions) * (contributors)

2. Benefit expenditure = (frequency of utilization) * (cost per benefit unit) * (covered population).

While these structures are generally subject to disaggregation into population subgroups or benefit categories, the methods for determining the values for the two key components (frequencies and unit costs) are often quite rudimentary. They may be derived from past experience, and simply projected into the future. In many cases, this is virtually the only possible way for estimations to be performed, since data constraints do not allow for more sophisticated approaches.

There certainly are cases where more detailed models may be constructed. While the formulas below represent to some extent variations and conversions of the basic formulas given above, their principal structure is the same. Some basic techniques have been adopted to determine frequencies and unit costs.

6.3 INCOME PROJECTIONS

The key parameters in calculating the total income of a health insurance scheme are the assessment base and other sources of income (especially investment income). These are described in the following subsections.

6.3.1 Total assessment base

The basic means of estimating the total assessment base was described in Formula 5.4 and in equation numbers 5 and 6 of the 12 basic equations given in Box 5.1. The assessment base is usually disaggregated by age and sex, as follows:

(Formula 6.5) *Contributors*

$$\text{(6.5a)}\quad CONT(t) = CONT_1(t) + CONT_2(t) + CONT_3(t)$$

$$\text{(6.5b)}\quad CONT_1(t) = \sum_{s,x} E_{s,x}(t) * covr_{1,s,x}(t) * contr_{1,s,x}(t)$$

$$\text{(6.5c)}\quad CONT_2(t) = \sum_{s,x} [LF_{s,x}(t) - ET_{s,x}(t)] * covr_{2,s,x}(t) * contr_{2,s,x}(t)$$

$$\text{(6.5d)}\quad CONT_3(t) = \sum_{s,x} POPINACT_{s,x}(t) * covr_{3,s,x}(t)$$

(Formula 6.6) *Assessment base*

$$\text{(6.6a)}\quad AB_{1,s,x}(t) = W_{s,x}(t) * catchr_{1,s,x}(t) * compr_{1,s,x}(t) \quad \text{for } {}^{\forall}x \in \{15, \ldots, \text{retirement age}\}$$

$$\text{(6.6b)}\quad AB_{2,s,x}(t) = UB_{s,x}(t) * catchr_{2,s,x}(t) * compr_{2,s,x}(t) \quad \text{for } {}^{\forall}x \in \{15, \ldots, \text{retirement age}\}$$

$$\text{(6.6c)}\quad AB_{3,s,x}(t) = TRANS_{s,x}(t) * catchr_{3,s,x}(t) * compr_{3,s,x}(t) \text{ for } {}^{\forall}x$$

where:

$UB_{s,x}(t)$ = Unemployment benefits for persons of sex s and age (group) x

$TRANS_{s,x}(t)$ = Transfers to those other than employed and unemployed persons of sex s and age (group) x.

(Formula 6.7) *Total assessment base*

$$TAB(t) = \sum_{i,s,x} CONT_{i,s,x}(t) * Ab_{i,s,x}(t)$$

(For the above formulas, the categories of contributors are denoted by $i = 1, 2, 3$: employed, unemployed, inactives including pensioners.)

Most of the nomenclature of the variables used above was explained in Box 5.1. The assessment base for unemployed persons is usually unemployment benefits (UB). The assessment base for pensioners is normally the pension, while other inactives might have other transfer income that qualifies as an assessment base for their health care contributions. The general variable for transfer recipients other than unemployed persons has been called TRANS. Inactive persons who do not receive any benefits but who are still covered by insurance would still have an assessment base, and the average assessment base in their age and sex group would have to be reduced accordingly. Inactive persons who are not covered would reduce the age- and sex-specific contributor ratios. Transfer benefits usually increase annually in line with average wages in the economy. The catchment factors and compliance rates for transfer income recipients are normally equal to one, as one would expect that the full amount of transfers (if they are insurable at all) would be subject to contributions, and that the normal amount of benefits typically provided by public institutions would be paid in full.

Changes in wages over the time of the projection period are reflected as follows:

(Formula 6.8)

$$W_{s,x+1}(t) = W_{s,x}(t-1) * [1 + w(t)] * wsc_{s,x+1}/wsc_{s,x}$$

where:

$w(t)$ = Increase of the average wage in the economy in year t (calculated on the basis of equation number 3 in Box 5.1)

$wsc_{s,x}$ = Relative wage scale, which describes average age-specific wages as a multiple of the average wage in the economy (scales are not normally changed during the projection period).

The effect of an income ceiling on the development of total insurable earnings may be reflected in the catchment factor "catchr(t)". In addition to the ceiling effect, the catchment factor might also reflect other factors that reduce the level of total wages subject to contributions, such as exemptions of certain population subgroups from contribution payments. For the sake of simplicity, we will ignore these effects for the moment. In the discussions following, we assume that the catchment factor reflects only the ceiling effect.

If the catchment factor is constant, this usually means that the income ceiling is adjusted in line with wages. If we assume that the average rate of increase in wages applies uniformly at all income levels (i.e., across the entire wage distribution), then the share of wages "caught" by the ceiling would not change if the ceiling were to move in line with wages. On the other hand, if the ceiling were to be held constant in nominal terms while nominal wages increase, then the share of total insurable wages in total national wages would automatically decline.

Dealing with this effect calls for some additional remarks regarding methodology, because in many social security schemes the non-adjustment of ceilings leads to substantial income reduction for the scheme over time. Catchment factors should be assessed for each year of the contribution period, and theoretically for each age and sex group, as well. In reality, the latter is close to impossible. That is why one would normally assess a global catchment factor, and apply it to a global distribution of earnings. However, if we were to assume an identical statistical shape for the distribution of earnings in each age category, then we could easily determine the catchment factors for total earnings in each age group. The statistical shape of earnings or wage distributions is normally log normal, and a log-normal earnings distribution can be defined by two parameters: average earnings and the coefficient of variation (i.e. the ratio of the average to the standard deviation). One could thus determine a common shape for the income distribution in all single ages by assuming a coefficient of variation that is equal for all ages. Box 6.1 on page 138 describes the relationship between the catchment factor and the log-normal distribution for those who wish to pursue a more sophisticated approach to the modelling of the assessment base of active contributors.

In the simple but perhaps more realistic case of a discrete known income distribution with n earnings classes, where the upper border of the j-th class is equal to the income ceiling, the catchment factor is calculated as follows:

(Formula 6.9)

$$\mathrm{catchr}(t) = \left\{ \left[\sum_{i=1}^{j} W_{\mathrm{class}=i}(t) * p_i \right] + \left(1 - \sum_{i=1}^{j} p_i \right) * \mathrm{cei} \right\} \Big/ W(t)$$

where:

$W_{\mathrm{class}=i}(t)$ = Average wage in the i-th wage class

p_i = Share of total wage earners in the i-th class or, mathematically, the discrete probability of the i-th class if

$$\sum_{i=1}^{j} p_i = 1$$

Example 6.1 on page 140 demonstrates how the assessment base for active contributors in Demoland could deteriorate if the income ceiling for contributions is not increased in line with wages.

6.3.2 Other income

Other income includes sums received on the investment of social security funds. The annual surplus available for investment is derived from predicted expenditure and contribution income at a given contribution rate. The amount of income from investment, denoted as I(t) in year t, can be roughly calculated as:

(Formula 6.10)

$$\begin{aligned} I(t) = i(t) * \{&\mathrm{RES}(t-1) + 0.5 \\ &* [\mathrm{TAB}(t) * \mathrm{CR}(t) + \mathrm{OI}'(t) - \mathrm{BE}(t) - \mathrm{AE}(t) - \mathrm{OE}(t)]\} \end{aligned}$$

(*continued on page 140*)

Box 6.1 The log-normal probability distribution and the catchment factor[6]

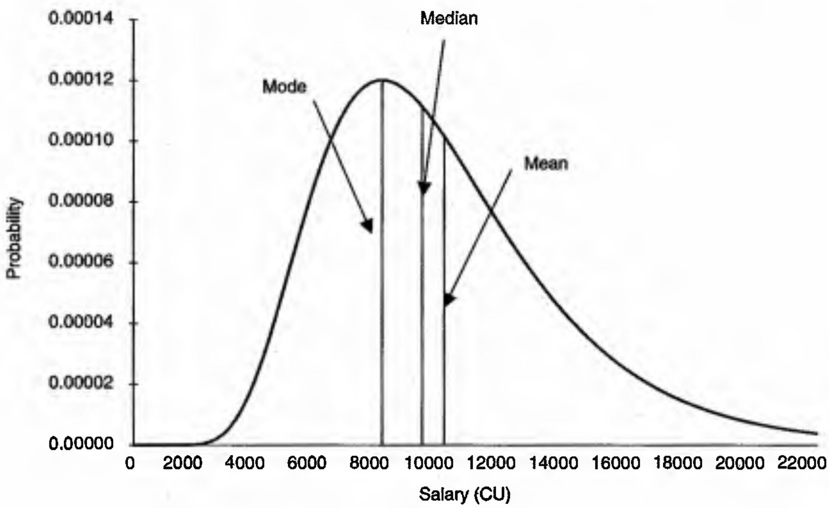
The assumption that earnings within a particular age are distributed in log-normal fashion is widely accepted. As shown in figure B6.1a, a log-normal distribution of probability has the following characteristics:

- A range of values from 0 to Infinity
- Non-symmetrical distribution around the average
- A wider range of values for the upper tail of the distribution (high income group).

This implies that:

- The average level of earnings (arithmetic mean or average) is greater than the earnings of the average contributor (median).
- The proportion of people who earn less than the arithmetic mean or average is greater than 50 per cent (with the exact proportion depending on the dispersion of the distribution).

Figure B6.1a The log-normal distribution of mean 10,000 and standard deviation 4,000

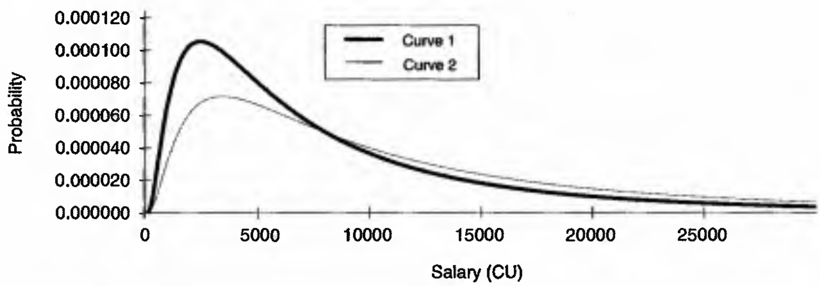


The exact shape of the log-normal distribution depends on two parameters: the mean and the parameter of dispersion. The dispersion may be measured either in absolute terms (standard deviation) or as a percentage of the mean (coefficient of variation):

$$\text{Coefficient of variation} = \frac{\text{Mean}}{\text{Standard deviation}}$$

In our case, the mean is deduced from the assumed wage/earnings scale and level of salary inflation. The coefficient of variation can be estimated based on available discrete earnings data. The salary distribution in the overall population is a function of the salary scale, the salary distribution in the specific age-sex groups, and the age distribution of the population. Specified values of salary scale and salary distribution are illustrated in figure B6.1b.

Figure B6.1b Income distribution



Coefficient of variation = 80%
Curve 1: No salary scale
Curve 2: Salary scale = annual increase of 2% (i.e. salary doubles over a 35-year career)

The parameters of the distribution can also be estimated empirically, since the natural logarithm of the log- normal random variable X follows a normal distribution.

$$\ln(X) \sim N(\mu, \sigma) \qquad \textit{(Distribution of random variables)}$$

Provided that we experience the sequence of empirical random data (x_i, where $i = 1, \ldots, n$), it is possible to estimate the values of μ and σ on the basis of data (X_i):

$$\mu = \frac{\sum_{i=1}^{n} \ln(X_i)}{n}; \qquad \sigma = \sqrt{\frac{\sum_{i=1}^{n} [\ln(X_i) - \mu]^2}{n}}$$

Then, we would assume the log-normal distribution with the following probability density function for $t = \log x$:

$$f_{\mu,\sigma}(t) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left[-\frac{1}{2}\left(\frac{t-\mu}{\alpha}\right)^2\right]$$

Using the log-normal continuous distribution, the discrete formula for the catchment factor becomes:

$$\text{catch}_{cei} = \frac{\int_{-\infty}^{\log(cei)} \exp(t) * f(t)d + \left(1 - \int_{-\infty}^{\log(cei)} f(t)d\right) * cei}{\int_{-\infty}^{\infty} \exp(t) * f(t)d}$$

where:

$$i(t) = \text{Assumed interest rate in year t}$$
$$RES(t) = \text{Invested reserve at the end of year t}$$
$$OI'(t) = \text{Other income (excluding investment income) in year t.}$$

$OI'(t)$ is here exogenous. This variable might contain such items as government subsidies, or other income from the rental of office space. Such revenue might be estimated through ad hoc procedures.

Example 6.1 Demoland 5: The impact of income ceilings on insurable earnings

In our continuing example of the case of Demoland, we have not yet assumed an income ceiling. The catchment factor was thus therefore assumed by default to be equal to 100 per cent, meaning that the full amount of earnings of insured persons would be theoretically subject to contributions. To demonstrate the effect of an income ceiling, we will now use sensitivity analysis to modify this assumption.

Scenario 1 of this analysis will maintain the prior assumption of a full catchment ratio of contributor earnings. Scenarios 2 and 3, on the other hand, will examine the situation if a ceiling of 30 CU on earnings is assumed in the start year. Table E6.1a shows the effects of such a ceiling under a discrete income distribution, as was assumed for Demoland in the start year. This income distribution leads to an average wage of 22.9 CU in the start year.

Scenario 2 specifically assumes that an income ceiling of 30 CU is introduced, and adjusted in the future in line with increases in the average wage. The income ceiling leads to a catchment of 93 per cent of all wages in the first year. It is then assumed that all wages in the income distribution increase by the same average rate over time. This is, of course, a simplification. If the ceiling also increases with the average wage increase, however, then the catchment ratio remains constant at 93 per cent during the projection period.

Scenario 3 assumes the same initial ceiling, the same income distribution, and hence the same overall level of catchment of 93 per cent in the initial year. The ceiling is not adjusted during the projection period, however, but remains at the level of 30 CU. This is a realistic case, as many schemes face enormous political difficulties in adjusting their ceilings in line with wage increases, or even with inflation.

Table E6.1b then summarizes the outcomes of the three scenarios. The overall level of catchment and its impact on the necessary contribution rate serve as the main comparator variables. Scenario 1 produces the same values as the standard case, as seen in Chapters 2 and 5. Scenario 2 leads to a constantly higher contribution rate, while Scenario 3 leads to an increasing contribution rate over the four years of the projection. The example shows that the effect of not adjusting income ceilings is fairly dramatic, even in the short run. The overall catchment ratio drops by 6 per cent in four years, and the necessary contribution rate is about 0.5 percentage point higher than in Scenario 2. This result demonstrates the importance of income ceilings.

Table E6.1a Income distribution of individuals in Demoland, 1998

Earnings class	Avaraga earnings within class	Parcantage of population in class	Total earnings par 100 population, by class	Cumulative earnings per 100 population, to upper limit of class	Cumulativa earnings as percentage of total earnings
0 to 10 CU	5	11	55	55	2.41
10 to 20 CU	15	21	315	370	16.19
20 to 25 CU	22.5	30	675	1045	45.73
25 to 30 CU	27.5	24	660	1705	74.62
30 to 40 CU	35	9	315	2020	88.40
40 to 60 CU	50	4	200	2220	97.16
60 plus CU	65	1	65	2285	100.00
Total		*100*	2285		

Income ceiling for contributions, CU	30
Earnings that fall completely under the 30 CU ceiling	1705
as percentage of total earnings	*0.75*
Earnings in classes above 30 CU that are subject to contributions (30 CU × 14)	420
Total earnings subject to contributions	2125
as percentage of total earnings (catchment ratio)	*0.93*

Table E6.1b Sensitivity testing and the effect of income ceilings

	1998	1999	2000	2001	2002
Total insurable earnings (bn CU)	100.00	111.94	125.44	140.50	157.40
Catchment ratio (standard – Scenario 1)	1.00	1.00	1.00	1.00	1.00
Catchment ratio (constant – Scenario 2)	0.93	0.93	0.93	0.93	0.93
Catchment ratio (decreasing – Scenario 3)	0.93	0.92	0.90	0.88	0.88
Required contribution rate (%), Scenario 1	7.68	7.67	7.66	7.66	7.66
Required contribution rate (%), Scenario 2	8.26	8.25	8.24	8.23	8.24
Required contribution rate (%), Scenario 3	8.26	8.38	8.52	8.68	8.75

6.4 PROJECTING EXPENDITURE

Expenditure projections must be made, regardless of whether the system is financed through taxes or contributions. The methods applied for these two types of systems do not differ significantly. Expenditure in the various categories of goods and services are estimated along three basic dimensions:

- Benefit packages and provisions specific to the scheme
- Organization of service delivery (e.g. according to provider, services or patients)
- Method of provider payment (budgeting, salary, capitation, fee-for-service, etc.).

Many social security health care schemes provide both cash and in-kind benefits. Projection methods for these categories of benefits are different. The treatment of administrative costs is discussed in section 6.4.3.

6.4.1 Cash benefits

Cash benefits usually consist of sickness allowances, maternity allowances and funeral benefits. These benefits might also be provided by other branches of the social security system.

If consistent data on the experience of these benefits are available, projections of expenditure in these categories are straightforward. If not, international experience patterns may be used as reference points for temporary assumptions, until scheme experience is available.

The first important step is to determine the subgroup of the insured population actually eligible for these benefits. In the case of cash benefits, only the contributing population is eligible, or a particular subgroup thereof (e.g. women, in the case of maternity allowances). Eligibility may also be subject to a qualifying period – for example, new entrants in year t might only become eligible for benefits in year t + 1. Part of the insured population might also exhaust its benefit entitlements by surpassing a maximum period. The population at risk, therefore, is usually smaller than the entire insured population.

Sickness allowances

Sickness allowances are usually paid in each case of sickness, for a maximum duration per incidence of sickness or per calendar year. Generally, benefits are paid after a specified number of waiting days have elapsed (usually one to three days). The amount of the daily allowance is usually calculated as a fixed percentage of the beneficiary's average daily insurable earnings in a defined reference period.

The frequency of sickness cases per capita and the number of days per capita show a clear age-specific trend: they increase more or less steeply as a function of age. The basic formula for expenditure in this benefit category could be:

(Formula 6.11)

$$BE(t) = \sum_{s,x} CONT_{s,x}(t) * SD_{s,x}(t) * AS_{s,x}(t)$$

where:

$SD_{s,x}(t)$ = Average number of sickness days per eligible insured person of gender s and in age (group) x in year t (this figure is often held constant over a medium-term period)[7]

$AS_{s,x}(t)$ = Average benefit amount of sickness allowances per day, for eligible insured people of gender s and in age (group) x in year t.

$SD_{s,x}(t)$ and $AS_{s,x}(t)$ are assumed, relying on experience during the observation period. $AS_{s,x}(t)$ is adjusted for each year of the projection period using procedures similar to those for age-specific insurable incomes (see Formula 6.8).

Since age-specific frequencies are generally quite stable over a short period of time under relatively stable economic conditions (e.g. constant unemployment rates), more sophisticated estimation methods for frequencies are not necessary.

If the sickness allowance is a fixed proportion of the insurable earnings, $AS_{s,x}(t)$ can be approximated as follows:

(Formula 6.12)

$$AS_{s,x}(t) = [W_{s,x}(t)/DW] * rb$$

where:

DW = Number of working days (salary in the reference period is divided by this figure to determine the daily reference salary for the calculation of the sickness benefit)[8]

rb = Benefit rate for the sickness benefit

The unit for the calculation of expenditure for sickness benefits is thus the sickness day. The frequency refers to the (age-specific) number of days per eligible insured person. All other formulas that use frequencies of cases or sickness rates can ultimately be traced back to Formula 6.11.

Maternity allowance and funeral benefits

The formula for maternity allowance expenditure has the same basic structure as Formula 6.11. The eligible insured population (specifically, the eligible female insured population) is normally defined as those between age 15 and 44 or 49 (reproductive ages).

Funeral benefits are usually paid in a lump sum, in case of the death of an insured person. An approximate formula for expenditure on this benefit is:

(Formula 6.13)

$$BE(t) = \sum_{s,x} CONT_{s,x}(t) * m_{s,x}(t) * FB$$

where:

$m_{s,x}(t)$ = Central death rate of insured persons of gender s and age (group) x in year t [9]

FB = Amount of the funeral benefit per case, usually determined in the benefit regulations

6.4.2 Benefits in kind

Projections of expenditure on benefits in kind are usually made separately for the various categories of services, such as:

- ambulatory care (general practitioner services)
- specialist and dentist services
- supply of pharmaceuticals
- supporting laboratory and diagnostic services
- hospital care
- other care.

Appropriate modelling techniques for each of the above categories are discussed in the following sections. Ambulatory care is treated first and in greater detail, as many of the concepts discussed in this category will later be applied to the modelling of other categories of in-kind benefits.

Ambulatory care (general practitioner services)

The modelling of expenditure on ambulatory care depends on the method of delivery of care, or on the method of payment to the provider. This section will discuss issues related to the budgeting, capitation and fee-for-service payment methods.

Budgeting

If outpatient facilities are owned by the scheme, or if services are contracted out to external providers paid by budget, a modelling method also known as *budgeting* may be applied. The budgetary costs of ambulatory care can be estimated using the budgeting method. It should be noted that the method outlined here is only a general guideline – the specific provisions of individual schemes may call for completely different modelling techniques.

Total expenditure is split into the categories of fixed (recurrent) and variable (benefit) costs. Non-recurrent and non-benefit costs, such as those incurred for investments in the scheme's own facilities (capital expenditure) should be dealt with as administrative costs.

The principal formula for the projection of total benefit cost in this category is as follows:

(Formula 6.14)

$$BE(t) = \sum_{j} FC_j(t) + VC(t)$$

where:

$FC_j(t)$ = Fixed benefit cost for facility j in year t
$VC(t)$ = Variable benefit cost in year t.

Fixed benefit costs include all items that – at least for the duration of one financial year – are not directly dependent on the degree of utilization of a provider unit (e.g. the salaries of regular staff). A budget plan is usually established for fixed benefit costs, covering the subsequent four- to five-year period (prediction period). Whether the present capacity of outpatient facilities will be sufficient to serve the protected population over the entire prediction period must be analysed – adjustments to capacity might be necessary and should be allowed for in the model.

Variable benefit costs per case (unit costs) for recent observation years must be determined statistically (if possible, by age and sex of protected persons). The term "case" must also be defined. Usually, it refers to one outpatient contact with a provider of ambulatory services. The number of cases per covered persons (frequencies or utilization rates, broken down into the same age and sex classification as defined for unit costs) in recent years must also be established.

We will explain the formula used to project variable benefit costs in some detail, since it can serve as a base formula for systems with other types of provider payments and categories of services. For ambulatory care, variable benefit costs can be calculated as:

(Formula 6.15)

(6.15a) $$VC(t) = \sum_{s,x} VC_{s,x}(t) * COVPOP_{s,x}(t) * f_{s,x}(t)$$

where:

$VC_{s,x}(t)$ = Variable cost per case for a patient of sex s and of age (group) x in year t

$COVPOP_{s,x}(t)$ = Number of covered eligible persons of sex s and of age (group) x in year t

$f_{s,x}(t)$ = Frequencies of cases per covered person of sex s and of age (group) x in year t.

Variable costs per case and frequencies are generally modelled in a recursive fashion, as follows:

(6.15b) $$VC_{s,x}(t) = VC_{s,x}(t-1) * [1 + vc_{s,x}(t)]$$

(6.15c) $$f_{s,x}(t) = f_{s,x}(t-1) * [1 + if_{s,x}(t)]$$

where:

$vc_{s,x}(t)$ = Rate of increase of $VC_{s,x}(t)$ in year t

$if_{s,x}(t)$ = Rate of increase of $f_{s,x}(t)$ in year t.

The pragmatic recursive approach has the advantage that it implicitly takes into account all visible, invisible and even unknown structures, as well as all the determinants of the given health care system. The absolute cost per case within a single category of care and the relative differences in case costs between different categories of care reflect, to some extent, the patterns of production and division of labour in the given health care system. This structure is generally difficult to model explicitly. It may therefore be preferable to adopt observed normal levels of cost per case.

Thus, exceptionally low or high levels of care in the starting year should be replaced with levels that are considered "normal" in light of developments in recent years. The projection then limits itself to predicting rates of increase or decrease in observed levels of care. Although using this approach helps the modeller avoid larger mistakes, it has the disadvantage of giving the model a certain amount of inertia – sudden, dramatic, trend-breaking changes in costs, such as those caused by structural changes within the system, cannot be evaluated if this technique is used.

Rates of change can be projected in several ways, provided that no major changes in the legal provisions governing services in the particular category are expected over the projection period. Box 6.2 describes a very simple procedure for such projections.

For variable costs, which generally represent only a minor portion of total costs for ambulatory care, the rates can be derived by observations of $VC_{s,x}(t)$ and $f_{s,x}(t)$ during a reference period. As said earlier, the reference period should be at least twice as long as the projection period.

Capitation

Expenditure under a capitation system is relatively straightforward. A provider, such as a clinic or GP, receives a fixed fee for each patient registered with the provider for a defined period of time (usually one quarter). The maximum number of protected persons on the list may be limited, or fees may decrease with the total number of enrolled persons.

Costs under a capitation system thus vary primarily with the number of protected persons. With each new protected person, the scheme pays an additional fee to a certain provider. The level of the fee depends on the position of the protected person on the list of the chosen provider.

Costs for newly protected persons can be estimated as roughly equal to the additional fees that would be due if the list slots with the highest fees were filled first (these are slots on lists of providers whose list is shorter than "normal"). After the slots with the highest fees are filled, slots on the list with the next highest fee level would be filled, and so on.

The arrival of a new provider will lead to a redistribution of protected persons among providers. *Ceteris paribus*, the average fee per insured person will increase. A pessimistic assessment of the effects of new providers is obtained by calculating the difference between the volume of fees for a certain number of patients in the highest fee bracket, and the volume for the same number in the lowest fee bracket.[10] The difference obtained is a prudent estimate of the additional cost incurred with the introduction of a

Box 6.2 Estimation of frequencies and unit costs: A simplified methodology

Frequencies and unit costs vary along the dimensions of *age* and *time*. In the following sections, we will assume that the relative age differentials of frequencies and unit costs remain constant at observed levels over the entire projection period. This is obviously a simplification, since age differentials vary over time. For example, the relative differential of frequencies and unit costs between those of patients 40–45 years of age and those aged 60 and over tends to increase over time. With our relatively short projection period, however, we can assume that the error resulting from this assumption will be negligible.

Age-specific starting values for frequencies and unit costs can be derived from statistical data obtained during the observation period. These figures are then adjusted for each year of the projection period by non-age-specific rates of increase, which can be determined as follows:

1. Frequencies can be derived through simple *one-dimensional linear regressions* of the time series of observed frequencies (i.e. total average frequencies over the entire protected population). From the estimated linear equation describing the overall time trend of frequencies, the rates of change for formula 6.15b can be calculated.

2. The rate of increase of the *cost per case* (unit costs) which, in the case of ambulatory care in a budgeted system are predominantly materials and drugs costs, might be predicted using Formula B6.2a below. (This formula will later be modified for other types of care and payment systems.):

(Formula B6.2a)

$$1 + vc_{s,x}(t) = [1 + p(t)] * d_{s,x}(t)$$

where:

$p(t)$ = General inflation rate in year t
$d_{s,x}(t)$ = The *average deviation factor*, which describes the average deviation of the rate of increase in unit costs from the observed general inflation rate over the entire observation period, or during part of the observation period.

The average deviation factor $d_{s,x}(t)$ for a single year of the observation period is calculated as follows:

(Formula B6.2b)

$$d_{s,x}(t) = [VC_{s,x}(t)/VC_{s,x}(t-1)]/[1 + p(t)]$$

The average deviation factor reflects the deviation of the average medical inflation cost per case from general inflation. Medical inflation can be driven by a variety of factors, such as technological innovation, improved medical training for providers, etc. These factors are generally unknown to actuaries or financial analysts. By applying the deviation factor, the average level of medical inflation is taken into account in the model.

new provider. An implied assumption here is that the arrival of new providers does not increase the total number of listed persons. However, if we assume that there will be a net increase in the number of listed persons, the above difference must be modified to reflect the additional number of full fees the system must pay.

The effect of annual adjustments of fees depends on the provisions of the scheme. If the provisions do not stipulate any specific adjustment procedures, it is reasonable to assume that the effect per provider will be equal to or less than that of the average insurable earnings per insured person.

Fee-for-service

The basic formula for a fee-for-service system is identical to that developed above for variable costs under the budgeting system. With fee-for-service payments and an indirect delivery system, virtually all benefit costs are variable for the scheme:

(Formula 6.16)

$$BE(t) = \sum_{s,x} C_{s,x}(t) * COVPOP_{s,x}(t) * f_{s,x}(t)$$

where:

$C_{s,x}(t)$ = Cost per case for a patient of sex s and of age (group) x in year t.

The unit cost $C_{s,x}(t)$ and frequencies $f_{s,x}(t)$ are estimated recursively (as in Formulas 6.15a and 6.15b). However, more attention should be devoted to the derivation of the rates of increase in this case. Box 6.3 describes a more sophisticated procedure than the one described in Box 6.2.

As a first step, the unit "case" has to be defined. This definition is almost always predetermined by whatever quantity units are reported statistically. For example, these may be visits to doctors' offices, sessions, etc. Fees are often paid, according to a fee schedule, for units "smaller" than visits or sessions (such as single medical acts). The statistically reported unit is a set of medical acts whose structure is determined by the nature of the case, and is thus a heterogeneous entity. Fees for various acts reflect costs for personnel, materials, drugs, depreciation for used medical technological equipment, etc. Even for the treatment of identical illnesses, the composition of the basket of medical acts may vary from one provider to another, according to the provider's style of practice, available equipment, time available and other factors.

Furthermore, there is ample evidence in fee-for-service systems that providers determine the demand for their own services, to a certain extent. Thus, apart from the initial contact initiated by a patient, a provider can, within certain limits, determine the composition and price of the basket of services. There is some evidence that providers actually compensate losses from lower numbers of

Box 6.3 Estimation of frequencies and unit cost: Second methodology

As in Box 6.2, we also suggest here that the relative age differentials of frequencies and unit costs be kept constant over the entire prediction period. Theoretically, a more sophisticated econometric estimation, treating age-specific frequencies and unit costs as interdependent variables in time, would be feasible.

The methodology presented here estimates the overall rates of change in costs per case and frequencies through econometric techniques, taking supply-side and demand-side explanatory variables into account. Not all of the variables which theoretically influence cost and utilization might be readily available in national or social security statistics. Thus, the model is often very crude. The econometric equation for frequency might be estimated as follows:

(Formula B6.3a)

$$f_{s,x}(t) = \text{func}_1(s, x, \text{PHD}(t), e_{s,0}(t), qi_{s,0}(t), \text{SD}_{s,x}(t), sh_s^{65+}(t), \text{GDP}(t)/\text{POP}(t))$$

where:

$\text{PHD}(t)$ = Physician density in a given area in year t
$e_{s,0}(t)$ = Life expectancy at birth of sex s in year t
$qi_{s,0}(t)$ = Infant mortality of sex s at year t
$\text{SD}_{s,x}(t)$ = Average number of sickness days per person of sex s and of age (group) x
$sh_s^{65+}(t)$ = Ratio of persons over 65 years of age in the total population of sex s.

As a general rule, several sets of explanatory variables should be tested, so that the equation fits past observations.

Using expected future values for the exogenous variables in Formula B6.3a, we can determine the predicted value of future frequencies which are used as variables in Formula 6.15. Per capita GDP (GDP(t) / POP(t)) is of particular relevance. It is generally the case that level of income (approximated by per capita GDP) has a strong influence on the consumption of health care. If econometric estimates are not possible, the modeller may have to assume that observed frequencies remain constant over the projection period. One can still demonstrate the impact of income level by assuming alternative GDP elasticities of utilization, however, and applying these to the last observed frequencies (utilization rates).

For modelling in developing countries, formulas that reflect national or regional capacity constraints may be necessary. Capacity constraints limit overall increases in frequencies, because providers do not have the ability to provide unlimited treatment, and because the number of providers cannot simply be increased beyond certain reasonable levels.

The rate of increase in *unit* costs, denoted as uc(t), can be estimated as follows:

(Formula B6.3b)

$$1 + uc(t) = \text{func}_2([1 + phd(t)], [1 + p(t)], [1 + w(t)], [1 + pd(t)])$$

where:

phd(t) = Rate of increase in physician density in the given area in year t
p(t) = General inflation rate predicted for the year t
w(t) = Rate of increase of insurable earnings per capita in year t
pd(t) = Rate of increase in the average price of drugs or medical supplies in year t.

If the rate of increase in physicians' per case fees can be obtained from observation data, it is preferable to use that rate in the above equation in place of the figures for general inflation and the rate of increase in the insurable earnings per capita. If the required exogenous data are not available for the observation period, or if a regression curve does not fit past observations, the deviation factor approach described in Box 6.2 must be applied. Issue Brief 4 provides examples of econometric estimation of the coefficients of the various variables in the above equations for frequencies and unit costs. Ready-made econometric software packages can be used to estimate different equations.

contacts or lower fees for single acts through a greater number of performed activities per case, or by performing higher-priced activities.[11]

Therefore, the frequencies and average cost per case of different benefit categories partially depend on the number and structure of providers. Moreover, they are to some extent interdependent. The notion of a stochastic interdependence between frequencies and costs per case is especially troublesome, since it is difficult to model the interdependence or to predict the degree to which it will actually materialize in a given year of the projection period.

The recursiveness that is built into the formulas presented above reduces the potential for mistakes in the model as a result of this problem. Known or unknown interdependencies are implicitly taken into account by establishing absolute and relative expenditure levels based on observations. It can then be assumed that for a limited period of projection (four to five years), the rate of increase in these frequencies might be treated as if it were independent, with an acceptable margin of error.

Specialist and dental services

Specialist services are generally either provided in facilities and hospitals owned by the schemes themselves, or are contracted out to private providers. When provided in scheme facilities, the budgeting method or a suitable variant might be applied. However, when specialist services are contracted to private providers, payment is usually by session on a fee-for-service basis. Here, the fee-for-service method might be adapted and applied. Since specialists normally act upon referral of a patient by a general practitioner, the frequency rate of ambulatory care might be one explanatory variable for the frequency of specialist sessions. According to delivery and payment type, the methods described for ambulatory care may be adapted and used for dental services.

Pharmaceuticals

Expenditure on pharmaceuticals may be expressed either as a combination of fixed and variable costs or entirely as variable costs. The former applies if drugs are provided entirely or in part by scheme-owned dispensaries, the latter if drugs are purchased from external suppliers in each case of sickness. If lump-sum payments are made for the provision of pharmaceuticals to a certain subgroup of protected persons, these expenditures can be modelled according to a variant of the budgeting method.

Regarding the quantitative reasoning behind the development of a formula for the variable costs of pharmaceuticals, we note that drugs are usually provided according to the prescription of a general practitioner, specialist or dentist (except for those consumed in hospitals). Thus, the most likely unit for this category of services will be the prescription. The quantity component of the formula will be directly linked to the frequencies for ambulatory, specialist and dental care:

(Formula 6.17)

$$\begin{aligned} BE(t) = \sum_{s,x} (&NAC_{s,x}(t) * PRAC_{s,x}(t) * PAC_{s,x}(t) + NSC_{s,x}(t) \\ &* PRSC_{s,x}(t) * PSC_{s,x}(t) + NDC_{s,x}(t) * PRDC_{s,x}(t) * PDC_{s,x}(t)) \end{aligned}$$

where (in all variables, for insured persons of gender s and age (group) x in year t):

$NAC_{s,x}(t)$ = Number of units (visits, sessions, etc.) of ambulatory care provided
$NSC_{s,x}(t)$ = Number of units of specialist care provided
$NDC_{s,x}(t)$ = Number of units of dental care provided
$PRAC_{s,x}(t)$ = Number of prescriptions per unit of ambulatory care
$PRSC_{s,x}(t)$ = Number of prescriptions per unit of specialist care
$PRDC_{s,x}(t)$ = Number of prescriptions per unit of dental care
$PAC_{s,x}(t)$ = Average cost per prescription in ambulatory care
$PSC_{s,x}(t)$ = Average cost per prescription in specialist care
$PDC_{s,x}(t)$ = Average cost per prescription in dental care

In reality, the number of prescriptions is not a simple linear function of the number of units in the category. There is evidence that the number of prescriptions actually decreases as the personal care of a physician becomes more intensive. Since such relationships are too difficult to model, it is suggested that the number of prescriptions be derived using linear regression, with the number of units per respective category as sole explanatory variables.

Future developments in unit prices for prescriptions are estimated using the deviation factor approach described in Box 6.2. If consistent data are available, more sophisticated equations might be derived in order to add exogenous explanatory variables for the cost per prescription.

Supporting laboratory and diagnostic services

Supporting laboratory and diagnostic services are usually provided based on the prescription of a general practitioner or specialist. Although laboratories act as subcontractors to hospitals in some cases, such arrangements are considered to be of minor importance. Given the direct link between laboratory services and general practitioner or specialist services, expenditure on these items can be estimated along the same lines as the expenditure for pharmaceuticals.

Hospital care

Hospital care for the covered population is provided either in scheme-owned hospitals or in external private or public hospitals under contract with the scheme. When hospitals are scheme-owned (or external hospitals are paid by budget), the budgeting method as described above for ambulatory care may be applied.

In case of per diem payments to private or public hospitals, the basic formula is:

(Formula 6.18a)

$$BE(t) = \sum_{s,x} HD_{s,x}(t) * CHD_{s,x}(t) * COVPOP_{s,x}(t)$$

where:

$HD_{s,x}(t)$ = Number of hospital days per insured person of gender s and of age (group) x

$CHD_{s,x}(t)$ = Average cost per hospital day per insured person of gender s and of age (group) x (disaggregation by age x may not be necessary)

The frequency (number of days per protected person) and the unit costs (average cost per hospital day) can be estimated in a recursive fashion, in line with the general principles outlined in Formulas 6.15b and 6.15c. A detailed description is omitted here.

The frequency and the change in costs per hospital day (which in some cases might be split into cost of room and board and cost of medical treatment) for the projection period can be derived using econometric techniques. The explanatory variables of the equations contain both supply-side and demand-side factors. Assuming uniform per diem rates for protected persons, regardless of age, the rate of increase in the unit costs chd(t) is estimated as follows:

(Formula 6.18b)

$$1 + \mathrm{chd}(t) = \mathrm{func}_3([1 + \mathrm{hbd}(t)], [1 + \mathrm{sm}(t)], [1 + w_2(t)], [1 + p(t)], [1 + \mathrm{pd}(t)])$$

where:

hbd(t) = Rate of increase in the hospital bed density in year t
sm(t) = Rate of increase in earnings per salaried medical personnel (physician and nursing staff) in year t (this is approximated by an increase in insurable earnings of male contributors)
$w_2(t)$ = Rate of increase in insurable earnings per female contributor in year t, assuming this is a good proxy for the rate of increase in earnings per non-medical staff in a hospital

The number of hospital days per covered person may be estimated as:

(Formula 6.18c)

$$\mathrm{HD}_{s,x}(t) = \mathrm{func}_4(s, x, \mathrm{HBD}(t), \mathrm{gsr}_{s,x}(t), \mathrm{fac}_{s,x}(t), \mathrm{fsc}_{s,x}(t), \mathrm{GDP}(t)/\mathrm{POP}(t))$$

where:

HBD(t) = Number of hospital beds available per protected person in a given country or region in year t
$\mathrm{gsr}_{s,x}(t)$ = Rate of general sickness for the population of sex s and of age (group) x in year t
$\mathrm{fac}_{s,x}(t)$ = Frequencies of ambulatory care for the population of sex s and of age (group) x in year t
$\mathrm{fsc}_{s,x}(t)$ = Frequencies of specialist care for the population of sex s and of age (group) x in year t

Including the frequencies of other categories of services as explanatory variables implies that interdependencies between various categories of care are explicitly taken into account. If the above equations do not fit past observations, an alternative approach may be pursued, along the lines of that described in Box 6.3 (i.e., holding observed age-specific patterns constant over the projection period and estimating only the overall trends for all protected persons through an econometric equation).

Frequencies of utilization (utilization rates) by age and sex play an important role in all major benefit categories. Age-specific consumption patterns become more important with longer assumed projection periods and greater expected changes in population coverage. They become even more important when evaluating the validity of savings schemes for health. A few more thoughts on the age pattern of health care consumption are therefore in order here. However, age-specific utilization data are usually the most difficult to collect.

Many schemes, particularly those in developing countries, do not have age-specific utilization data available. Data gaps have to be filled using time-consuming surveys or estimates based on foreign experience (see International Reference Statistics in the annex). Box 6.4 shows a third way, which permits an estimate of the pattern of health care consumption on the basis of a mathematical formula. Graphically, the age pattern of health care utilization by age takes the form of a curve roughly resembling the letter j (and is therefore called a J-curve). In the early years of a person's life, health consumption is relatively high, usually around 150–200 per cent of the lowest age-specific consumption rates. The lowest level of health care consumption is usually observed at around age 15 for females and around age 20 for males. This five-year age differential between men and women in age of minimum consumption is explained by the female consumption triggered at around age 15 by fertility. During the remainder of life, consumption increases more or less steeply to reach it final levels, which are expressed as a multiple of minimum consumption – usually between four and seven times the minimum level. In the absence of data, the J-curve can be calculated as a J-parabola, based on two pairs of key assumptions about the age and level of minimum consumption, and the age and level of maximum consumption. Box 6.4 describes the mathematical estimate of the J-parabola.

Other care

The category "other care" is a residual quantity, composed of a variety of services provided under the scheme. The size of the individual components of this residual category generally does not warrant separate projection. Due to the heterogeneity of this category, it is suggested that total "other" expenditure be modelled as the product of average expenditure per protected person and the number of protected persons. Average per capita expenditure can then be adjusted according to expected inflation rates and deviation factors over the projection period (see Box 6.2).

6.4.3 Administrative costs

Most administrative costs are fixed for a given range of membership or number of covered persons. Within this range, only a small portion of overall administrative costs will vary with the actual number of covered persons. A major shift in administrative costs occurs when membership increases to the extent that the additional administrative workload cannot be accommodated within the given system, or when the additional patient load cannot be handled in the present facilities. At this point, new operative or administrative staff has to be hired,

Box 6.4 The J-curve and the J-parabola of health care consumption

Based on standard patterns of age-specific health care consumption, we have developed here a mathematical function which can serve as a proxy of a real but unknown J-curve in a country where the database is insufficient. The shape is a function, in the form of a stretched and decentred parabola defined by the assumed age of minimum health care consumption (*mina*), the age of maximum consumption (*maxa*), as well as the respective utilization levels at these ages (*minu* and *maxu*). The proxy formula then reads as:

(Formula B6.4)

$$U(x) = sc * [(x - mina)/mina]^2 + minu$$

where:

$$sc = \text{Shape coefficient of the J-parabola,}$$
$$\text{i.e.: } (maxu - minu)/[(maxa - mina)/mina]^2$$
$$U(x) = \text{Utilization variable at age x}$$

Table B6.4 displays an observed utilization curve constructed on standard patterns in Western Europe. The utilization variable used here is a global utilization indicator, standardized at an indicator of level 1 at the minimum utilization age of 20, and a maximum indicator level of 6.2 at age 100. The graph describes, in parallel, the observed level of utilization and the proxy J-parabola. The shape of the J-parabola was calculated using the formula given above. The R-square measure of fit shows a value of 0.99, describing a very good fit in this specific example.

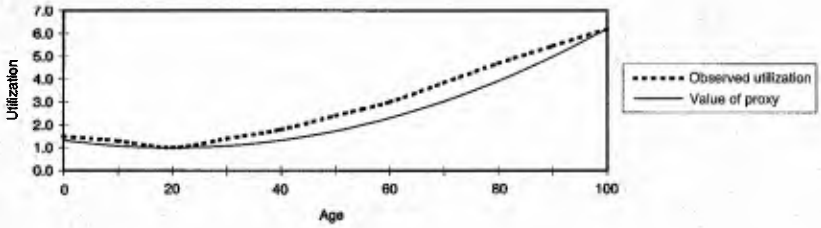
The fit in other cases might be substantially worse; but what really matters is that the above formula offers a quick, heuristic way to take into account the age differentials of consumption, even in cases where little is known about the actual patterns. Where nothing is known about the specific patterns of consumption – as could be the case in a new scheme, for example – we can still make use of the J-parabola to test the sensitivity (or non-sensitivity) of projection results to changing age patterns over the projection period.

One may wish to vary the maximum age in the above formula to bring it closer to "younger old ages", say, to the maximum age of 60 years, when applying this technique to countries where life expectancies are low. It is more important for the calculation of costs that the curve fit well in these "young old ages" than in the final ages, since the latter do not represent a very large percentage of any population.

Table B6.4 Observed and approximated values of the J-curve for a utilization indicator

Value of indicator/age	0	10	20	40	60	80	100
Observed utilization	1.5	1.3	1.0	1.8	3.0	4.7	6.2
Values of proxy	1.36	1.08	1.0	1.32	2.3	3.9	6.2

Figure B6.4 The J-curve and its proxy



or cost rationalization measures have to be implemented. New investments in facilities might also be necessary.

In a status quo situation, the actual level of administrative costs in a given scheme depends more or less directly on the number of protected persons, the number of employers, the structure and volume of scheme facilities, and the number of staff employed by the scheme. In order to predict administrative costs, the budget approach should be followed. Although there may be some justification for projecting administrative costs simply as a percentage of total benefit expenditure or of total insurable earnings, the budget approach is certainly preferable. Administrative expenditure might be modelled as follows:

(Formula 6.19)

$$AC(t) = AC(t-1) * \{sp(t-1) * [1 + w(t)] + [1 - sp(t-1)] * [1 + p(t)]\} \\ * [COVPOP(t)/COVPOP(t-1)]$$

where:

sp(t) = Share of personnel cost (salaries, allowances, etc.) in total administrative costs in year t.

We implicitly assume that all personnel costs increase in a linear fashion with the estimated rate of increase of insurable earnings, and that all other costs increase linearly with the expected rate of inflation. The term COVPOP(t)/ COVPOP(t − 1) links the increase in total administrative costs in the previous year to the increase in the number of covered persons. This provides for a safety margin, since an increase in operative or administrative capacity might not be necessary as a result of a limited increase in the number of covered persons. This factor can be replaced with a different estimate if concrete investment plans exist for the term of the projection period. Should the observation period show persistent and systemic deviations from the estimated values, then a deviation factor is applied (see Box 6.2).

6.5 PLAUSIBILITY CONTROLS

Before describing the calculation of medium-term contribution rates for statutory health insurance schemes, we will examine two formulas that permit a quick plausibility check on projected overall expenditure. The first formula relates the expenditure of the specific scheme to the overall national social expenditure, simply by calculating the relative cost of the scheme as a share of GDP and dividing this by the total population coverage rate of the scheme (i.e. COVPOP(t)/POP(t)). The resulting share of GDP, which we will call GDPS(t), reflects the total expenditure that the country would face if the total population were covered under the scheme. For social insurance schemes in developing countries, this figure should be higher than the country's actual total health expenditure as a share of GDP, but it should be smaller than the share realized in lower-income OECD countries. Thus, an estimated upper and lower limit for the potential order of magnitude of national health expenditure is obtained, and can serve as a plausibility check for the scheme's total expenditure. The method implies that the scheme provides a comprehensive health care package.

(Formula 6.20)

$$\mathrm{GDPS(t)} = \mathrm{TE(t)}/[\mathrm{GDP(t)} * \mathrm{covr(t)}]$$

where:

$$\begin{aligned}
\mathrm{GDPS(t)} &= \text{Potential share of health expenditure in GDP,} \\
& \text{assuming full population coverage} \\
\mathrm{TE(t)} &= \text{Total health expenditure in year t} \\
\mathrm{covr(t)} &= \text{Population coverage rate of the scheme in year t}
\end{aligned}$$

A second formula permits a quick rule of thumb for the order of magnitude of the PAYG cost of the scheme:

(Formula 6.21)

$$\mathrm{PAYGR(t)} = \mathrm{HES(t)} * \mathrm{W(t)} * \mathrm{covr(t)}/[\mathrm{TAB(t)} * \mathrm{Staffcs(t)}]$$

where:

$$\begin{aligned}
\mathrm{PAYGR(t)} &= \text{Pay-as-you go contribution rate in year t} \\
\mathrm{HES(t)} &= \text{Health sector employment in year t} \\
\mathrm{Staffcs(t)} &= \text{Share of staff costs in total health expenditure in year t}
\end{aligned}$$

This rule of thumb is based on the assumption that the staff employed by the health sector to service the insured population is financed by the insured population, and that staff costs account for a certain proportion (Staffcs(t)) of the total expenditure of the health sector.

Taking another look at the ongoing case of Demoland, and assuming that the country employs about 7.5 per cent of its formal-sector workforce in the national health sector (which is not an excessive assumption), then the above rule of thumb would yield an approximate necessary contribution rate of 7.56 per cent, while the model calculations yield a value of 7.68 per cent (see Example 5.1 for more on Demoland's calculation of contribution rates).

6.6 CALCULATION OF A MEDIUM-TERM CONTRIBUTION RATE

After all expenditure and income items have been estimated for each year of the projection period, the necessary pay-as-you-go contribution rate for a given year can be calculated based on the basic structural formula (equation 12 in Box 5.1). This formula permits only the cost for one financial period to be covered. The necessary contribution rate is a perfect indicator of the relative cost of the scheme but is certainly not realistic, even in the short run. Setting the contribution rate actually charged according to the modelled necessary contribution rate would almost inevitably mean that the scheme would run into cash flow problems whenever expenditure increases at rates even slightly faster than expected, or when contribution collections or receipts of other income are slightly later than anticipated. The charged contribution rate should allow for the buildup or maintenance of a contingency reserve. Most likely, political decision makers will also prefer a contribution rate that remains stable, at least in the medium term.

A third parameter therefore enters into the calculation of the actual contribution rate, in addition to expected income and expenditure. This is the desired level of contingency reserves (k(t)), which is usually defined as a multiple of annual expenditure:

(Formula 6.22)

$$k(t) = RES(t)/TE(t)$$

where:

$$\begin{aligned} RES(t) &= \text{Reserve at the beginning of year t} \\ TE(t) &= \text{Total expenditure in year t} \end{aligned}$$

Alternative definitions of the level of funding can be formulated, replacing the numerator (reserve at the beginning of year t) with the reserve at the end of year t, or the denominator (total expenditure in year t) with benefit expenditure.

Depending upon the size of the scheme, the factor k(t) might vary between 0.25 and 1, or may even be higher than 1. A scheme with a large stable population might need only three months' expenditure as a contingency reserve, whereas a small fund with fluctuating morbidity experience might need three times the level of annual expenditure. Normally, a complex risk analysis should be undertaken to decide the desired level of the reserves, based on the probability of predicted total expenditure exceeding the projected levels, or of the projected assessment base falling short of the predicted level. Also important is the amount of time which a government or the management of a scheme would need to implement an increase in the contribution rate or a decrease in benefit entitlements in order to bring the scheme back into financial equilibrium after unforeseen financial developments.

We have therefore developed a pragmatic estimate for k(t), to serve as a guide for all schemes with a reserve requirement. The formula is based on the assumption that the reserve must be large enough to cover a maximum deviation of expenditure from the normal level and a maximum shortfall of total income. We assume that the scheme has only marginal other income and that non-benefit expenditure also represents only a small part of total expenditure. Under these conditions, the maximum risk on the expenditure side can be assessed as the product of $(1 + \mathrm{df})$ and $(1 + \mathrm{dp})$, where df is the assumed maximum level of utilization in excess of the normal standardized level 1, and dp represents the assumed maximum level of medical prices in excess of the assumed or projected standardized level 1. The deviation factors dp and df are both greater than zero.

The maximum risk on the income side would be a shortfall in the total assessment base, expressed as the product of $(1 - \mathrm{dc})$ and $(1 - \mathrm{dw})$, where dc represents the assessed maximum shortfall of contributors, and dw represents the expected shortfall of the average wage subject to contributions. Factors dc and dw are positive and smaller than one.

Based on these factors, and on the assumption that each scheme can react with an increase of the contribution rate or adjustment of expenditure provisions within the fraction y of a year, the minimum reserve level can then be calculated as:

(Formula 6.23)

$$\mathrm{k(t)} = [(1 + \mathrm{df}) * (1 + \mathrm{dp})/(1 - \mathrm{dc}) * (1 - \mathrm{dw}) - 1] * \mathrm{y}$$

We can also calculate the constant contribution rate CCR(t) for a period of t years, i.e. for years $0, 1, 2, \ldots, t - 1$, on the condition that the level of funding is $k(t - 1)$ at the end of the period:

(Formula 6.24)

$$\mathrm{CCR(t)} = \frac{\mathrm{DS[TE(t) - OI(t)] + k(t) * D[TE(t)] - RES(0)}}{\mathrm{DS[TAB(t)]}}$$

where:

DS[TE(t) − OI(t)] = Discounted value of total expenditure minus other (non- investment) income during the period up to $t = 0$, the beginning of the projection period

$D[TE(t)]$ = Discounted value of the expenditure in year t, discounted for exactly n years up to $t=0$

$RES(0)$ = Initial reserves at the beginning of year $t=0$

$DS[TAB(t)]$ = Discounted value of total insurable earnings up to $t = 0$

The discounted value of total expenditure during the period of t years is calculated as:

(Formula 6.25)

$$DS[TE(t)] = (1 + i/2)^{(-1)} * \sum_{k=0}^{t-1} TE(k) * (1 + i)^{(-k)}$$

The discounted value of expenditure in year t (from the beginning of year t to the beginning of year $t = 0$) is calculated as follows:

(Formula 6.26)

$$D[TE(t)] = (1 + i)^{(-n)} * TE(n)$$

In the above equation, i is again the interest rate, assumed to be constant throughout the calculation period. The discounted values of the other variables are calculated accordingly. In the case of a new scheme, the necessary initial reserve is usually created through the means of a time lag between the commencement of contribution collection and that of benefit payments.

Returning again to our Demoland exercise, Example 6.2 demonstrates how the authorities fix the contribution rate for the projection period.

6.7 A PRAGMATIC, STOCHASTIC EXTENSION OF THE MODELLING APPROACH

In some cases, deterministic, one-point estimates of expenditures and contribution rates in each year, as described above, might not be sufficient. Actuaries might want to take the uncertainty of the prognosis into account, in which case, a deterministic model could be replaced with one that incorporates stochastic elements. The following statement of type reflects a deterministic model:

Given the assumptions, the expenditure or contribution rate in year t equals x.

This could be modified into a stochastic statement of the following type:

Given the assumptions, the expenditure or the contribution rate in year t lies with some probability of y under a value of x.

Here, we attempt to briefly describe a pragmatic way to introduce a stochastic dimension into the modelling exercise:

1. For each category of services and each year of the projection period, upper and lower boundaries and the expected value of total expenditure in the category are estimated.

Example 6.2 Demoland 6: Fixing the contribution rate for the SHI

Continuing our Demoland example, and its main results as displayed in the table in Example 5.1. In order to determine the necessary contribution rate, we need to determine the level of funding, with the help of Formula 6.23.

It is assumed that the maximum deviation of the global utilization of care is 20 per cent higher than assumed. This should accommodate the outbreak of a sudden epidemic of an infectious disease. Thus, $1 + df = 1.2$. The maximum deviation of the price for health care goods and services is assumed to be 10 per cent ($1 + dp = 1.1$). The estimated maximum shortfall of contributors is likewise 10 per cent ($1 - dc = 0.9$), as is the maximum shortfall of wages ($1 - dw = 0.9$). One also considers that the government and the scheme would need about 6 months (0.5 years) to adapt the contribution rate to the new situation. Thus, the required funding level is:

$$k(t) = [(1.2 * 1.1)/(0.9 * 0.9) - 1] * 0.5 = 0.315$$

We would round this factor up to one-third, and thus require a funding level with reserves sufficient for a period of four months. Based on Formula 6.24, the contribution rate would then be calculated as demonstrated in the table below:

Table E6.2 Calculation of the constant contribution rate

	1998	1999	2000	2001	2002
Interest rate:	*0.03*	*0.03*	*0.03*	*0.03*	*0.03*
Discounted value (DS) of TE-OI	7.57	8.21	8.92	9.70	10.56
DS(TAB)	98.52	107.07	116.49	126.68	137.78
Buildup of reserves (bn. CU)	0.64	1.39	2.27	3.27	4.41
k(t)	0.08	0.15	0.22	0.28	0.34
CCR	**8.31**				

The SHI in Demoland would thus have to charge a contribution rate of 8.31 per cent. This level would permit a buildup of a reserve level of $k = 0.333$ during the first five years. In other words, roughly 0.7 percentage point must be added to the necessary contribution rate to finance benefits which, in this example, is fairly constant throughout the projection period, at a level of 7.67 per cent. The additional 0.7 percentage point permits the buildup of a contingency reserve from the initial level of zero. If one were to assume that at the beginning of the first year ($t = 0$) the reserve were already at a level of $k = 0.333$, then the contribution rate actually charged could be reduced by approximately 0.5 percentage point.

2. The variance of the above three-point-distribution is calculated (called a *standard distribution*, a generalization of the Bernoulli distribution). It can be shown that this distribution has the largest variance of all distributions in the given interval and with the given expected value.

3. If the model expenditure equations are of a recursive nature, it can be shown that the stochastic variables describing expenditure in various categories of services can – with a negligible margin of error – be assumed to be stochastically independent.[12]

4. With the help of the central limit theorem, it can be shown that the normal distribution, under which the expected value and variance equal the sum of the respective values of the above-mentioned distributions for single categories of services, allows upper-boundary estimations of the quantile-limits of the compound total expenditure distribution of the model.

The above-mentioned normal distribution permits statements of the above stochastic type.

5. A deterministic model takes into account only the expected value of future expenditures. The above procedure allows the modeller to take into account the variations of expenditure within defined limits as well. The difference between these limits depends on the maturity of the scheme and the degree of risk aversion built into the model.[13]

6.8 SUMMARY

Chapter 6 has provided a basic methodological toolbox for the mathematical representation of all major model variables and core parameters in the twelve basic structural equations identified in Chapter 5 that require further technical explanation. The toolbox compiled here should not be interpreted as an exhaustive listing of all techniques which can be applied to the mathematical formulation of a health financing model, but it is a self-contained "methodological survival kit" to enable the reader to build a model of acceptable quality for almost all types of health care financing schemes. Details on specific actuarial and econometric techniques are provided in Issue Briefs 3 and 4, which should be read in conjunction with this chapter.

The following box lists the major model variables along with the corresponding standard mathematical formulas and estimation techniques found in this book. Variables are categorized according to the same module structure used for the 12 basic equations. Global rules of thumb are also provided to check the order of magnitude of projected total expenditure. A straightforward calculatory proxy for the essential parameter of health care utilization by age is also provided. If model parameters cannot be estimated due to a lack of national or scheme-specific data, then temporary assumptions may be derived from suitable international experience, as documented in the annex of International Reference Statistics.

Finally, this chapter also demonstrates how the advanced modeller could, in principle, refine the modelling approach to take the fundamental uncertainty in health care modelling into account. This may be done through the use of stochastic models, in which basic parameters are interpreted as probability variables.

Box 6.6 A mathematical toolbox for modelling

Model module	***Model variables: Standard formula provided***	***Specific techniques provided***
Demographic and economic module	• Demographic development	• Population projection model
Income module	• Total assessment base • Other income	• Estimation of the catchment factor for income ceilings
Expenditure module	• Cash benefits • Benefits in kind: – ambulatory care – specialist and dental care – pharmaceuticals – laboratory and diagnostic services – hospital care – other care • Administrative expenditure	• Overall "rules of thumb" for plausibility control of total expenditure • Mathematical mapping of benefit expenditure depending on provider payment system • Techniques for the projection of utilization rates and unit cost • A proxy for the age function of benefit utilization rates
Result module	• Calculation of a medium- term contribution rate in a social health insurance scheme	• Formula for establishing a recommended reserve level in a social health insurance scheme

Notes and references

[1] The derivation (based on overall population figures) of the labour force, the employed population as well as the insured and covered populations was explained in Chapter 5.

[2] Persons with curtate age x (= integer number) have an age between x and x = 1 (x inclusive and x + 1 not inclusive) Note that the average age of this population at the middle of year is equal to $x + \frac{1}{2}$.

[3] Remark on the derivation of Formula 62: Suppose that the deaths in any age are spread uniformly over a year. Then, for the time length of h less than y year ($0 < h < 1$), we have:

- $_{h}q_{s,x}(t) = h \cdot q_{s,x}(t)$

$\therefore$ $_{h}p_{s,x}(t) = 1 - h \cdot q_{s,x}(t)$

- $_{(1-h)}q_{s,x+h}(t+h) = (1-h) \cdot q_{s,x}(t)/[1 - h \cdot q_{s,x}(t)]$

$\therefore$ $_{(1-h)}p_{s,x+h}(t+h) = [1 - q_{s,x}(t+h)]/[1 - h \cdot q_{s,x}(t)]$

Thus, we have the following:

- $p_{s,x+\frac{1}{2}}(t+\frac{1}{2}) = {}_{\frac{1}{2}}p_{s,x+\frac{1}{2}}(t+\frac{1}{2}) \cdot {}_{\frac{1}{2}}p_{s,x+1}(t+1) = [1 - q_{s,x}(t)]/[1 - \frac{1}{2} \cdot q_{s,x}(t)] \cdot [1 - \frac{1}{2} \cdot q_{x+1}(t+1)]$

[4] For example, see United Nations, *Unabridged model life tables corresponding to the new United Nations Model Life Tables for Developing Countries* (New York, United Nations, 1982).

[5] ILO, *The ILO population projection model: A technical guide* (draft), June 1997.

[6] This box is based on ILO (D. Latulippe), *ILO-Dist: The ILO Wage Distribution Model* (draft 01, December 1996, chapter 1).

[7] If major changes in the level and pattern of sickness days per person occur during the observation period, it may be necessary to estimate the trend of these changes, according to a procedure similar to that described in Box 6.3.

[8] If no age-specific breakdown of frequencies is possible, then an overall frequency for the total eligible population is used.

[9] The *central death rate* allows the modeller to work on estimated mid-year population. It is defined by the equation:

$$m_{s,x}(t) = 2_* q_{s,x}(t)/[2 - q_{s,x}(t)]$$

where $q_{s,x}(t)$ represents the usual death rate for the overall population in the country in year t. For the derivation of the approximation, see Chester Wallace Jordan, *Society of Actuaries' textbook on life contingencies* (Chicago, Society of Actuaries, 2nd edition, 1967).

[10] The number of patients in the highest fee bracket will, in general, be equal to the average number of persons on a provider's list.

[11] Wissenschaftliches Institut der Ortskrankenkassen, *Bilanz der Kostendämpfungspolitik 1977–1984* (draft paper, Bonn, 1986), pp 76–81.

[12] Perhaps with the exception of expenditure for hospital services, where even the rate of increase might be, to a non-negligible extent, dependent on increases in other categories of services. In this case, a combined distribution for the dependent categories must be determined.

[13] The methodology is described in detail in Michael Cichon, *Stochastisches Modell zur Prognose des GKV-Beitragssatzes*, Spardorf: Wilfer, 1985.

MODEL EXAMPLES 7

In health ministries and health authorities around the world, there are probably hundreds of financial models for national health care systems and individual components of these systems. They range from ambitious, complex models that begin with micro-level analysis of health needs and then progress to an assessment of financial consequences, to fairly crude and pragmatic budget estimation techniques. Some of these models were developed decades ago and have undergone a long process of refinement, some were developed and then later abandoned, some are relatively new, some were planned and designed by specific research teams, while still others were developed in response to ad hoc policy questions. The following sections briefly describe a small sample of nine models used by various national agencies and consulting firms. The objective is to provide the reader – after an extensive treatment of modelling theory in the preceding chapters – with a quick overview of the reality of modelling around the world. This chapter surveys the scope, methodology and application of typical health care financing models, as used in actual policy planning and governance processes.

7.1 THE ACTUARIAL MODEL OF MANAGEMENT SCIENCES FOR HEALTH (MSH)[1]

This section describes a classical actuarial model for valuation of a health insurance scheme used by Management Sciences for Health (MSH) of Boston, USA.

7.1.1 Financial sustainability

The determination of the actuarial soundness of a health insurance scheme usually revolves around three key elements:

- benefit expenditure
- programme income
- operating or administrative expenses.

Benefit expenditure is influenced by factors such as the benefit structure, the price or amount charged by providers of health goods and services, the extent of population coverage, and the utilization pattern within the insured population.

Programme income is composed mainly of the premiums and contributions paid by or on behalf of the insured population. There may also be additional income from short-term interest earnings, and sometimes longer-term interest earnings on funds are also included as income. Actuarial practice often excludes these, however, in order to be conservative in its approach. It is felt that such earnings, if any, will not be a significant part of income, since there should not be increasing amounts of long-term reserves in a pay-as-you-go health insurance system. If reserves begin to accumulate in an unplanned fashion, then either benefits should be increased, premiums and contributions decreased, or an explicit policy for reserve allocations should be defined. The model can easily be adjusted, however, to reflect any interest earnings that may be assumed by the user.

The *operating expenses* of the administering organization are invariably expressed as an explicit percentage of collections. While benefit expenditure and programme income are customarily the subject of more careful actuarial analysis to determine the viability of government-sponsored insurance programmes, this is not the case for administrative costs, which are seldom subjected to critical actuarial analysis. In most instances, it is sufficient to assume a given percentage of income as the expected operating expenses of the administering organization.

Any health insurance scheme must ensure that revenues are greater than expenditure, if it is to be financially sustainable. Figure 7.1 represents the basic balance required for health insurance and the basic model used by MSH. The right side of the model consists of the factors that determine total expenditure. The left side contains the sources of income or revenue for the scheme. The model states that revenues must be equal to or greater than expenditure for the scheme to be sustainable. If expenditure exceeds revenues, three options are available:

1. *Expenditure must be reduced* through reduced benefits, lower unit costs from providers, lower utilization rates in the covered population, or by changing the population covered by the scheme.

2. *The income of the scheme must be increased* through measures such as increased premiums and contributions, or greater tax subsidies from the government.

3. *Both expenditure must be reduced and income increased.*

Figure 7.1 The sustainability of health insurance

Factors determining health insurance revenues

Population
Income groups
Financing
Contributions
Taxes
Subsidies

Revenues ≥ Expenditure

Factors determining health insurance expenditure

Benefits
Utilization
Paying providers
Organization of services
Administration

Results:

1. If Revenues > Expenditure, health insurance is sustainable
2. If Revenues < Expenditure, health insurance is not sustainable

Then the options are:
¬ Expenditure,
↑ Revenue, or
¬ Expenditure and ↑ Revenues

7.1.2 Financing a sustainable social health insurance scheme

For financially viable social health insurance (SHI) programmes, it is often presumed that the government intends to adopt a "pay-as-you-go (PAYG)" method of financing ("current disbursement" financing). This method is highly recommended by many experts, as it does not require the explanation of technical matters inherent in a build-up of reserves for future benefits. There can also be difficulties in making some politicians comprehend the nature of long-term liability reserves and this can result in the misuse of accumulated funds.

The PAYG approach is not without drawbacks. In times of rapidly rising costs for health care services, premium contributions to the scheme may need to rise dramatically over short periods of time. The same is true in times of recession, when fewer employees are contributing to the programme. Under other methods of financing for social insurance programmes, such increases can be more gradual.

Under the PAYG method, the actuarial balance is simple to define. An SHI programme may be said to be in actuarial balance in a given year when its total premium contributions are determined to be at least equal to total expenditure for benefits promised and operating expenses incurred. When calculating premiums for a given year, it is considered actuarially wise to set up a contingency reserve to protect the fund against any unexpected adverse and substantial increases in benefit expenditure for that year. At times, the actuary may recommend that the equivalent of one or two months' estimated benefit and administrative expenditure be the minimum reserve maintained, as a precaution against a negative cash and asset balance for the fund. Shortages of funds may lead to expensive borrowing, or to a shut-down of operations. A cushion totalling 10 to 20 per cent of expected annual expenditure greatly reduces the risk of short-term deficits for the SHI fund.

The year-to-year state of actuarial balance is considered a short-term measure of actuarial soundness. Funds need not be in actuarial balance every year, however, in order to be considered actuarially viable. Nobody can prevent unexpected events, and even a cushion of 15 to 20 per cent does not provide assurance that the programme will not run out of money. Long-term measurements are more appropriate for assessing the financial stability of the scheme. One such measure would be obtained by averaging income and expenditure separately over a period of ten years or more. Long-term actuarial soundness would be considered to exist for the fund if average annual income is greater than average annual expenditure, say by 15 to 20 per cent. This measurement may be applied either retrospectively or prospectively. Prospectively, it would be used to test assumptions regarding the future state of the programme, and would also involve assumptions on future economic developments, the demographic profile and other important factors that will affect the financial status of the programme. Collectively, these factors are referred to as *actuarial assumptions*.

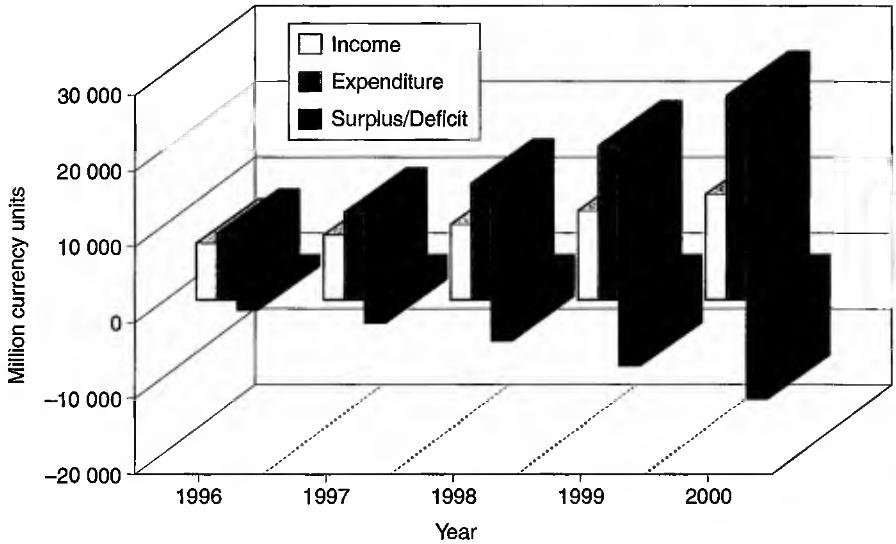
7.1.3 Projecting expenditure and revenues

The MSH actuarial model has the principal function of calculating the expected annual income and expenditure of health insurance schemes based on certain actuarial assumptions for the next ten years, counting from the current year.[2] The required actuarial assumptions include the following:

1. number of persons belonging to subsidized groups
2. rates of inflation and cost increases
3. average cost of health benefits
4. rate of increase of health benefit costs
5. health benefit utilization rates (inpatient and outpatient treatment rates, drug prescription rates, etc.).

With these assumptions and projections about membership and costs, the programme is considered to be in a healthy situation if expected income is equal to or greater than expected expenditure in each of the ten years. Figure 7.2 provides an example of model results, showing a situation of increasing deficit for the next five years.

Figure 7.2 Valuation results under partial premium payment compliance



	1996	1997	1998	1999	2000
Income	7 481	8 624	10 049	11 838	14 095
Expenditure	8 743	11 609	15 392	20 390	26 988
Surplus/Deficit	(1 262)	(2 985)	(5 343)	(8 552)	(12 893)

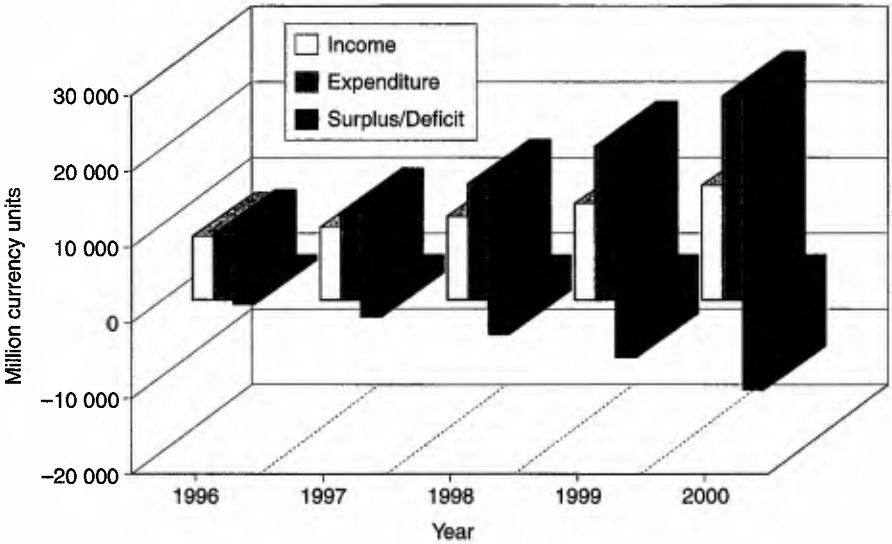
7.1.4 "What if" scenarios

Since all variables are not known in modelling, several "what if" scenarios are also considered. In the situation portrayed in figure 7.2, it was assumed that there would only be partial compliance of enrollees paying their expected contribution rate. To see the surplus or deficit if there were full compliance with premium payment obligations, the actuary undertook a second analysis, presented in figure 7.3. As we see, even at full compliance this scheme would remain in deficit under current provisions and assumptions, although its size of deficit would be reduced.

7.1.5 Calculating premiums

A second feature of the MSH model is that it can be used to calculate the premium appropriate for each category of insured person, based on that category's benefit utilization pattern. This feature makes visible the amount

Figure 7.3 Valuation results under full premium payment compliance



	1996	1997	1998	1999	2000
Income	8 350	9 526	10 987	12 815	15 113
Expenditure	8 765	11 631	15 416	20 414	27 014
Surplus/Deficit	(415)	(2 105)	(4 429)	(7 599)	(11 901)

of cross-subsidies actually made from one or more groups of the insured to other groups. The model can be used to calculate the premium for one group of insured persons, while varying the premiums for other groups. The user can, for example, calculate the percentage of their salaries that employees should contribute, while the premiums for a specific subsidized group may be set at one-half this rate.

Table 7.1 is an illustration of calculated expected premiums that would need to be imposed over a ten-year period, assuming there would be full compliance regarding the payment of contributions.

7.2 THE WHO MODEL FOR LOCAL GOVERNMENTS

The WHO has developed a model to demonstrate the impact on the national health care system of introducing a health insurance scheme for a regional or local health care delivery system. The model was originally built to assist in the development of a statutory health insurance system in Viet Nam, as a

Insured category	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1. Under full premium subsidy by the government (total)	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779
a. Children under 16 years old	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779
b. Students of professional training institutions	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779
c. Citizens with pension as the only income source	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779
d. Women taking care of babies under 2 years old	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779
e. Category 1 and 2 invalid citizens	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779
f. Persons in regular military service	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779
2. Under partial subsidy by the government (total)	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779
a. Herdsmen	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779
3. Employees of econ. entities and organizations (total)	1.80%	1.74%	2.05%	2.40%	2.82%	3.32%	3.90%	4.59%	5.41%	6.38%	7.52%
a. Employees of economic entities	1.60%	1.53%	1.79%	2.10%	2.47%	2.90%	3.42%	4.02%	4.74%	5.58%	6.58%
b. Employees of budget institutions (gov't)	2.89%	3.10%	3.63%	4.26%	5.01%	5.89%	6.93%	8.16%	9.61%	11.33%	13.36%
4. Sole proprietors and owners of economic entities	28.87%	33.80%	39.62%	46.50%	54.63%	64.24%	75.59%	89.00%	104.85%	123.58%	145.70%
5. Voluntary insureds	289	372	479	619	800	1 035	1 339	1 734	2 248	2 914	3 779

composite of local schemes. The following section briefly describes the methodology and the typical results of the model.[3]

7.2.1 Projecting scheme demographics

Population and demography. The future population is estimated on the basis of the total population in the base year and future assumptions on the rate of growth. These assumptions are exogenous. The number of dependants is then calculated by multiplying the percentage of dependants in the total population.

Labour force and income. The total population in working age, excluding dependants, is further classified into categories based on economic groups, such as farmers, industrial workers, government workers and self-employed persons, by using the share of each group in the population. Average annual income in each category is estimated by modifying the base year amount according to the nominal growth rate of income, exogenously defined.

Health insurance membership. Future developments in terms of the percentage of health insurance membership in each category of the population exogenously given by setting the percentage in the base year, a number of years of delay while the percentage remains constant, the target year, and the assumed percentage in the target year. The percentages are then linearly interpolated between the target year and the year when the percentage starts to increase. The number of the insured in each category is obtained by multiplying the number of persons in each category by the percentage of the health insurance membership. For each insurance group, it is possible to define the percentage of insured persons who are exempt from health insurance contributions, e.g. the poor and the old.

7.2.2 Expenditure

Health care costs are classified into several categories – e.g. salaries for health personnel, maintenance of equipment and buildings, pharmaceuticals, and recurrent costs such as electricity and water. The cost is, in principle, obtained by multiplying the unit cost per service by the average number of cases per insured. Future developments in unit costs and the average number of cases are provided exogenously for future years, in a method similar to that of future health insurance membership. Each cost item is inflated according to suitable economic indicators, exogenously given. For example, imported items are inflated by the external inflation rate.

Costs are separated into government costs and patient costs. Patient costs are further disaggregated into those financed via health insurance arrangements and those financed through the direct payment of user fees by the non-insured.

Administrative expenditure is estimated by increasing the expenditure of the base year by an annual rate of increase. The level of administrative expenditure can be linked to health insurance membership.

7.2.3 Revenues

Rates or flat amounts for *contributions* are given for each category of insurance and each year during the projection period. With respect to salaried workers, the amount of contribution revenue is calculated by multiplying the number of the insured, the average income and the contribution rate for each category of insurance. For self-employed or dependent persons, the amount of the contribution is calculated by multiplying the number and flat amount of contributions.

Government financing of health care costs is obtained by using the government share in financing the cost, exogenously given.

Co-payments are calculated using a co-payment rate, defined as a fraction of the average patient cost. This proportion is exogenously given for each year of the projection period. Co-payment income is then calculated by multiplying the patient cost by assumed co-payment rates.

7.2.4 Projection results

The simulation output provides a summary of expenditure, revenue and the balance of the health insurance scheme, plus the structure of the financing of

Table 7.2 Population, health insurance membership and care cases in Hai Phong, Viet Nam

	1993	1994	1995	1996	1997
Population					
Total	*1 500 000*	*1 533 000*	*1 566 726*	*1 601 194*	*1 636 420*
Dependents	585 000	597 870	611 023	624 466	638 204
Farmers	755 000	771 610	788 585	805 934	823 665
Membership					
Total	*300 000*	*368 942*	*447 039*	*528 394*	*613 112*
Dependents	58 500	89 681	122 205	156 116	191 461
Farmers	81 500	115 742	157 717	201 484	247 099
Workers, *total*	137 500	140 525	143 617	146 776	150 005
Gov. administration	67 500	68 985	70 503	72 054	73 639
Industrial workers	70 000	71 540	73 114	74 722	76 366
Retired gov. administration workers	22 500	22 995	23 501	24 018	24 546
Cases					
Total	*3 447 600*	*3 523 448*	*3 600 963*	*3 680 184*	*3 761 149*
Inpatient at city/province hospitals	268 800	274 714	280 757	286 934	293 247
Inpatient at district hospitals	928 800	949 234	970 117	991 459	1 013 271
Outpatient at city/province hospitals	225 000	229 950	235 009	240 179	245 463
Outpatient at district hospitals	1 680 000	1 716 960	1 754 733	1 793 337	1 832 791
Outpatient at commune health centres	345 000	352 590	360 347	368 275	376 377

Table 7.3 Financial results of model for the health insurance scheme in Hai Phong, Viet Nam (in VND)

	1993	1994	1995	1996	1997
1. Expenditure and revenues					
Total expenditure	*5 496 480*	*7 641 495*	*10 508 009*	*14 145 066*	*18 734 787*
Administrative expenditure	499 680	574 632	660 827	759 951	873 943
Health care payments	4 996 800	7 066 863	9 847 182	13 385 115	17 860 844
Total revenues (only from contributions)	*5 529 700*	*7 683 963*	*10 530 045*	*14 214 372*	*18 758 734*
Balance	33 220	42 469	22 036	69 306	23 947
As % of expenditure	0.60	0.56	0.21	0.49	0.13
2. Financing of overall health care expenditure					
Total health cost	*24 984 000*	*29 363 695*	*34 511 151*	*40 560 956*	*47 671 291*
From user fees	19 987 200	22 296 833	24 663 969	27 175 840	29 810 447
as % of total	80.00	75.93	71.47	67.00	62.53
From insurance contributions	4 996 800	7 066 863	9 847 182	13 385 115	17 860 844
as % of total	20.00	24.07	28.53	33.00	37.47
From government	0	0	0	0	0
as % of total	0	0	0	0	0

the health sector in the local community, region or country being modelled. The simulation results include the following key outputs:

1. number of patients and amount of health services
2. number of insured and amount of contributions
3. projected income and expenditure of the scheme
4. general structure of the financing of the health care system in the community, region or country.

Tables 7.2 and 7.3 show the results of the model in the case of the Community of Hai Phong, one of the three largest cities in Viet Nam.

7.3 THE WHO BUDGET MODEL FOR MINISTRIES OF HEALTH (SIMFIN)[4]

This model focuses on governments' behaviour with regard to their budgets for publicly provided health services. It aims to provide decision makers with a tool for checking financial feasibility in health care planning. More concretely, it is a tool for examining the financial repercussions of choices regarding health services, such as preventive and curative care, primary health care, administration of facilities, staff qualifications, etc.

Since proposals on government health policy and expenditure on health should be based on budgetary possibilities on the one hand and the financial needs of the health sector on the other, this model (known as *SimFin*) has two modules: one for the examination of budgetary possibilities that expresses resource constraints (*MacroFin*), and one on the financial needs of the system (*MicroFin*).

7.3.1 Projection methods

Budgetary possibilities. The MacroFin module shows both the resource constraints that result from characteristics of the national economy and those attributable to the international environment. Constraints also depend on choices made by the government with regard to the role of health care in the government budget. Government health expenditure is measured within the framework of general government revenues and expenditures. They are also presented in the broader context of the national economy, for example, as a proportion of GDP. The estimations made in this module are influenced by exogenous and policy variables, such as GDP growth by sector, rising price indexes, tax rates and growth in government expenditure and income.

Financial needs. The MicroFin module analyses the financial resources needed by the government for the functioning of publicly provided health services. It should be noted that this module does not seek to forecast or predict the actual expenditure of the relevant ministry; rather, it aims to assist decision makers in measuring the repercussions of decisions they wish to make, based on given assumptions regarding exogenous variables (e.g. increases in the number of beds, doctors, salaries of doctors, etc.). This module is, roughly speaking, based on the concept of controlling the supply side of medical care; it does not take account of changes to the demand side (such as increases in costs due to ageing, etc.).

Expenditure is first classified into two major functions: the production of services by government health structures, and the overall management and supervision of the system by the responsible health administration. The production of health services is further disaggregated into those provided by health centres, by referral hospitals (such as district, regional or national hospitals) and by national referral hospitals (e.g. specialized or teaching hospitals). Administrative costs are also classified into district, regional and central costs.

For each facility and administration, costs are disaggregated into the categories of personnel costs, pharmaceuticals, supervision, food, etc. For each cost item, the following dimensions are taken into account: the category of the related administrative unit (e.g. health centre, referral hospital or district or regional administration); the nature of the cost item (e.g. personnel, pharmaceuticals or food); and type of care (e.g. ambulatory care or surgery).

Future increases or decreases in expenditure depend primarily on policy variables, such as annual rates of salary adjustment, population coverage, average expenditure per service, time required to produce services and different rates of staff mix (ratios of doctors, nurses, and other general staff).

7.3.2 Projection results

Results include the following: the macroeconomic environment (GDP, balance of trade, net foreign exchange reserves, government budget deficits, etc.); health expenditure at current prices and as a proportion of total government spending; the structure of health expenditure (e.g. current and capital expenditure); and government contributions to health financing (including real growth in government expenditure and the percentage of total government expenditure allocated to the ministry of health).

Confronting needs with possibilities. The comparison between financial needs and possibilities as revealed in the MacroFin and MicroFin modules gives policy makers clues regarding policy choices they might have to make in the near future. If financial needs exceed budgetary possibilities, they must revise their needs downwards by changing some of the hypotheses selected for the calculations. Alternatively, they could seek additional financial resources (such as by increasing levels of community financing or external aid), or persuade the government to increase the funding it allocates to the health sector. If budgetary possibilities exceed financial needs, policy makers might be able to increase health expenditure without requesting government to alter its global budget policy.

7.4 THE MODEL OF THE AUSTRALIAN HEALTH INSURANCE COMMISSION

This model has been constructed and used by the Australian Health Insurance Commission to carry out financial projections regarding the Turkish health care system under a technical cooperation agreement between the two countries. The purpose of the model is to analyse the policy options available to the Turkish government in health care financing.

7.4.1 Projecting the economic, demographic and infrastructure environment

Economic variables. Official projections of employment, GDP growth and personal incomes (as a percentage of GDP) are used as basic parameters for the model. The projections are provided by the Turkish government.

Demographic variables. Here, too, official projections are used as a basis for the model. Official figures on the fundamental demographic structure are estimated in a standard fashion, using mortality rates and fertility rates, and provide a breakdown of the population by age and gender. In addition, official estimates of urbanization (the percentage of the population living in metropolitan areas, urban areas and rural areas) serve as a further basis for the projections.

A population data matrix for each projection year is constructed on the basis of the above-mentioned economic and demographic environment. The total number of cells in the matrix is 2,700 ($= 5 * 2 * 6 * 3 * 5 * 3$). The respective variables are: 5 age groups (0–4, 5–14, 15–34, 35–54, and 55+); 2 gender groups; 6 insurance types;[5] 3 insurance statuses (active, retired, and dependent); 5 income quintiles; and 3 locations of residence (metropolitan, urban, and rural).

The *health infrastructure and workforce* are drivers of utilization expenditure, as well as capacity constraints. This module includes data on the number of hospital beds and the number of physicians.

7.4.2 Projecting expenditure

Total expenditure is obtained by aggregating the cost of hospital admissions, physician contacts, pharmaceuticals and other costs, including administrative expenditure.

Hospital admission costs are estimated by multiplying the population in the above-mentioned matrix by the utilization rate and unit cost which, for each cell in the start year of the projection, is determined by analysing the statistical data. Increases in the admission rate in past years are broken down into increases due to the effects of ageing, urbanization, insurance and other factors. Thus, in addition to increases in hospital admission rates due to ageing, urbanization and insurance coverage, which are already taken into account because of the construction of the matrix and the different utilization rate in each cell of the matrix, any remaining rate of increase is accounted for by observed historical increases found in past trend analysis. Increases in unit costs are determined by taking into account the fact that approximately 80 per cent of hospital costs consist of expenditure on salaries.

Physician contacts. In the absence of reliable historical statistics on ambulatory medical services, the cost for physician contacts is increased according to a projection of the number of doctors practising in Turkey. This figure, in turn, is obtained through past data analysis of medical school graduations and retirements. Calculation of increases in unit costs for physician contacts also take into account that about 80 per cent of hospital costs are for salaries.

Pharmaceuticals. The past trend of cost increases for pharmaceuticals is attributed to increases in volume and in unit costs. Increases in unit costs are further broken down into those due to general price increases and those due to other increases. Future costs are projected based on estimated increases in volume and unit costs.

Other costs include dental services, community and public health, therapeutic goods and administrative expenditure. Since these costs are less significant than the three major areas of expenditure listed above, and the data are not sufficient to undertake a full analysis, total aggregated costs are assumed in principle to grow at the same rate as GDP. Thus, the detailed demographic structure is not taken into account. The administrative costs of social security organizations are assumed to grow at the same rate as the number of active contributors.

Cost structure. In addition to the above-mentioned projections of the status quo, regression models of cost structures are developed to assess alternative policy options or alternative benefit provisions, such as extending coverage. For example, the hospital admission rate is expressed as a function of the proportion of the population over 55 years of age, the number of beds per 10,000 population, the amount of income per person and the proportion of the population living in rural areas. Annual physician contacts per person are expressed as a function of the average patient age, the number of doctors per 1,000 population, the proportion of the insured population and the proportion of the population living in rural areas.

7.4.3 Projecting revenues

The amount of revenue from health insurance premiums is calculated by aggregating the premiums for each cell of the population matrix. These values are obtained by multiplying the respective number of insured persons, their average income and the contribution rate. Co-payment revenues are calculated using utilization and co-payment rates; any costs in excess of contributions and co-payments are assumed to be financed through general taxation income.

Table 7.4 Summary of expenditure by type of service, Turkish health care system*

		1992	1994	1996	1998	2000	2005
Hospital admissions	*bn TL*	42 875	45 870	52 858	60 834	70 039	99 234
	rate (%)	28.6	28.1	28.1	28.1	28.1	28.0
Ambulatory services	*bn TL*	46 493	49 656	57 206	65 916	75 974	108 254
	rate (%)	31.0	30.4	30.4	30.4	30.5	30.6
Pharmaceuticals	*bn TL*	38 607	45 166	52 815	61 653	71 867	104 570
	rate (%)	25.7	27.7	28.1	28.5	28.8	29.5
Other health services	*bn TL*	18 620	18 922	21 116	23 564	26 296	34 595
	rate (%)	12.4	11.6	11.2	10.9	10.5	9.8
Social security administration	*bn TL*	3 361	3 524	4 047	4 642	5 327	7 467
	rate (%)	2.2	2.2	2.2	2.1	2.1	2.1
Total	***bn TL***	**149 956**	**163 138**	**188 042**	**216 609**	**249 503**	**354 120**
	(%)	100.0	100.0	100.0	100.0	100.0	100.0
Average growth rate over period (%)			**4.30**	**7.36**	**7.33**	**7.32**	**7.25**

* Currency figures are in 1994 prices.

Table 7.5 Summary of expenditure by source of funds, Turkish health care system*

		1992	1994	1996	1998	2000	2005
Social security organizations	*bn TL*	34 988	35 560	39 625	44 184	49 264	64 626
	rate (%)	23.3	21.8	21.1	20.4	19.7	18.2
Private insurance	*bn TL*	955	998	1 144	1 306	1 488	2 032
	rate (%)	0.6	0.6	0.6	0.6	0.6	0.6
User payments	*bn TL*	51 989	57 000	65 247	74 596	85 178	117 902
	rate (%)	34.7	34.9	34.7	34.4	34.1	33.3
Civil servants and military	*bn TL*	29 929	31 816	36 028	40 759	46 096	62 337
	rate (%)	20.0	19.5	19.2	18.8	18.5	17.6
Other	*bn TL*	32 085	37 763	45 998	55 764	67 479	107 223
	rate (%)	21.4	23.1	24.5	25.7	27.0	30.3
Total	***bn TL***	**149 946**	**163 137**	**188 042**	**216 609**	**249 505**	**354 120**
	(%)	100.0	100.0	100.0	100.0	100.0	100.0

* Currency figures are in 1994 prices.

7.4.4 Projection results

The main results of the model are the number of insured persons, the number of cases and the financial structure of health care. The financial impact of introducing a universal insurance model are also analysed – there would be about a 22 per cent increase in hospital admissions, 18 per cent in physician contacts and about 30 per cent in pharmaceuticals. These utilization increases translate directly into cost increases. The summaries for the status quo projection are shown in Tables 7.4 and 7.5.

7.5 THE JAPANESE MINISTRY OF HEALTH SOCIAL HEALTH INSURANCE MODEL

Cost estimates for the national health insurance system in Japan are carried out, in principle, under the following assumptions:

1. The demographic structure of the insured will change according to the official *Population Projection for Japan.*

2. The average cost per person will increase with the average growth rate observed during the past several years under existing schemes.

This is a short- to medium-term budget model that assumes cost and wage increases without an explicit link to economic developments (e.g. to assumed GDP growth rates).

7.5.1 Demographic projections

The gender- and age-specific future national population is estimated in the *Population Projection for Japan*, issued by the National Institute of Population and Social Security Research. This gender- and age-specific population projection is carried out as a standard cohort projection, based on assumptions on future mortality and fertility rates.

The gender- and age-specific population projection is further classified according to specific scheme membership, and by categories of insured persons and their dependants. This is done by using the data of the base year of the projection.

7.5.2 Expenditure

Health care costs for each scheme in the pluralistic Japanese system is obtained by aggregating age-specific costs, which are the product of the number of insured persons and the per capita cost. The rate of increase in the cost per insured person over the past several years is analysed and separated into the increase due to ageing and due to other factors. Since the increase due to ageing is automatically projected into the future by using the gender- and age-specific demographic structure, the increase due to other factors is, in principle, used to extend the age-specific cost per insured person. Utilization effects caused by changes in patient-cost-sharing measures in past years (e.g. changes in co-payments) are analysed and taken into account when considering the potential effect of future changes in cost sharing. In Japan, changes in utilization due to different cost-sharing arrangements are referred to as the "Nagase effect".

Financial transfers to other schemes, such as contributions to a special system for those over 70 years of age, are also calculated based on the medical costs of the scheme and shares of contributions stipulated in legislation.

Table 7.6 Financial effects of 1997 amendments to the Employees' Health Insurance scheme in Japan (billion yen)

	1997	1998	1999	2000	2001
Financial balance before amendments	*–831*	*–1 037*	*–1 279*	*–1 526*	*–1 779*
Financial effects of amendments					
Increase in contribution rate	239	294	302	309	317
Increase in patient cost sharing, total	604	751	795	835	882
For elderly persons	22	34	44	53	65
For insured persons	307	382	397	412	428
For medicines	275	335	354	370	389
Other	–11	–13	–22	–55	–63
Financial balance after amendments*	**0.5**	**–5**	**–204**	**–436**	**–644**

* Columns do not necessarily add up precisely, due to rounding.

7.5.3 Revenues

Contributions. Gender- and age-specific salaries per insured population are projected into the future, based on exogenous assumptions on the future growth rates of insurable earnings. Contributions are calculated by multiplying salaries by the contribution rates.

National subsidies are legally stipulated as a percentage of costs. The amount of these subsidies is obtained by multiplying the costs by the percentage defined in legislation.

7.5.4 Results

The *surplus* or *deficit* is obtained by subtracting total expenditure from total income. The *closing balance* is obtained by adding the surplus or deficit to the reserves of the previous year.

Table 7.7 Financial projections for the Employees' Health Insurance scheme in Japan (billion yen)

	1997 (budget)	1998	1999	2000	2001
Insurable earnings	*761 744*	*786 342*	*805 488*	*82 500*	*84 488*
Total revenues	7 162	7 430	7 641	7 861	8 083
Contributions	6 246	6 448	6 605	6 765	6 928
National subsidies	890	956	1 014	1 078	1 138
Other	25	26	22	18	16
Total expenditure	7 161	7 435	7 845	8 297	8 726
Insurance payments	4 580	4 638	4 810	4 967	5 151
Contributions to the health service system for elderly persons	1 954	2 152	2 371	2 210	2 397
Contributions to the medical care system for retired persons	395	410	426	437	457
Facilities	158	158	158	158	158
Contributions to special elderly care	0	0	0	440	474
Other	74	76	80	85	89
Balance*	**0.5**	**–50**	**–2 040**	**–4 360**	**–6 440**
Total expenditure as percentage of insurable earnings (PAYG cost)	**9.40**	**9.46**	**9.74**	**10.06**	**10.33**
Reserves	**5 493**	**5 440**	**3 400**	**–960**	**–7 400**

*Columns do not necessarily add up precisely, due to rounding.

Basic assumptions for table:

1. Draft budget for 1997 is used.
2. The annual rates of increase from 1998 are the average of the three-year period 1994–1996:
   - Number of insured: 1.4%
   - Average base salary: 1.0%
   - Cost per insured (excluding ageing factor): 2.4%
   - Cost per retired (excluding ageing factor): 2.3%
   - Cost per elderly (excluding ageing factor): 4.8%
3. It is assumed that a newly proposed system of care for elderly persons is to be introduced in 2000.

Whenever alternative policy options are analysed, the main results of the simulation include a comparison of the financial effects of the draft legislation or policy proposal with the model's projected results under current legislation (status quo projection).

The model can also perform typical financial consolidation exercises that aim to contain emerging budget deficits; these are being undertaken in similar forms by many governments around the world. The model results for such an exercise are displayed in tables 7.6 and 7.7.

7.6 THE STOCHASTIC MODEL OF THE GERMAN MINISTRY OF LABOUR[6]

This model was developed in the early 1980s at the German Ministry of Labour and Social Affairs, which at the time was still in charge of the legal supervision of the statutory health insurance systems (consisting of more than 1,200 individual sickness funds). Its primary objective was to provide policy makers with an early warning system for financial difficulties (expressed as increases in PAYG contribution rates), thus allowing sufficient time to react by modifying revenue or expenditure provisions.

7.6.1 Projection techniques

The model is highly aggregated, and functions over the medium term. It projects the income and expenditure of the National Health Insurance Systems – i.e. the total expenditure and income of all statutory health insurance schemes. As in the Japanese model discussed above, the German model also treats demographic and economic parameters as exogenous input variables. The model largely follows the standard procedure described in Chapter 6 concerning the estimation of total scheme revenues.

Estimates on the expenditure side, however, differ from those of most other models, in that they are stochastic. A specific stochastic projection methodology was developed, referred to as Model-Internal Simulation Techniques (MIST). The basic model structure for expenditure is again identical to that described in Chapter 6. The model disaggregates total expenditure into 13 expenditure categories, and expenditure in each category is considered to be a random variable. For each of these variables, a simple bipolar distribution of the expenditure values is assumed. The mean of the distribution is identical to the classical deterministic projection of expenditure in each category, according to the methods described in Chapter 6. That is, for most benefit categories:

$$E_i = Covpop * f_i * u_i$$

The bipolar distributions are built by determining maximum and minimum boundaries for utilization rates (f_i) and unit costs (u_i). In case of the utilization rates, the 95 per cent confidence corridor around the regression lines was chosen as a border. In the case of unit costs, observed minimum and maximum deviation factors, as described in Box 6.2, were used as boundaries. All hypotheses used in the projections are derived from values obtained over an observation period twice as long as the projection period. Using the central limit theorem, the model estimates the probability distribution of total expenditure as a normal distribution with a mean and variance equal to the sum of the means and variances of all distributions in the various categories of expenditure.

The use of the central limit theorem is justified by the fact that the variables describing expenditure in the various categories of care may be regarded as stochastically quasi-independent. While the absolute amounts of expenditure in each category of health care services are certainly not independent, annual rates of increase show a sufficiently independent behaviour within certain limits.

7.6.2 Model results

The central result of the model (i.e. the "early warner") is a distribution of the average contribution rate for the overall national health insurance system. The results are displayed as the 60 per cent and 70 per cent fractiles of the resulting normal distribution of the contribution rate. Thus, the model results actually have to be interpreted as follows:

> *With a probability of 60 or 70 per cent, the contribution rate for the next* t *years lies under the value* $x(t)$.

Table 7.8 shows the predicted contribution rates for the years 1982 to 1985 for two model variants. The first is a status quo scenario based on prevailing legal conditions in 1981. The second is the simulation of a legal change, reflecting a cost containment law which was under consideration in 1981.

Table 7.8 Projected contribution rates for the Statutory Health Insurance System in the Federal Republic of Germany, 1981–1985 (percentage of insurable earnings)

	1981 (base year)	1982	1983	1984	1985
Base scenario					
Expected mean (bs)	11.75	12.01	12.12	12.35	12.61
60% fractile (bs)	11.75	12.05	12.18	12.45	12.74
70% fractile (bs)	11.75	12.09	12.25	12.55	12.88
Modified law scenario					
Expected mean (ms)	11.75	11.34	11.43	11.47	11.70
60% fractile (ms)	11.75	11.37	11.48	11.55	11.81
70% fractile (ms)	11.75	11.4	11.54	11.64	11.93
Value actually observed	**11.75**	**12**	**11.8**	**11.4**	**11.8**

Figure 7.4 Projected and real development of contribution rates in the Federal Republic of Germany

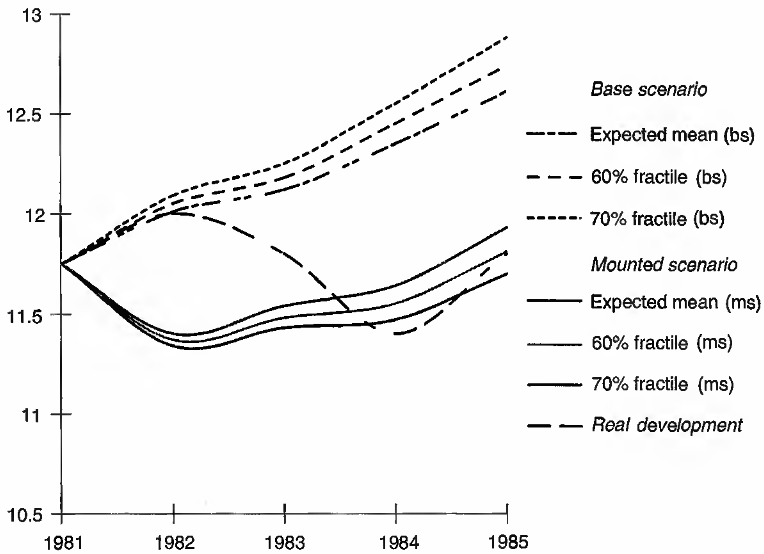


Figure 7.4 shows that the effects of cost-containment measures actually began to show up much later than anticipated in the model. This was because the law was passed later than anticipated during the modelling process.

7.7 SOME ILO MODELS

Three ILO models are included in this section. The first is a simple ad hoc spreadsheet model developed for the capitation-based health care financing system of the Social Security Organization in Thailand. This model is a typical result of a technical advisory mission.

The second ILO model used is the standard health care module of the ILO Social Budget Model, which is a highly aggregated model of the financial structure of a national health care financing system. The strength of this module is that it portrays the entire health sector as a component of the larger social sector, and maps its relationship to the macroeconomic and demographic environment. This type of a model can also be used by the analyst to perform quick benchmark projections for health expenditure that are compatible with a given national demographic and economic environment.

The third ILO model is the organization's standard health care model. This is a stand-alone model – as opposed to the health care module of the social budget model, which only functions within the larger model environment. It allows the simulation of a wide variety of policy options for the financial consolidation of a social health insurance scheme. Its functions are described in greater detail, because the International Financial and Actuarial Service of the ILO (ILO-FACTS) makes this model available to all interested users. National health care financing analysts could use this model as a starting point for the development of more sophisticated national models.

7.7.1 The ILO spreadsheet model for cash-based health benefits[7]

This is an Excel-based spreadsheet model, which was developed by Kenichi Hirose of the ILO in 1997 for the actuarial valuation of the short-term benefits of the national social security scheme in Thailand. Like other ILO models for quantitative analysis, this model is fully consistent with the economic and demographic development as assumed by national planning authorities. It estimates income and expenditure (for health care, maternity, invalidity and death) for a ten-year period, and simulates the financial status of the accounts for the same period. It is a simplified health care model, as health benefits are essentially treated as per capita monthly cash payments. In Thailand, health benefits are provided to covered persons by participating hospitals, which are paid on a capitation basis. The benefit side of the model therefore largely consists of the provision of benefits which, from the point of view of the government payer, are of a cash nature. The model is somewhat atypical, as it contains other benefits in kind that are not direct health care costs, but its methodology should nonetheless be instructive.

Model data base and assumptions

The model uses the following base data:

1. statistics on beneficiaries and insured workers
2. statistics on utilization in hospitals
3. scheme financial statements (income and expenditure, investment portfolio).

Model assumptions and the sources of these assumptions are as follows:

1. Population projections for Thailand are carried out by the National Economic and Social Development Board (NESDB).

2. Projections of labour force and employment are also carried out by the NESDB.

3. Estimates and forecasts of macroeconomic indicators (e.g. growth, inflation, interest rate and current account deficit) are obtained from the

national development plan, and from more recent IMF target values (in view of the rapid changes resulting from the Asian economic crisis).

Projection methods

Income side. The number of insured workers is estimated by applying assumed coverage rates to the projected employed population. At the same time, the number of dependants of insured workers is estimated from rates obtained from family statistics (a proportion of married persons and the average number of children). The age structure of the population is not taken into account, as capitation payments are not graduated by age.

Average insurable earnings are estimated by applying assumed rates of wage increases to data in the base year. The total contributions are calculated from the number of insured workers, the average insurable salary and the rates of contribution.

Expenditure side. Basic scheme parameters (e.g. the capitation amount and flat-rate benefits) are projected by applying appropriate rates of adjustment. The total amount of capitation payments is calculated by multiplying the projected capitation amount per person and the number of persons entitled to health care benefits. Short-term cash benefits (maternity, sickness, death and invalidity grants) are estimated by considering the assumed incident rates of these risks in the insured population, together with the estimated average amount of benefits, calculated from projected scheme parameters and the average salary. Long-term periodical payments (invalidity pensions) are estimated from the number of newly awarded invalidity pensions and survival rates of existing pensioners.

Fund operations. Starting from the base year, estimated contribution income and expenditure are calculated for each projection year. Then, the cash surplus and expected investment income are calculated for each year by applying their present proportions in the income and expenditure account. Finally, any surplus is added to the previous reserve, and the closing balance is obtained.

Model results

The model has the following key outputs:

1. amount of insurable earnings and number of contributors
2. amount of benefit expenditure and number of pensioners
3. projected income and expenditure of the scheme.

These outputs may be used to analyse the financial implications of raising the contribution rate or of extending health care benefits to other population groups. They may also be used to test the sensitivity of model results to alternative economic assumptions.

Table 7.9 displays the key results of this model for a specific simulation under a standard set of assumptions. This presentation of possible model results

Year (Year B.E.)	1996 (2539)	1997 (2540)	1998 (2541)	1999 (2542)	2000 (2543)	2001 (2544)	2002 (2545)	2003 (2546)	2004 (2547)	2005 (2548)	2006 (2549)	2007 (2550)
A. Income	**19 029**	**19 220**	**18 630**	**20 160**	**21 620**	**23 130**	**25 000**	**26 800**	**28 900**	**31 300**	**33 700**	**36 100**
Contributions	*15 234*	*14 230*	*13 000*	*14 180*	*15 480*	*16 880*	*18 200*	*19 600*	*21 200*	*23 000*	*24 800*	*26 700*
from employers and employees	10 156	11 540	8 660	9 450	10 320	16 880	18 200	19 600	21 200	23 000	24 800	26 700
from government	5 078	2 690	4 330	4 730	5 160	0	0	0	0	0	0	0
Interest income	*3 724*	*4 950*	*5 610*	*5 950*	*6 110*	*6 200*	*6 700*	*7 200*	*7 700*	*8 200*	*8 800*	*9 400*
Other income	*71*	*30*	*30*	*30*	*30*	*50*	*50*	*60*	*60*	*70*	*70*	*80*
B. Expenditure	**6 760**	**8 110**	**10 020**	**14 140**	**16 100**	**17 180**	**18 900**	**19 900**	**21 900**	**24 600**	**25 900**	**28 300**
Benefit expenditure	*6 239*	*7 180*	*8 980*	*13 010*	*14 860*	*15 830*	*17 500*	*18 400*	*20 200*	*22 800*	*23 900*	*26 200*
Sickness	4 077	4 670	5 980	9 420	10 850	11 400	12 600	13 100	14 400	16 300	16 900	18 500
Maternity	1 857	2 040	2 330	2 790	3 100	3 320	3 600	3 800	4 200	4 600	4 900	5 300
Death	269	420	600	640	690	820	870	1 000	1 070	1 230	1 300	1 470
Invalidity	35	60	80	150	210	290	370	460	550	660	790	910
Administrative expenses	*522*	*920*	*1 040*	*1 130*	*1 240*	*1 350*	*1 500*	*1 600*	*1 700*	*1 800*	*2 000*	*2 100*
C. Surplus = (A) − (B)	**12 268**	**11 110**	**8 610**	**6 020**	**5 520**	**5 950**	**6 000**	**6 900**	**7 000**	**6 700**	**7 800**	**7 800**
D. Cash flow (Surplus less interest income)	**8 545**	**6 160**	**3 000**	**60**	**−590**	**−260**	**−600**	**−300**	**−700**	**−1 500**	**−1 000**	**−1 600**
E. Reserve (End of year)	**46 415**	**57 520**	**66 130**	**72 150**	**77 660**	**83 610**	**89 600**	**96 500**	**103 500**	**110 200**	**118 000**	**125 800**
Total contribution rate (%)	**4.50**	**4.50**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**	**3.00**
PAYG rate (%)	**1.92**	**2.11**	**2.31**	**2.99**	**3.12**	**3.05**	**3.12**	**3.05**	**3.11**	**3.21**	**3.13**	**3.18**
Fund ratio	**5.05**	**5.72**	**5.74**	**4.68**	**4.48**	**4.52**	**4.41**	**4.49**	**4.40**	**4.21**	**4.25**	**4.17**
Interest income liquidated (%)	**0**	**0**	**0**	**0**	**11**	**6**	**11**	**6**	**10**	**20**	**13**	**18**

serves to alert the government to the effects of differing economic assumptions and alternative cost developments on the overall necessary contribution rate. The variation of the contribution rate is substantial. This is explained in part by the uncertainty regarding the medium-term economic future in Thailand when these projections were made.

7.7.2 The health module in the ILO Social Budget Model

The health care module of the ILO Social Budget Model is only one component of the social protection sub-model of the overall social budget model. Before describing this model component, some explanations of the concept of a social budget model are in order.

The structure of the ILO Social Budget Model

A **social budget model** compiles all national social expenditure (e.g. on pensions, unemployment benefits, short-term cash benefits, social assistance and health care) and revenues (e.g. social security contributions, taxes and out-of-pocket outlays), and links expenditure to the demographic and economic environment.[8] A social budget model is a tool for the macro-governance of the overall social sector, and treats the health care sector as one subsector of the national social protection system. The model thus stresses the interaction between the economy, the demographic structure and health care, as well as the interaction between the health care financing system and other social protection systems. With appropriate modifications, however, the module can also be turned into a national health care model. The basic methodology fully reflects that described in the previous chapters, although "shortcuts" are taken in cases where the complexity of the health module is subject to overall capacity constraints imposed by the larger model. The ILO Social Budget Model consists of a series of components, as follows:

- A *population sub-model* (ILO-POP) projects national populations on the basis of standard demographic assumptions.
- A *labour force sub-model* (ILO-LAB) projects the size and structure of the labour force, as well as the structure of employment and unemployment under assumed future labour force participation and economic growth rates.
- An *economic sub-model* (ILO-ECO) predicts future aggregate employment and coverage under social security schemes, as well as wages, under a set of assumptions on future growth and productivity developments.
- A *social protection sub-model* (ILO-SOC) projects expenditure and revenues for a variety of social protection subsystems, and summarizes the expenditure and financing of specific functions within the national social protection systems (including health care).
- An *accounting sub-model* (ILO-GOV) consolidates functional expenditure and revenues into institutional budgets and the central government budget.

The health care module

The health care module of the ILO Social Budget Model aims to compile an aggregated, simplified version of a national health care budget. First of all, we can generally assume that the government remains ultimately responsible for the financing of primary preventive measures, the education of health professionals and investment in and maintenance of public provider facilities. In addition, the government might directly provide care for the entire population (e.g. in the case of a national health service) or for a part of the population (e.g. for the poor, for civil servants and public employees or for the military). A second part of the population may be covered by a social insurance scheme. A third part of the population, meanwhile, may not be covered by any public or para-statal third-party financing scheme; health care for such persons may be financed entirely on a private basis, through direct purchase or private insurance. These mechanisms might also complement the coverage of a public third-party payer.

The specific combination of the above three basic financing subsystems is different in each country. At one end of the spectrum, we find the still-operating public service health care systems of Central and Eastern European countries.[9] Most developing countries also have systems in which health care is provided through a branch of the public service and financed through the government budget, with extensive private out-of-pocket complements. Then there are countries with a dominant national health service (such as the United Kingdom's NHS), and countries with dominant Bismarckian social insurance schemes (such as Belgium, France and Germany). Finally, at the other end of the spectrum, are countries with a dominant private financing system, such as the United States. The overall national health budget of an individual country must therefore be specifically constructed, using varying weights for the basic "building blocks" listed above. The model provides a tool for the quantitative mapping of these building blocks.

Government health expenditure

Government health expenditure is estimated as the sum of the following main components of expenditure:

- government administrative expenditure (including, for example, the administrative expenditure of the ministry of health)
- expenditure in government outpatient care facilities
- expenditure in government hospitals
- government investment expenditure for health facilities.

Government administrative expenditure is estimated in each of the expenditure categories for each year of the projection period as the product of last year's expenditure, times the rate of increase of the total population, times the rate of increase of wages in the economy, times a deviation factor describing the "usual" differential between the development of wages in government health care administration and general average wages. The values for the deviation factors are normally historically observed from statistical data.

Expenditure in outpatient facilities and hospitals are separated into staff and non-staff costs (per ambulatory care unit and per hospital bed, respectively), which are projected separately. The major explanatory variables for staff costs are the number of ambulatory care units or number of beds, the development of wages in the overall economy as well as the development and structure of the overall population. For non-staff costs, the factors are the same, except general inflation is considered rather than the increase in average wages. Both the staff and non-staff components are multiplied by deviation factors describing the historically observed deviation in wage growth and inflation in the health care sector from those in the general economy. In addition, the share of staff costs in overall health care costs is multiplied by a development factor which describes the staffing trend per care unit and per bed, respectively. This allows for the simulation of expenditure differentials triggered by reductions or increases in the number of units of care or hospital beds. Thus, compensatory or compounding effects are forecast, caused by changes in the intensity of care (approximated by a factor describing the change in staffing per unit or per bed).

The most important factor driving health expenditure, however, is the utilization of health care. Utilization, in turn, is usually affected by the population structure, since utilization rates per capita differ by age and sex. In addition, there is general statistical evidence that utilization is positively correlated with real per capita GDP; in other words, the richer a country becomes, the higher its utilization of health care services. The elasticity between the growth of health care utilization and the growth of GDP per capita must be observed statistically. If no such observations are available, the elasticity is assumed to be zero. A zero elasticity implies that utilization rates per capita are driven exclusively by the change in population structure.

The accounting and statistical structure of government health services usually provides relatively good financial data, but often does not disaggregate expenditure according to the age and sex of the "utilizers" of government health facilities. Global utilization indicators are often available, without linkage to costs. Thus, the impact of changing demographic structure on costs has to be taken into account through the use of a global factor, equal to the overall average utilization rate in year t divided by the overall utilization rate in year t. The overall utilization rate is the weighted average of the utilization rates for different age groups (e.g. under 15, 15–64, 65–74, and 75+). If no national or scheme-based age-specific utilization rates are available, then a typical standard utilization function may be assumed. Since only the change in the overall utilization rate is used in the forecast (rather than absolute values), errors caused by using a standard age-specific profile are probably smaller than those that would result if the impact of age structure on forecasted expenditure were ignored altogether.

Overall government expenditure can be calculated based on the above assumptions and data. Net government expenditure is calculated by subtracting the amount of patient co-payments in government facilities from gross government expenditure. The amount of co-payments is generally projected as a constant percentage of gross government expenditure. However, depending on national circumstances, this factor might well be a policy variable.

Expenditure of the health insurance scheme

A portion of the total population is assumed to be eligible for health insurance benefits. The projection of the total expenditure is aggregated into the following subcategories:

- Ambulatory care
- Hospital care
- Dental care
- Pharmaceuticals
- Other care
- Administration.

Administrative costs are estimated as a percentage of total benefit expenditure. However, for all categories of care, projections consist of the multiplication of per capita cost by the number of projected eligible persons. For the major categories of care (ambulatory and hospital care), per capita costs are calculated as the number of cases or hospital days per capita (i.e. the frequency of utilization) times the cost per case or per bed-day (i.e. the unit cost). Costs per case or per bed-day are, in turn, disaggregated into staff and non-staff costs. Again, a deviation factor is applied to each category, which describes the estimated deviation of the change in staff costs from general salary increases, and the deviation of the change in non-staff costs from general inflation.

Expenditure on ambulatory and hospital care is also disaggregated into six population subgroups, with different per capita costs calculated for children, persons of working age and persons of pensionable age for both sexes. Persons in these categories usually have distinctly different health care needs. The utilization of care facilities by persons in pensionable age (and, therefore, the per capita cost in that age group) is usually treated as a multiple of the respective value for persons of active age. Unlike government schemes, social insurance health care schemes should maintain individual accounts on insured persons; these should record contributions paid as well as benefits received. In theory, therefore, it should be possible to identify utilization by age group and by the unit benefit cost per ambulatory care contact or hospital day within the respective age groups. If age-specific disaggregations of utilization and costs are not part of the standard statistical framework of the social security health insurance scheme, specific surveys might have to be organized to obtain the data. Age-specific disaggregation allows for a mapping of the effect of changing age structures on health care expenditure.

Total benefit costs, total benefit expenditure, total insurable earnings, as well as PAYG cost indicators and the build-up (or depletion) of reserves follow the principles previously described in Chapter 6, and need not be repeated here.

Private health care expenditure

Unless a country's health care system is dominated by privately financed health care, the projection of the private share of total health care financing can be relatively simple. The easiest way to project private health expenditure is to link it to the other major financing systems, assuming that revenues (private out-of-pocket outlays and private insurance premiums) are equal to expenditure. Private expenditure may then be estimated as a proportion of government or social insurance expenditure, to which the amount of co-payments in government facilities is added. This results in a very conservative estimate of private health expenditure, as it is obvious that in many countries, notably in developing and transition countries, additional remuneration in public facilities occurs in the form of unofficial, under-the-table payments. Due to the nature of these payments, their order of magnitude is unknown and cannot be taken into account.

With some adaptation, the techniques used for modelling social insurance schemes can also be used in countries where the health care sector is predominantly financed through private insurance. The most important adaptation is to modify the form of financing used in the social insurance model to the mechanism of age-specific, flat-rate premiums that are not related to income and are paid on an individual basis. This implies that individual premiums are paid on behalf of every covered person, including dependants, which are normally insured without contribution supplements in a social insurance scheme. Using this financing method, a substantial technical reserve is normally accrued. As in other schemes, changes in reserves are regarded as either expenditure (if the reserve increases) or as income (if the reserve decreases). The other main difference between private insurance and social insurance is that the former usually has much higher administrative costs, which are mostly triggered by substantial promotional expenditure.

Illustration: The case of Ukraine

Tables 7.10–7.14 show an exercise conducted for Ukraine, a country in transition. Table 7.10 sets out the key economic assumptions used for the social budget exercise. (The assumptions for the model were made in collaboration with a national working group, but do not necessarily reflect the views of Ukrainian government agencies or of the ILO.) Table 7.11 displays the projected development of total social expenditure in Ukraine and its financing. Among the major expenditure components, we can identify the health sector. Tables 7.12 and 7.13 expand on these health care projections and identify

Table 7.10 Assumptions for health care financing and social budget projection for Ukraine, 1995–2015

	1995	2000	2005	2010	2015
Real GDP growth (%)	−12.2	6.0	5.0	3.0	2.0
Real labour productivity growth (%)	−16.6	8.0	4.0	2.0	1.0
Employment growth (%)	5.3	−1.9	1.0	1.0	0.6
Inflation (GDP deflator, %)	5.2	1.0	1.0	1.0	1.0
Unemployment rate (%)	5.1	16.1	14.0	9.4	3.0
Proportion of unemployment officially registered (%)	9.8	70.0	100.0	100.0	100.0
Registered unemployment rate (%)	0.5	11.3	14.0	9.4	3.0
Real wage growth (%)	−14.3	1.6	3.0	2.0	1.0
Minimum unemployment rate (%)		3	3	3	3
GDP at current prices (bn hryvna)	54.52	125.91	189.04	259.01	331.52
Labour productivity at current prices (hryvna)	2 248.27	5 971.86	8 629.44	11 262.73	13 722.61
Employment (millions)	24.25	21.08	21.91	23.00	24.06
Unemployment (millions)	1.31	4.04	3.57	2.38	0.74
Registered unemployment (millions)	0.13	2.83	3.57	2.38	0.74
Covered employees (millions)	20.22	16.99	17.65	18.53	19.39
Contributing employees (millions)	16.73	16.76	17.06	16.93	16.19
Population (millions)	51.28	49.63	48.31	47.41	47.02
Working age population (millions)	37.23	36.48	36.52	35.54	34.65
Labour force (millions)	25.56	25.12	25.47	25.38	24.80
Labour force as proportion of working-age population (%)	69	69	70	71	72
Labour force as proportion of overall population (%)	50	51	53	54	53
Covered population as proportion of the employed (%)	83.38	80.59	80.59	80.59	80.59
Contributing population as proportion of the employed (%)	69.00	79.49	77.86	73.63	67.32
Share of labour costs in GDP (%)	44	43	40	38	37
Total labour costs (bn hryvna)	23.73	53.70	74.89	99.21	124.19
Total wage fund (bn hryvna)	16.68	36.65	51.47	69.16	88.15
Social security contributions (% of gross wages)	6.07	14.83	20.33	25.96	30.92
Other labour costs (% of gross wages)	0.98	2.21	3.09	4.09	5.12

the parameters which are needed to "steer" the health sub-model. Table 7.14 displays the final results: the health sector budget of Ukraine. As we can see from the results, Ukraine does not yet have a social health insurance scheme (accounting for the several zero entries in the health budget section of the table).

7.7.3 The standard ILO health care model

As a final example, we will perform a modelling exercise for a fictitious country, using the standard ILO health care model. This exercise contains data from a

Table 7.11 Ukraine's social budget as a percentage of GDP

	1995	2000	2005	2015
Expenditure				
1. Pension insurance	**7.39**	**11.67**	**9.13**	**9.21**
Benefits, of which:				
old age	6.08	9.51	7.49	7.41
invalidity	0.79	1.34	1.00	1.09
survivors'	0.26	0.42	0.32	0.37
length of service	0.05	0.08	0.06	0.07
social pensions	0.16	0.26	0.20	0.22
military pensions	0.39	0.86	0.67	0.67
Chernobyl pensions	0.23	0.39	0.30	0.35
2. Short-term benefits paid by Pension Fund	**0.65**	**0.38**	**0.30**	**0.25**
Parental leave for employed persons	0.12	0.11	0.07	0.04
Funeral benefits	0.06	0.11	0.09	0.07
Other pension supplements	0.35	0.04	0.03	0.03
Child benefits (on behalf of local budgets)	0.12	0.12	0.11	0.11
3. Health	**4.86**	**4.25**	**4.16**	**5.01**
Government expenditure	4.85	4.25	4.16	5.00
Social insurance expenditure	0.00	0.00	0.00	0.00
Private expenditure	0.00	0.00	0.00	0.01
4. Unemployment and employment promotion	**0.24**	**1.58**	**1.78**	**0.43**
5. Short-term benefits	**1.07**	**1.23**	**1.13**	**1.28**
6. Tax-financed family benefits	**0.69**	**0.85**	**0.66**	**0.50**
7. Social assistance	**0.03**	**0.08**	**0.06**	**0.04**
8. Housing	**0.07**	**2.17**	**1.62**	**0.78**
9. Chernobyl	**1.57**	**1.58**	**1.30**	**1.13**
10. Other	**0.82**	**0.92**	**0.73**	**0.56**
Total current social expenditure	**17.39**	**24.70**	**20.87**	**19.18**
Change of reserves	**0.26**	**1.62**	**0.58**	**0.75**
Pension insurance	0.00	1.61	0.57	0.19
Health insurance	0.00	0.00	0.00	0.00
Short-term benefits	0.10	0.01	0.00	0.00
Unemployment insurance	0.15	0.00	0.00	0.15
Chernobyl Fund	0.01	0.00	0.01	0.40
Total social expenditure	**17.65**	**26.32**	**21.45**	**19.93**
Income				
1. Social security contributions	**11.09**	**16.84**	**12.90**	**12.96**
Pension insurance	7.73	13.39	9.73	9.34
Health insurance	0.00	0.00	0.00	0.00
Short-term benefits	1.18	1.23	1.13	1.28
Unemployment insurance	0.30	0.54	0.49	0.58
Chernobyl	1.88	1.69	1.55	1.76

Table 7.11 (Continued)

	1995	2000	2005	2015
2. Investment income	**0.08**	**0.03**	**0.08**	**0.15**
Pension insurance	0.00	0.02	0.07	0.09
Health insurance	0.00	0.00	0.00	0.00
Short-term benefits	0.00	0.01	0.00	0.00
Unemployment insurance	0.08	0.00	0.00	0.00
Chernobyl	0.00	0.00	0.00	0.06
3. Other income	**0.06**	**0.09**	**0.09**	**0.09**
4. Income from general revenues	**6.42**	**9.36**	**8.39**	**6.73**
Total income	**17.65**	**26.32**	**21.45**	**19.93**

fictitious European country, which we will call Euroland (to distinguish it from our Demoland case, which refers to a fictitious developing economy). For technical reasons, the model does not project for more than a ten-year period, due to the sheer number of variables involved and the fact that the uncertainty of the model results simply become too significant after that period. In this exercise, only three projection years are displayed.

The parameters of the model permit the simulation of the financial effects of various assumptions on expenditure and revenue. The model is a stand-alone module for a social insurance health care financing subsystem. It can be used as a teaching tool for health care staff, or as a basis for building a full-blown model as a management tool for a national social insurance scheme. In its generic version, the model provides a framework for simulations and projections which must be "customized" for specific national use.

The model has four major components: a demographic module, a contribution base module, an expenditure module and an income module. Model simulations and projections normally start with the demographic module, which can project the future population on the basis of a set of demographic assumptions (i.e. mortality, fertility and migration). The demographic module is crucial because it is the basis for modelling both the expenditure side (e.g. the eligible population and age-related cost differentials) and the revenue side (i.e. contributors in contribution-financed schemes or taxpayers in tax-financed schemes).

Since many governments require that the health care modeller begin with official population forecasts, typical results of the demographic module are not presented here. Rather, we assume that demographic data are available.

Estimating the contribution base

The **contribution base** is the sum of total earnings subject to contributions. In this example, we assume that the scheme is financed through a percentage

Table 7.12 Health care parameters and assumptions for the Ukrainian exercise

	1995	2000	2005	2010	2015
Expenditure parameters					
Investment in government health facilities (factor of benefit expenditure)	0	0	0	0	0
Investment in non-government health facilities (factor of benefit expenditure)	0	0	0	0	0
Other benefit cost rate (factor of benefit expenditure)	0	0	0	0	0
Private health care delivery (factor of gov't expenditure)	0.001	0.001	0.001	0.001	0.001
Expenditure elasticities					
Deviation factor for health investments	1	1	1	1	1
Annual staff cost per ambulatory care unit	0	0	0	0	0
Development of staff per ambulatory care unit	1	1	1	1	1
Deviation factor for health care staff salaries	1.01	1.01	1.01	1.01	1.01
Non-staff costs per ambulatory care unit	1.01	1.01	1.01	1.01	1.01
Deviation factor for non-staff costs	1.05	1.05	1.05	1.05	1.05
Development of staff in inpatient care	1	1	1	1	1
Deviation factor for staff costs in hospitals	1.01	1.01	1.01	1.01	1.01
Deviation factor non-staff costs in hospitals	1.05	1.05	1.05	1.05	1.05
Deviation factor for administrative costs	1	1	1	1	1
GDP elasticity of utilization	0	0	0	0	0
Health care consumption patterns					
Ambulatory care, male, contacts per person per year					
under 15	2	2	2	2	2
15–64	1	1	1	1	1
65–74	3	3	3	3	3
75+	4	4	4	4	4
Indicator (weighted average)	1.66	1.63	1.60	1.57	1.59
Ambulatory care, female, contacts per person per year					
under 15	1.8	1.8	1.8	1.8	1.8
15–64	1.2	1.2	1.2	1.2	1.2
65–74	2.8	2.8	2.8	2.8	2.8
75+	3.2	3.2	3.2	3.2	3.2
Indicator (weighted average)	1.59	1.57	1.58	1.58	1.59
Hospital care, male, days per person per year					
under 15	0.2	0.2	0.2	0.2	0.2
15–64	2	2	2	2	2
65–74	3	3	3	3	3
75+	4	4	4	4	4
Indicator (weighted average)	1.95	1.97	2.00	1.99	1.98
Hospital care, female, days per person per year					
under 15	0.2	0.2	0.2	0.2	0.2
15–64	3	3	3	3	3
65–74	3	3	3	3	3
75+	3	3	3	3	3
Indicator (weighted average)	2.49	2.53	2.59	2.61	2.59

Table 7.13 Projections for the government health care delivery system in Ukraine

	1995	2000	2005	2010	2015
Infrastructure					
Ambulatory care units, MOH	6 500	6 315	6 148	6 033	5 984
Ambulatory care units, non-MOH	700	680	662	650	644
Staff per ambulatory care unit, MOH	86.2	84	82	81	80
Staff per ambulatory care unit, non-MOH	81.2	80	78	77	76
Number of hospitals, MOH	3 360	3 360	3 360	3 360	3 360
Number of hospitals, non-MOH	540	540	540	540	540
Number of beds, MOH	532 000	495 503	482 391	473 381	469 517
Number of beds, non-MOH	107 000	103 958	101 208	99 317	98 507
Unit costs (in thousand hryvna)					
Staff cost per ambulatory unit	82 917	202 862	288 167	387 648	496 407
Non-staff cost per ambulatory unit	82 917	146 916	220 581	326 363	482 874
Staff cost per hospital bed	934	2 285	3 246	4 367	5 593
Non-staff cost per hospital bed	995	1 655	2 485	3 677	5 441
Utilization indicators					
Ambulatory care indicator, overall population	1.62	1.60	1.59	1.58	1.59
GDP-adjusted ambulatory care indicator	1.62	1.60	1.59	1.58	1.59
Hospital care indicator, overall population	2.24	2.27	2.32	2.32	2.31
GDP-adjusted hospital care indicator	2.24	2.27	2.32	2.32	2.31

* Note: MOH = Ministry of Health

contribution based on insurable earnings, which are defined by the relevant social insurance law.

As a first step, the number of contributors is calculated, for which it is necessary to forecast the size of the labour force and the number of persons employed, self-employed and unemployed. The number of contributors, however, may not be limited to the labour force. Pensioners and recipients of other social benefits may also pay contributions, or the State may pay contributions on their behalf. For the purposes of this demonstration, we will assume that the latter is the case. The labour force is defined as

- the population in working age *minus* the non-active; or
- the population in working age *times* the participation rate; or
- the number of the employed *plus* the self-employed *plus* the unemployed.

When calculating the size and structure of the labour force, assumptions concerning future participation rates, unemployment rates and the number of self-employed persons must be established for each age group. Then, the number of insured persons in each of these groups must be determined. In many countries, the group of insured employed persons is smaller than the total group of employed persons.

Table 7.14 Health care projections: Results of the Ukrainian exercise

	1995	2000	2005	2010	2015
1. Gross government expenditure					
Administrative expenditure	*0.24*	*0.61*	*0.81*	*1.01*	*1.23*
MOH	0.21	0.53	0.70	0.88	1.06
non-MOH	0.03	0.12	0.11	0.13	0.17
Investment expenditure	*0*	*0*	*0*	*0*	*0*
Care in ambulatory facilities	*1.19*	*2.40*	*3.39*	*4.63*	*6.36*
MOH	1.08	2.17	3.06	4.18	5.74
non-MOH	0.12	0.23	0.33	0.45	0.62
Care in hospitals	*1.23*	*2.40*	*3.47*	*4.78*	*6.46*
MOH	1.03	1.98	2.86	3.95	5.34
non-MOH	0.21	0.42	0.60	0.83	1.12
Other care	*0*	*0*	*0*	*0*	*0*
Gross government expenditure	**2.67**	**5.42**	**7.67**	**10.42**	**14.04**
Net government expenditure on health (gross expenditure less private financing)	**2.65**	**5.31**	**7.51**	**10.21**	**13.76**
2. Private financing and expenditure					
Private financing					
Private insurance contributions	0.00	0.01	0.01	0.01	0.01
Co-payments in government health care	0.02	0.11	0.16	0.21	0.29
Co-payments in the social security system	0.00	0.00	0.00	0.00	0.00
Direct and indirect purchases	0.00	0.00	0.00	0.00	0.00
Private sector expenditure					
Private insurance (benefit and administrative expenditure plus profits)	0.00	0.01	0.01	0.01	0.01
Employer health care	0.00	0.00	0.00	0.00	0.00
Other health care providers	0.00	0.00	0.00	0.00	0.00
Total expenditure (bn hryvna)	**2.65**	**5.31**	**7.52**	**10.22**	**13.77**
as percentage of GDP	*4.86*	*4.22*	*3.98*	*3.95*	*4.15*
1. Expenditure in government facilities	2.65	5.31	7.51	10.21	13.76
2. Social insurance expenditure	0	0	0	0	0
3. Private expenditure	0.003	0.005	0.008	0.010	0.014
Total functional income (bn hryvna)	**2.65**	**5.31**	**7.52**	**10.22**	**13.77**
1. Government financing	2.62	5.20	7.35	10.00	13.47
2. Social security contributions	0	5	10	15	20
3. Private financing	0.03	0.12	0.16	0.22	0.30

As a result of the above, we obtain the number of contributors. In many countries, contributions are not fully collected due to non-compliance or exemptions from contribution payments, among other reasons. The model therefore permits a contribution collection rate to be entered, i.e. a percentage rate that describes contributions actually collected as a share of all contributions due.

Contribution payers may also be pensioners or recipients of other social benefits, and thus members of the non-active population. Thus, they represent a part of the contribution base that must be estimated and projected separately. These separate calculations result in the number and structure of contributors.

Once these data have been obtained, the contribution base can be calculated. A fully correct modelling of the contribution base would involve establishing and projecting earnings by income and age group. An approximation of the contribution base may be obtained by multiplying the number of contributors in each category (the employed, self-employed, unemployed, pensioners and others) with an average amount of earnings subject to contributions in that category. The projection of average earnings incorporates assumptions on the future development of earnings.

Table 7.15 shows the calculated number of contributors and the contribution base. The model can also be used for tax-financed health care systems; in this case, the calculation of the contribution base is omitted.

Estimating health expenditure

Demographic projections are necessary in order to obtain the total number of persons eligible for benefits, i.e. the total number of the insured or covered persons. Demographic forecasts also permit an estimation of the impact of demographic changes (e.g. ageing) on the overall level of health expenditure.

The number of insured persons is determined in a method similar to that for determining the number of contribution payers. The difference between the number of insured persons and contributors is the number of dependants (or other insured persons who do not pay contributions). In the model, it is supposed that dependants do not pay contributions, in keeping with classical social insurance tradition.

For all groups of insured persons, projections are made on the basis of a breakdown by age group. The next step assumes that health costs for each age group and category of benefits are available. These costs normally increase with the age of the insured persons. Table 7.16 shows the figures used in our model calculation. Designations such as "care 1", "item 1", etc., stand for the various available categories of health care services (e.g. they could be "ambulatory care", "hospital care" or "pharmaceuticals"). There should be a residual category called "other" services. The choice of which specific categories of health care services to include separately in projections, and which categories to assign to a residual "other" category, depends on the specific schemes. It also depends, as elsewhere, on the availability of data.

Multiplying the per capita costs with the number of insured in each age group leads to total health care expenditure. The overall cost structure can be used, inter alia, to demonstrate the effects of demography on health costs (see table 7.17).

In order to project health care expenditure, factors determining both price- and volume-related cost increases must be estimated separately for each category of health services. These "development factors" may be based on the methodology described in Chapter 6 for projections of per unit prices and

Table 7.15 Calculation of contribution base (in Euroland currency units)

	1997	1998	1999
Population	**65 290 700**	**65 283 162**	**65 255 967**
Insured	**65 290 648**	**65 457 873**	**65 430 755**
Non-insured	**0**	**0**	**0**
1. Insured employed and self-employed persons			
Self-employed	1 981 766	1 984 256	1 983 866
Employed persons	18 193 362	18 167 499	18 123 010
Average income of self-employed subject to contributions	55 000	56 650	58 350
Average income of employees subject to contributions	45 000	46 350	47 741
Estimated labour income subject to contributions	**927 698 405 373**	**954 471 721 177**	**980 959 118 847**
As percentage of contributions collected	100%	100%	100%
2. Unemployed persons			
Number of unemployed receiving benefits	1 177 344	1 285 194	1 287 395
Average amount of benefit received	20 000	20 600	21 218
Volume of payments subject to contributions	**23 546 874 661**	**26 475 004 871**	**27 315 938 359**
3. Pensioners			
Old age and survivors' pensioners	7 256 478	7 341 333	7 443 279
Average pension	20 000	20 600	21 218
Invalidity pensioners	423 440	426 794	432 228
Average pension	10 000	10 300	10 609
Volume of pensions subject to contributions	**149 363 951 914**	**155 627 441 215**	**162 517 008 450**
4. Other			
Recipients of other social income subject to contributions	7 037 136	7 014 920	6 976 966
Average assessment base per person	10 000	10 300	10 609
Volume of payments subject to contributions	**70 371 363 638**	**72 253 680 868**	**74 018 635 242**
Persons with other income	185 139	184 395	183 623
Estimated average income submit to contributions	45 000	46 350	47 741
As percentage of contributions collected	100%	100%	100%
Contribution base	**8 331 255 000**	**8 546 719 652**	**8 766 233 047**
Total contribution base	**1 179 311 850 587**	**1 217 374 567 783**	**1 253 576 933 945**

Table 7.16 Per capita costs in Euroland currency units (CU), 1997

	Care 1	Care 2	Care 3	Item 1	Item 2	Item 3	Other
Men							
0 to 4 years	188.47	661.31	9.45	31.38	54.39	49.05	55.21
5 to 9 years	101.66	131.21	25.71	36.61	63.46	57.23	64.41
0 to 14 years	91.66	152.21	36.67	41.84	72.52	65.40	73.61
15 to 19 years	98.32	162.70	21.93	36.61	63.46	57.23	64.41
20 to 25 years	163.32	283.42	49.15	34.00	58.93	53.14	59.81
25 to 29 years	186.65	362.14	96.79	31.38	54.39	49.05	55.21
30 to 34 years	206.65	514.35	135.35	39.23	67.99	61.31	69.01
35 to 39 years	241.64	551.09	183.36	52.30	90.65	81.75	92.01
40 to 44 years	351.63	866.00	193.57	57.53	99.72	89.93	101.22
45 to 49 years	416.62	1 039.20	188.28	65.38	113.32	102.19	115.02
50 to 54 years	666.60	1 285.88	150.47	104.61	181.31	163.50	184.03
55 to 59 years	749.92	2 041.66	145.56	117.68	203.97	183.94	207.03
60 to 64 years	999.90	2 608.49	101.32	156.91	271.96	245.25	276.04
65 to 69 years	1 149.88	2 876.16	85.07	180.45	312.76	282.04	317.45
70 to 74 years	1 199.88	3 663.44	87.33	188.29	326.36	294.30	331.25
75 to 79 years	1 299.87	4 120.05	79.77	203.99	353.55	318.83	358.86
more than 80	1 416.52	4 707.88	77.50	222.29	385.28	347.44	391.06
Women							
0 to 4 years	173.13	498.34	9.45	31.38	54.39	49.05	55.21
5 to 9 years	100.58	98.88	25.71	36.61	63.46	57.23	64;41
0 to 14 years	90.69	114.70	36.67	41.84	72.52	65.40	73.61
15 to 19 years	123.67	415.28	21.93	36.61	63.46	57.23	64.41
20 to 25 years	199.52	1 020.41	49.15	34.00	58.93	53.14	59.81
25 to 29 years	184.68	1 269.58	96.79	31.38	54.39	49.05	55.21
30 to 34 years	204.46	1 178.62	135.35	39.23	67.99	61.31	69.01
35 to 39 years	239.09	806.84	183.36	52.30	90.65	81.75	92.01
40 to 44 years	347.91	652.59	193.57	57.53	99.72	89.93	101.22
45 to 49 years	412.22	783.11	188.28	65.38	113.32	102.19	115.02
50 to 54 years	659.55	969.00	150.47	104.61	181.31	163.50	184.03
55 to 59 years	742.00	1 538.53	145.56	117.68	203.97	183.94	207.03
60 to 64 years	989.33	1 965.68	101.32	156.91	271.96	245.25	276.04
65 to 69 years	1 137.73	2 167.39	85.07	180.45	312.76	282.04	317.45
70 to 74 years	1 187.20	2 760.66	87.33	188.29	326.36	294.30	331.25
75 to 79 years	1 286.13	3 104.75	79.77	203.99	353.55	318.83	358.86
more than 80	1 401.55	3 547.72	77.50	222.29	385.28	347.44	391.06

utilization per capita. These development factors may be estimated outside of the model, or they may be included in a specific national version of the model. Finally, total expenditure is calculated as:

$$\text{Total expenditure} = \text{Administrative expenditure} + \text{benefit expenditure} \\ + \text{other costs} + \text{transfers to reserves (if any)}$$

Factors describing the increase in administrative costs and other costs must be estimated as well. Table 7.18 shows total expenditure for our example – here, reserves have been disregarded.

Table 7.17 Total health costs in Euroland CUs

	1997	1998	1999	2000
Men				
0 to 4 years	1 979 640 737.24	2 018 834 248.10	2 057 515 932.26	2 071 352 194.69
5 to 9 years	829 209 943.82	878 621 307.56	927 763 053.28	986 668 567.32
10 to 14 years	900 501 151.48	939 392 343.33	977 232 832.88	1 005 416 645.64
15 to 19 years	854 718 015.83	866 027 098.80	884 652 068.64	921 848 766.47
20 to 24 years	1 739 297 256.00	1 635 135 382.48	1 537 661 054.03	1 464 617 095.54
25 to 29 years	2 583 462 913.43	2 644 727 316.30	2 651 566 138.19	2 614 063 512.55
30 to 34 years	3 091 982 984.47	3 311 019 301.44	3 507 061 714.93	3 678 520 692.52
35 to 39 years	3 128 880 866.66	3 343 194 199.36	3 557 475 882.59	3 795 624 056.93
40 to 44 years	3 986 366 478.26	4 165 122 572.51	4 304 165 809.87	4 466 898 694.96
45 to 49 years	3 993 310 866.80	4 153 791 245.95	4 360 529 309.60	4 799 894 911.57
50 to 54 years	6 771 209 329.68	6 814 753 948.21	6 689 888 759.30	6 232 213 847.58
55 to 59 years	7 596 623 846.97	8 404 234 301.80	9 049 125 738.07	9 652 640 878.58
60 to 64 years	7 834 199 772.87	7 924 184 649.18	8 378 568 028.62	8 948 259 698.89
65 to 69 years	6 682 734 969.01	7 341 226 874.33	7 980 419 617.18	8 511 223 212.62
70 to 74 years	5 534 150 773.51	6 195 535 013.10	6 580 778 858.57	6 879 637 637.56
75 to 79 years	3 834 862 323.19	3 474 962 483.84	3 485 315 798.89	3 998 488 828.90
more than 80	5 464 742 696.76	5 704 772 619.24	5 919 695 062.85	5 915 752 945.25
Women				
0 to 4 years	1 561 110 403.63	1 608 198 968.74	1 655 679 891.10	1 686 270 564.98
5 to 9 years	731 266 035.39	775 068 513.85	820 125 666.58	871 787 065.93
10 to 14 years	792 453 571.02	827 874 004.45	860 879 213.17	886 449 087.99
15 to 19 years	1 256 050 632.25	1 266 333 765.97	1 291 626 180.86	1 347 556 708.82
20 to 24 years	3 453 740 038.15	3 261 243 889.54	3 076 134 935.97	2 927 795 120.47
25 to 29 years	4 961 207 491.55	5 075 456 833.66	5 106 226 579.23	5 059 414 241.91
30 to 34 years	4 619 959 761.41	4 922 750 443.28	5 196 888 965.42	5 431 633 705.18
35 to 39 years	3 540 373 165.75	3 747 616 511.03	3 968 930 789.84	4 227 460 991.56
40 to 44 years	3 364 903 852.69	3 527 050 456.86	3 650 722 003.49	3 774 188 214.06
45 to 49 years	3 326 621 306.20	3 461 429 892.63	3 639 277 473.06	4 021 173 110.38
50 to 54 years	5 745 300 692.34	5 750 565 849.58	5 651 526 849.12	5 274 282 544.40
55 to 59 years	6 478 622 277.20	7 133 414 348.87	7 672 840 115.69	8 173 765 132.27
60 to 64 years	7 123 970 877.33	7 164 587 215.37	7 526 474 619.99	7 992 602 528.49
65 to 69 years	8 215 336 642.87	8 384 258 956.26	8 524 271 696.30	8 661 820 128.71
70 to 74 years	8 354 637 691.43	9 369 209 624.11	9 925 091 750.36	10 057 464 333.72
75 to 79 years	6 691 850 944.61	6 089 490 948.91	6 034 709 776.62	6 876 310 459.81
more than 80	12 071 458 417.20	12 748 230 850.57	13 404 992 780.28	13 626 069 469.71
Total	**149 094 758 727**	**154 928 315 979**	**160 855 814 947**	**166 839 165 596**

Estimating scheme income

The income of the scheme may be calculated as follows:

Total income = Income from co-payments (user charges and fees)
+ total income from contributions
+ transfers from the state budget or other schemes (if any)
+ investment income + other income

Table 7.18 Consolidated income and expenditure forecast (million CU, except as noted)

Budget	1997 (current)	1998 (forecast)	1999 (trend)
Contributions	153 227.8	159 225.7	165 317.5
Transfers from state budget			
Interests on reserve			
Co-payments	5 431.5	5 641.4	5 857.3
Other			
Total income	**158 659.3**	**164 867.1**	**171 174.8**
Benefit expenditure	149 094.8	154 928.3	160 855.8
Administrative expenditure	9 516.7	9 889.0	10 267.4
Other expenditure	47.8	49.7	51.6
Transfers to reserve			
Total expenditure	**158 659.3**	**164 867.1**	**171 174.8**
Deficit/surplus	none	none	none
Macroeconomic data			
GDP	**2 000 000**	**2 060 000**	**2 121 800**
Health budget, % of GDP	**7.66%**	**7.73%**	**7.79%**
Health expenditure, % of GDP	**7.93%**	**8.00%**	**8.07%**

Co-payments are calculated, for each category of care and each group of insured persons, as a percentage of expenditures. Table 7.19 shows the pattern of co-payments in our model. This co-payment pattern must be multiplied by total health costs in each group of insured persons mentioned. The results may be compiled in tabular form, showing the total amount of co-payments and the total share of costs covered by them. Other income, such as transfers from the state budget and from reserves, are treated here as external variables. In this example, other income is neglected.

Total contribution income required to balance the budget of the scheme on a PAYG basis is calculated as the necessary contribution rate times the contribution base. The necessary contribution rate is calculated by the fundamental equation of financial equilibrium:

$$\text{Necessary PAYG contribution rate} = \frac{(\text{Total expenditure} - \text{co-payments} - \text{other income})}{\text{Contribution base}}$$

Our example yields the following necessary contribution rates:

- 13.00 per cent for 1997
- 13.09 per cent for 1998
- 13.19 per cent for 1999.

The results of the model are shown in table 7.20. If the model signals a projected increase in the necessary contribution rate, this indicates a need for policy

Table 7.19 Costs shared through co-payments (percentages)

	Employed and persons with other income	Self-employed	Unemployment benefit recipients	Old age, survivors' and invalidity pensioners	Other recipients	Children under 15	Dependants and persons without assessable income aged 15 and over
Care 1	5.0	5.0	2.0	2.0	1.0	0.0	2.0
Care 2	5.0	5.0	2.0	2.0	0.0	0.0	3.0
Care 3	20.0	20.0	5.0	2.0	2.0	5.0	10.0
Item 1	10.0	10.0	3.0	3.0	0.0	0.0	5.0
Item 2	10.0	10.0	3.0	3.0	0.0	0.0	5.0
Item 3	10.0	10.0	3.0	3.0	0.0	0.0	5.0
Other	10.0	10.0	3.0	3.0	0.0	0.0	5.0
Total share of costs covered by co-payments:			**3.64**				

action. Indicating such needs is the purpose of this particular model. However, before policy actions are taken, the government of Euroland would probably request a variety of different scenarios, using different assumptions regarding economic growth and per capita cost increases. If all scenarios were to show emerging deficits under present *de facto* contribution rates (which should not be confused with the necessary contribution rate), then policy action would be inevitable. The model could then be used to identify possible political strategies for the consolidation of scheme finances.

Policy simulations

Model projections cover a ten-year period in order better to demonstrate the financial impact of potential policy changes. It is assumed that after the third year, expenditure grows one percentage point faster per year than the total contribution base (at 5 per cent p.a.). It is also assumed that the total amount of co-payments increases by about two percentage points per annum.

We assume that the government of Euroland will, on the basis of status quo projections, now begin considering legislation or regulatory measures to provide for either an increase in the contribution rate or a reduction in benefit expenditure. The latter could be achieved, for example, through an increase in co-payment rates (in view of European cost-containment policies in recent decades, this is not an unrealistic option).

Table 7.20 shows the results of the status quo projections and three policy alternatives. Figures 7.5 and 7.6 trace the most important results of the experiment – the contributions to be charged under the various policy alternatives, the resulting revenues and the total debt of the scheme throughout the projection period. Under status quo conditions, the scheme's cash flow would

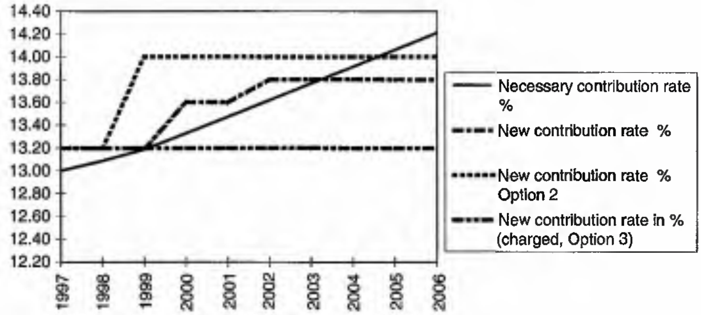
Table 7.20 Simulating alternative policy options in Euroland

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Status quo										
Total expenditure (bn CU)	158.70	164.90	171.20	181.47	192.36	203.90	216.14	229.10	242.85	257.42
Co-payments (bn CU)	5.40	5.60	5.90	6.02	6.14	6.26	6.39	6.51	6.64	6.77
Total contribution base (bn CU)	11.79	12.17	12.54	13.16	13.82	14.51	15.24	15.60	16.80	17.64
Necessary contribution rate (%)	13.00	13.09	13.19	13.33	13.47	13.62	13.77	13.91	14.06	14.21
Former contribution rate (%)	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20
Reserves at end of year (bn CU)	2.39	3.85	4.09	2.44	−1.35	−7.54	−16.41	−28.26	−43.44	−62.31
Reserves as a multiple of expenditure	0.02	0.02	0.02	0.01	−0.01	−0.04	−0.08	−0.12	−0.18	−0.24
Investment income (bn CU)	0.02	0.06	0.08	0.06	0.01	−0.09	−0.24	−0.44	−0.71	−1.05
Annual cash flow deficit/ surplus (bn CU)	2.37	1.40	0.16	−1.72	−3.80	−6.10	−8.63	−11.41	−14.47	−17.82
Simulations										
Policy option 1										
New contribution rates (%)	13.20	13.20	13.20	13.60	13.60	13.80	13.80	13.80	13.80	13.80
Reserves (bn CU)	2.39	3.85	4.09	7.75	9.65	12.48	13.25	11.68	7.48	0.31
Reserves as a multiple of expenditure	0.02	0.02	0.02	0.04	0.05	0.06	0.06	0.05	0.03	0.00
Investment income (bn CU)	0.02	0.06	0.08	0.12	0.17	0.22	0.25	0.25	0.19	0.08
Annual cash flow surplus/ deficit (bn CU)	2.37	1.40	0.16	3.55	1.73	2.61	0.51	−1.82	−4.39	−7.24
Policy option 2										
New contribution rates (%)	13.20	13.20	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
Reserves (bn CU)	2.39	3.85	14.22	23.40	31.20	37.39	41.73	43.96	43.80	40.93
Reserves as a multiple of expenditure	0.02	0.02	0.08	0.13	0.16	0.18	0.19	0.19	0.18	0.16
Investment income (bn CU)	0.02	0.06	0.18	0.37	0.54	0.68	0.78	0.85	0.87	0.84
Annual cash flow deficit/ surplus (bn CU)	2.37	1.40	10.19	8.81	7.26	5.51	3.56	1.38	−1.03	−3.71
Policy alternative 3										
Contribution rates (%)	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20
New level of co-payments (i.e. 100% increase)	10.80	11.20	11.80	12.04	12.28	12.52	12.77	13.03	13.29	13.55
New necessary contribution rates	12.54	12.63	12.72	12.87	13.03	13.19	13.35	13.51	13.67	13.83
Reserves (bn CU)	7.85	15.07	21.49	26.26	29.15	29.90	28.23	23.85	16.42	5.59
Reserves as a multiple of expenditure	0.05	0.09	0.13	0.14	0.15	0.15	0.13	0.10	0.07	0.02
Investment income (bn CU)	0.08	0.23	0.36	0.47	0.55	0.58	0.58	0.52	0.40	0.22
Annual cash flow deficit/ surplus (bn CU)	7.77	7.00	6.06	4.30	2.34	0.16	−2.24	−4.90	−7.83	−11.05

turn negative in 2000. The scheme would accumulate a total debt of 62 billion currency units (shown in the table as a negative reserve) by 2006, which is the equivalent of about one-quarter of annual expenditure.

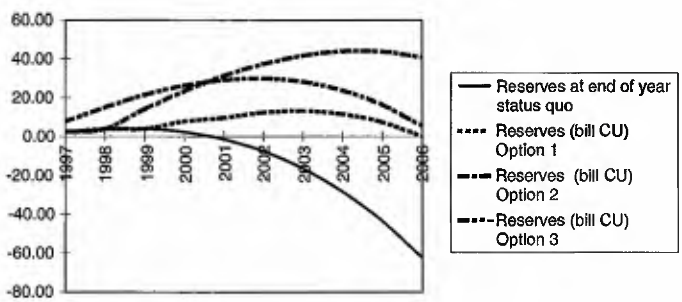
Under the first policy option, contribution rates would be increased in two steps – first to 13.6 per cent (up from 13.2 per cent) in 2000, and then up to 13.8

Figure 7.5 Contribution rates under alternative policy options



per cent in 2002. This would suffice to keep the scheme out of debt, but the annual cash flow would still turn negative in 2004. The second policy option calls for a single increase in the contribution rate, to 14.0 per cent in 1999. Reserves would peak at about 20 per cent of annual expenditure in 2003 and 2004, and then decline as the cash flow turns negative in 2004. At the end of the projection period, however, the reserves still remain positive at the equivalent of about 16 per cent of annual expenditure. Under this policy option, it appears that no further "consolidation measures" would be required before the second half of the following decade. The third option assumes that the co-payment rate would be increased by 100 per cent, i.e. that co-payments would increase from their initial equivalent of 3.4 per cent of total expenditure (5.4 bn CU) to 6.8 per cent of total expenditure (10.8 bn CU). This would keep the scheme out of debt for the duration of the projection period, but cash flow would turn negative in 2003. It is anybody's guess as to which policy option the government might adopt.

Figure 7.6 Development of reserves and deficits under alternative policy options



The ILO health care model offers a wide variety of possibilities for simulating more complex policy options, ranging from differential co-payment rates for different categories of benefits or differential contribution rates for the various groups of the insured, to different methods of cost containment for specific benefit categories. It can also simulate the reduction of utilization rates in specific benefit categories. The actual selection of a policy option for implementation would be determined in a consultative process involving policy planners, decision makers and quantitative analysts. The most likely outcome in most cases will be a menu of modifications to present financing and benefit provisions, aimed at balancing burdens between different groups of insured persons and beneficiaries. Non-quantitative and non-quantifiable criteria will also inevitably enter into the decision-making process. The modeller will respond to policy proposals with a quantification of the potential effects and perhaps a recommendation regarding a preferred course of action in favour of the long-term stability of scheme finances. It would be illusory to assume that policy choices are determined by models – nor should they be. Modellers must live with the fact that the actual choice of policy options might depend to a considerable extent on the date of the next elections, a factor clearly outside the scope of any modelling process.

7.8 SUMMARY

This chapter has described nine different health care financing models, developed by three national institutions (the Australian Health Insurance Commission, the Japanese Ministry of Health, and the Federal German Ministry of Labour and Social Affairs) and by three international institutions (ILO, WHO and MSH). The selection of models provides a fairly representative overview of models used in recent years.

As these examples demonstrate, the models applied by various agencies show substantial methodological variety, as well as differences in their degree of disaggregation and linking of the health care sector to the overall economy and social sector. Some are fairly robust budget models, which take most demographic and economic variables into account by using a set of exogenous parameters and use simple per capita cost estimates. Others have a fairly disaggregated macroeconomic module and highly disaggregated projection methods for the expenditure side. Nevertheless, these models show certain important commonalities; these are listed in Box 7.1.

It may be interesting to note that the stochastic model developed in the Federal Ministry of Labour and Social Affairs in Germany in the mid-1980s is no longer in use. Stochastic modelling has been replaced by the use of a deterministic version, which is now complemented by scenario analyses.

Box 7.1 Common elements of the example models in this chapter

- All were developed in response to specific questions posed by policy makers, and thus all have played a real role in national social governance.
- They all respond to specific "how much" questions (HMQs).
- They all follow the basic model philosophy laid down in six ground rules in Chapter 5.
- They all have a basic structure as described by the 12 structural equations identified in Chapter 5.
- With the exception of the stochastic model, they all follow a robust, straightforward modelling approach.

Notes and references

[1] Management Sciences for Health (MSH) is a private, non-profit organization dedicated to closing the gap between what is known about public health problems in developing countries and what is done to solve them. Since 1971, MSH has collaborated with public and private health sector decision makers in over 100 countries to improve the quality of health services and make services available and affordable to all by providing technical assistance and training in health financing and primary health services.

[2] The following example of the model was developed at MSH by Charles Stover, Principal Program Associate, and Octavino Q. Esguerra, Actuarial Consultant.

[3] This model description was taken from Guy Carrin and Aviva Ron, *Towards a framework for health insurance in Viet Nam* (Geneva, WHO, 1993).

[4] This model is described in full detail in Guy Carrin and Jean Perrot, *SimFin: A simulation model of financial needs and government budget options for the functioning of the health system* (Geneva, WHO, 1998).

[5] The six categories of insurance membership are: SSK (the general social security scheme), Bag-Kur (for self-employed persons), Emekli (for civil servants), private insurance, no insurance, and other types (with cells reserved by type).

[6] The methodology is described in Michael Cichon, *Stochastisches Modell zur Prognose des GKV Beitragssatzes*, Spardorf: Wilfer, 1985.

[7] This model was developed in the context of a social security project executed by the International Financial and Actuarial Service of the ILO in 1997. The results are described in ILO (K. Hirose), *Thailand: Review of the Social Security Scheme* (Geneva, ILO, 1998).

[8] General social budget methodology and the methodological specifics of the ILO Social Budget Model will be described in full detail in a forthcoming book in the technical series of the ILO and ISSA, to which this health modelling volume also belongs (Wolfgang Scholz, Krzysztof Hagemejer and Michael Cichon, *Social budgeting*, forthcoming). More modelling details are described in ILO, *The ILO Social Budget Model* (Geneva, ILO, 1).

[9] Reform plans have been prepared in many of these countries, such as in Poland and Ukraine.

PART III

USING MODELS IN POLICY DECISIONS

POLICY DECISIONS

8

In our view, governments retain overall responsibility for the health sector, regardless of how the specific health systems within a given country are financed and organized. We also contend that top-level programme managers need to have detailed information on health care revenues and expenditures in order to be able to develop meaningful alternatives for health care financing. An abundance of financial information may be available, but it is often not in usable form. Models are tools that can help in identifying necessary information and organizing existing information, as well as planning and managing the finances of the system. Modelling is therefore a tool for governance and management. The focus of this book has been to describe and promote the use of this tool in the financing of health care systems.

Stepping aside from the field of financial modelling (and even from modelling in other health care fields, such as epidemiology), we will now place models in the perspective of the policy issues they address. Models have limitations -- they cannot resolve all questions on the financing of health systems. In this chapter, we delineate precisely what models *can* and what they *cannot do*. The key questions that must be addressed by national health policy makers are listed below.

1. What are the most critical health needs?
2. How can a health system provide effective and efficient services?
3. How can countries finance their health systems?
4. What is the appropriate mix of the public and private sectors in the delivery and financing of health care?

8.1 WHAT ARE THE MOST CRITICAL HEALTH NEEDS?

The WHO defines health as "a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity". People's health is influenced by the quality of the air they breathe, the cleanliness of the water they drink, the types of food they consume, their hygiene, their habitat and their environment. All these factors are related to the economic situation of individuals and nations. Health generally deteriorates most where national economies are unable to generate adequate incomes or provide stable social systems, infrastructure and services (including primary health care), or where the environment and use of natural resources are poorly managed. The most critical health care needs are not only determined directly by the prevalent disease burden, but also indirectly by general conditions that either cause or prevent the introduction and transmission of disease.

Every country has an epidemiological profile that determines its health care needs, measured by changes in such factors as life expectancy, the number of inhabitants living in urban and peri-urban settlements, birth rates, mortality rates, survival rates of infants and mothers, the extent of non-communicable diseases, the degree of exposure to diseases, as well as epidemics, disability and mental disorders.

Changes in economic and living conditions have had a profound effect in changing health care needs in most countries. One result of social and economic development has been an increase in the percentage of people over 65 years of age in most countries. Even if the elderly are healthier today than in the past, they are still more susceptible to non-communicable diseases (such as cardiovascular conditions, cancer, diabetes or tobacco-related diseases) and to physical or mental disability. As a result, they require nursing care services to replace traditional but rapidly eroding family-support structures. Urbanization, an ongoing and increasing phenomenon, also changes health needs because it requires capacity increases and structural changes in the medical and public health infrastructure. As well, rapid urban growth has provided an environment which facilitates the spread of disease.

Despite substantial progress in prevention (notably through vaccinations and public health measures) and improved treatment of communicable and infectious diseases, they continue to be public health threats. These include malaria, tuberculosis, hepatitis and HIV/AIDS. Another problem has been represented by the increasing number of diseases which are proving more difficult to deal with due to their drug-resistant mutations. Yet, in some these diseases that are easily preventable or treatable (e.g. infant diarrhoea or acute respiratory infections) are not adequately dealt with.

Changes in transportation and interchanges of people across national boundaries have increased the level of trans-border disease transfer – viruses, bacteria, parasites and microbes do not stop at political borders. This is not a new phenomenon, as migration and wars have always been potential transmitters of deadly diseases. Until the beginning of the 20th century, names such as cholera, scurvy, syphilis and typhus, could have meant an epidemic, and in 1918–1919 influenza was added to the list of major risks, after a pandemic killed over 20 million people throughout world. According to the WHO, the five major pandemics that cumulatively account for more than 20 per cent of all deaths in the world today are tuberculosis, HIV/AIDS, malaria, tobacco-related diseases, and violence- or trauma-related conditions. Apart from these five causes, some very serious bacterial infections have also spread all over the world, some of which have been the subject of worldwide eradication attempts. Other serious health problems spread within populations and across countries through water systems, polluted air or the mass distribution of contaminated food. Through a fuller understanding of the effects of the environment, industrialization and urbanization, awareness grew in the 1960s through to the 1980s that occurrences in one country had an impact on the health status in other countries. Thus, when the short list of the most serious diseases changed in a country, it was frequently necessary to look at health events in other countries (or even other regions of the world) to seek and identify the causes for the change.

There are also new diseases. The attention given to HIV/AIDS and its viral cause might give the impression that the biggest present threat to the state of health in the world is posed by viruses. However, many epidemiologists have warned that the most dangerous emerging diseases in much of the world are not viral, but bacterial or parasitic. HIV/AIDS has brought out much information about the way modern society deals with new health threats. First, there was nonchalance, followed by fear of the unknown matched with disdain for those infected, and then various forms of denial (claims that the virus was less dangerous than it was, or that certain people were able to survive the virus or had not contracted it in the first place). It took many years and great attention and effort on the part of certain interest groups to put HIV/AIDS fully on the agenda of national and international policy bodies. There is a growing recognition that HIV/AIDS has perhaps contributed most to the growing awareness among policy makers in most countries that ignoring developments elsewhere may represent a national health risk. There is growing realization that they must consider ways to deal not only with the national health agenda, but also with its effects both on the national environment and on the economy. Finally, HIV/AIDS and other recent health afflictions may have moved scientists and policy makers a step closer to identifying the means by which humans have actually helped the microbes spread: through ill-planned public health or development programmes. The unanswered question, however, is whether the events surrounding HIV/AIDS can serve as an effective lesson that other new diseases, which are bound to appear, should receive attention more quickly and be taken more seriously.

The most critical needs in the health sector are not an absolute or objective set of specific medical interventions but a set of priorities elaborated within a specific national context, composed of economic, social and medical aspects, and analysed according to the value systems and available data specific to each. At the same time, no country can consider itself to be completely isolated from its surroundings. The formation of public health policy requires an ongoing review of priorities and continuous readaptation of strategies to achieve better health.

Epidemiological models may be able to identify health needs, but they are not necessarily able to rank them by societal priority. Financial models can help in analysing alternative health care policies and interventions to deal with health priorities, but it is the policy makers, decision makers, and health managers who will implement the necessary actions – not the model.

8.2 HOW CAN A HEALTH SYSTEM PROVIDE EFFECTIVE AND EFFICIENT SERVICES?

Health systems can play an effective role in catering to health needs if they demonstrate a sustainable capacity to prevent, control and cure diseases across the entire span of life. The emphasis on a *life-span approach* is inseparably linked to the emphasis on preventive action, in that the health of adults is interrelated in complex ways to their health as infants. In fact, evidence points to links between factors prevalent in the early stages of life (pre-natal and infancy), to childhood, adolescence and later life. In other words, there are conditions that can be prevented through intervention at an early age, and such intervention may lead to significantly better health in later life. With this approach, priority is often given to preventing and curing infectious and communicable diseases that have a potential to become widespread, such as prevalent paediatric diseases.

As explained earlier, there are many sources of health risks, such as water, air, soil, food and waste disposal systems. The logical implication of this argument is that health systems cannot be effective in their task of meeting health needs if the environmental situation is ignored. Sustainable health systems do not seek to remedy all environmental risks, but there is a need to be alert to health risks directly related to environmental factors. Health information and medical coordination are essential to ensure access to safe water, clean air, and safe foods – not to mention sanitation, protection against dangerous chemicals, pollution hazards and other environmental amplifiers of ill health. The key emphasis here is on developing *health information systems* that are capable of providing, analysing, evaluating and distributing information necessary for disease surveillance, clinical practice, public health management, public education and policy making in health and related areas. Information is the most reliable early-warning system for changes in the health status of the community. Allocating adequate resources to a health information system implies a clear recognition that information, if properly considered, can be very cost-effective in terms of saving resources that could be allocated to clinical and preventive care. Information is also indispensable for modelling as well as for progress in policy-making and implementation activities.

Developments in science, technology and clinical practice have resulted in the less costly but equally effective ambulatory treatment of a growing number of conditions that were formerly treated on an inpatient basis. The sustainability of health services may depend, at least in some cases, on the ability to provide primary care through home-based or non-hospital-based care. This approach integrates very well with community-based efforts to prevent diseases, improve workplace safety and health, as well as to secure access to safe water, safe food, clean air and a sanitary environment. It also enhances the likelihood of developing health care facilities for as large a population as possible.

Meeting health care needs requires the elaboration of strategies to improve health. Since resources are invariably limited, priorities should be established to reflect the needs of the population, the general health situation, and national health priorities as revealed by information analysis. Priorities which are set in consultation with the community (through key and representative partners) enhance consensus, public support and success in implementation. This is particularly true when the dialogue is focused on the epidemiological measurements of the burden of disease, assessments of the effectiveness of interventions in terms of the equity and health gains, an understanding of the resources available, as well as realistic appraisals of institutional capacity within limited resources.

For health systems to be sustainable, they must have a reliable source of finance and ensure equity – equal access to a basic level of health services. This is a long-term goal, which is based more on a "human rights approach" than on specific or binding international instruments. In reality, most health systems cover only part of the population – equity has not been achieved. The policy options for achieving equity and the financial implications of extending coverage to the entire population can be examined using models.

Models can help in analysing various national health care delivery strategies, their effects on national health expenditure, and perhaps even their effects on aggregate indicators of national health status. However, no model can select a strategy. Policy makers and decision makers should use modelling to evaluate more clearly the implications of their policy options and decisions.

8.3 HOW CAN COUNTRIES FINANCE THEIR HEALTH SYSTEMS?

Adequate health systems require adequate financing, the approaches to which vary from country to country. In many of the poorest countries, some proportion of financing originates from *international donors*. These funds are meant to support essential health services that benefit the poorest members of society, other designated programmes, or (more rarely) general health schemes. Many Western European countries apply the social insurance model, in which workers are covered through an obligatory scheme which is financed through contributions or earmarked taxes that are shared between employers, employees and sometimes the State. The main criticism levelled against these tripartite or bipartite financing methods is that they often exclude persons who are either not economically active or who are self-employed (including those in the informal sector).

Other systems of financing tend to provide coverage to the entire population – known as national health service systems or public service health care systems. Such systems are predominantly financed through general taxation revenues, and theoretically offer universal access to what might in practice be rationed benefits. In many countries, employers provide some health benefits to their employees and their families. Employer-provided health services usually spring up where the State or the social protection system cannot guarantee access to care of adequate quality.

In a number of countries, especially middle-income countries, a significant share of financing originates from private or semi-public prepaid sources of revenue – such as *private or collective insurance* arrangements or *solidarity-based mutual societies*. In addition, various forms of patient co-payments are found in almost all countries. Those who are seeking services must pay these co-payments, generally at the point of delivery. A derivate of such individual risk-bearing mechanisms is *individual contingency funding*, through forced or voluntary savings.

All of us have preferences when it comes to the financing of health services. The fact is, however, that even though all national health care financing systems are dominated by one form of financing, at the same time they are generally pluralistic, meaning they have elements of each of the above-mentioned forms of financing. Determining the national mix implies striking a specific balance between solidarity and individual responsibility within the political context of the society. Naturally, these balances are different across international comparisons. Different forms of national health financing systems, however, have different distributional effects. It is the financing mix that determines who finances what share of a given amount of the national health system.

Financial models can help to explore the distributional effects of various health financing systems. They cannot, however, select these systems.

8.4 WHAT IS THE APPROPRIATE MIX OF THE PUBLIC AND PRIVATE SECTORS IN THE DELIVERY AND FINANCING OF HEALTH CARE?

Beginning in the 1950s, many OECD countries adopted an approach whereby the State assumed an all-encompassing, direct responsibility for policy making, planning, research and development in health care systems. They also became responsible for regulating the sector, and to a lesser extent for assessing and auditing operations within the sector. In most of these countries, the State also provides part of the funds that are needed to operate the health care delivery system – either directly through budgetary support, or indirectly by accepting responsibility to cover deficits, by providing funds to health-related research and infrastructure, or by paying for the coverage of selected population groups.

A more restricted approach to the role of the State centres around the regulatory function of government. This role puts in the hands of the State the responsibility to develop policies that strengthen the national capacity to ensure defined standards of health, encourage equitable access to health services, promote good governance of health services and favour the development of partnerships for health at the community, municipality, regional or national levels. However, the regulatory approach engages the government neither to finance the overall health system, nor to be involved in its current operations. This general regulatory role may involve financial allocations, but these may be spread across a wide range of economic, financial and social decisions. Because many of these decisions include at least some quantifiable aspects, the modeller can and, in our view should, be called in to analyse their likely quantitative results.

In recent years, the role of the State in general has changed and these changes have had implications for health systems as well. The degree of globalization in trade, finance, the movement of persons (both migrants and travellers), communications, technology, health-related values, and public health policies today is comparable to no previous period in history. Globalization has been both a bane and a boon – transnational transfers of food and people have brought about substantial gains, but at the same time they have brought about additional global threats to health. Examples of these threats include trade in contaminated food, ineffective pharmaceutical products, mood-altering drugs and toxic waste. Cross-border problems and issues involved in the movement of persons, services and health risks can be tackled only through contact and coordination between States. Likewise, repairing the effects of "exported" health risks (in the widest sense, including environmental dangers such as climate change and ozone depletion) is clearly within the mandate of governments, and cannot be left solely to market forces to resolve. The implications of globalization for the role of the State are considerable, and not least for its role as a central force in preserving and promoting health.

Many governments constantly review their position in their search for optimal promotion of health for all, without necessarily assuming the full responsibility for either financing or operating health systems. Experience points to many possible options, and there is no single best solution. The most frequent solutions today include the decentralization of national health systems, devolving responsibility to local authorities and the civil society. This includes the increased participation of the private (for-profit) sector in the delivery of health services, and restrictions in the available benefit package.

Views differ with regard to the increasing role of the private sector in operating sustainable health systems. The trend is supported by those who believe that the private sector is better organized and has built-in mechanisms to provide a more efficient health delivery system at the micro level. Some point to the inefficiency of publicly operated systems, notably because there is no inherent incentive within a monopoly to be economically efficient, as a reason for privatization. These voices promote the idea of private-sector involvement because they believe it is immune to these flaws. Many governments are under pressure to align national policies with global and regional standards, and to replicate the governance models of other countries. This has brought pressures for "less government", partly perhaps because of prevailing value systems, but also because of public sector inefficiencies caused by poorly adapted structures, corruption or external pressures.

Others criticize privately owned, profit-motivated initiatives because of their built-in lack of interest in investing in those parts of the system which are not likely to generate a profit. Ideology has swung back and forth in many countries over the past thirty years, first pushing for the nationalization of health systems, later for their privatization. Today, many countries are seeking an optimal solution for the involvement of the private sector in health care delivery systems. Governments still, however, play a major supervisory and regulatory role in the health sector, which cannot be delegated. Governments need to make macro-level decisions on the distribution of the state budget between various services and geographical areas, on the quantity and quality of services available to all, and on who should have access to health services under government financing. In addition, governments must play a role in strengthening the research and technological infrastructure available to public health services and policy-making bodies, to enable them to make better decisions.

Natural disasters and epidemics are crisis situations which also point to the need for a government role in the provision of health services. Quite another kind of crisis, with clear and immediate impact on the public health agenda, are regional crises such as the Asian financial crisis of 1997. Millions of people lose their jobs and savings in a very short time and cease to be able to contribute to the health insurance system in which they had participated for many years. The health system experiences a sudden drop in income, while demand for its services from those not covered (or no longer covered) by health insurance increases. In this situation, the government's general tax revenues also shrink, and allocations to the health sector decrease in real terms. Therefore, an increase in demand for public-sector health services is experienced concurrently with a decrease in the resources available to government health facilities to meet this demand. The health system cannot adapt to the changing conditions fast enough, and the private sector cannot provide a solution in such a situation. Hence, governments are perforce key players in providing leadership and solutions to resolve such health care crises.

In addition, only governments can make health a central part of national development. They can do so by linking their actions in the economic and social sphere, with health-promoting cross-sectoral programmes to combat poverty, enhance education (including health education), provide greater access to primary health services, control endemic diseases, exert efforts to eradicate selected diseases and secure sustainable financing for health systems. Thus, the role of government is multi-faceted in all sectors, especially health.

Models can help to explore the financial, fiscal and income distribution effects of various levels of state involvement in health care delivery and financing, but they cannot make the choice as to which options to consider or which policies to pursue.

8.5 SUMMARY

This chapter places models in their proper perspective. Models require information that reflects not only health conditions and demand for services but also takes environmental factors into consideration. The lack of data may make a model less robust, but it is not an excuse for inaction. Available data and information should be used to develop models which will help policy makers arrive at informed decisions. Box 8.1 summarizes the most important capabilities and limitations of models. The ultimate responsibility for considering and reviewing options, making choices, implementing strategies, and making a difference rests with those reading this book: the policy makers, decision makers as well as managers of health care schemes and systems in the public and private sectors.

Box 8.1 The capabilities and limitations of models

Models can:

- Identify health needs
- Identify the financial implications of different health interventions
- Analyse the financial and fiscal effects of alternative national health care delivery strategies
- Analyse the effects on income distribution of various national health financing systems
- Analyse the financial, fiscal and income distribution effects of alternative models of public and private responsibilities in the delivery and financing of health care

Models cannot:

- Rank them according to societal priorities
- Select the interventions
- Select one of the strategies
- Select a specific national health financing system
- Select the actual mix of public/private responsibilities in the national system

CONCLUSION

9

This book has presented modelling techniques adapted to the problems of health care financing. It has also explained the links between models and indispensable financial, accounting and statistical data which are needed as modelling inputs. Models are not self-contained formulas; they are adaptable to the specific situation in a country or scheme, and are based on specific quantitative information regarding the population, financial flows and type of benefit package that is being considered or examined.

Models are tools. Those who intend to use them need some training in their use. This book presents the tools, but training and practice in their use are desirable before making use of the models in real-life situations. The modelling of health care financing systems is not an academic exercise, nor is it abstract; it can be very useful, provided the model is adapted by the user or modeller to a specific situation. The guide to modelling presented here does not, and cannot, describe every situation encountered by practitioners. Unlike a computer game, which can be played without the user making any changes to the program, we offer a flexible guide to modelling that requires the user to participate actively in the model-building process. In fact, it will be more useful to the modeller if liberty is taken to adapt models to specific situations.

As we have demonstrated, models may be simple or complex – but they should never be a mystery or thought of as magic solely understood by the modeller. The cause-and-effect relationships depicted in the model must be transparent. A simple model that is fully understood is better than a complex one that is not fully understood. There is nothing wrong with simple models. We have also shown that while there can be no model without data, deficient databases are not a sufficient reason to do nothing. Wherever policy decisions are made, models that mirror reality are used. Quantitative modelling makes the bases of these decisions transparent, and forces modellers and decision makers alike to acknowledge insufficient decision bases.

Modelling is a process rather than an isolated event. Models that start from a simple structure and develop as the database improves symbolize the continuous process of an improved understanding of the function of modelling.

We are confident that the more you use, experiment with, and tailor your model to your specific situation, the better it will serve you.

In conclusion, we would like to share an important final thought with you. Models are subject to the primacy of policies and policy makers. Always. And if there is one thing that is worse than a world without models, it is a world run by modellers.

ISSUE BRIEF 1

CONCEPTS OF HEALTH ECONOMICS

Together with the morbidity structure of the population and the national income level, the specific economic characteristics of the health care sector determine the expenditure levels and financing of any health care delivery system. The modeller must understand the nature of economic relationships in the sector; otherwise, the model's projections might overlook factors such as how patients and providers react to particular economic incentives. The consequences can be serious, in terms of the accuracy of the model's projections.

This issue brief starts with a discussion of the key "products" of any health care delivery system – i.e. health and health gains. These "products" are the most important reason why societies finance health care in the first place. We will examine the specific nature of the relationship between providers and consumers of health care, before discussing more specific consequences of health sector economics on the financing of health care.

1.1 HEALTH AND HEALTH GAINS AS CRUCIAL PRODUCTS OF THE HEALTH CARE SECTOR

Health care financing systems should be servants of health policy. The objective of all planning and governance in health care schemes should be to ensure that the provided health care services meet the needs of the population, according to priority levels – i.e. the desired volume of care should be provided and allocated to those with the greatest capacity to benefit. This point deserves emphasis, in order to focus on improvement in health (or health gains) as the basis for setting priorities. We will discuss some practical approaches to the measurement of health gains.

It is not the role of managers of funding structures (e.g. social insurance companies, private insurance providers or tax authorities) to set policies for health and health care. In order to establish funding arrangements that are "servants" of policy, however, managers of the system must understand overall policy goals and ensure that the system helps the State to achieve these goals.

Interested parties and incentives

There are many interested parties in the health care sector:

- health care professionals
- patients and their relatives and friends
- tax and social insurance authorities
- insurance companies
- other financiers, including employers
- government health and welfare ministries.

Although these parties share an interest in the quality and effectiveness of services, they have different objectives and incentives. For health care professionals, these include pay and conditions of work, and the health of patients. Financing organizations also have an interest in cost containment and cost-effectiveness. Consumers are concerned about outcomes and the quality of the experience as patients, but usually have little interest in the issues of scarcity and cost containment. It falls to financiers to purchase access to care within resource constraints, which means that they must have an interest in the product of health care.

Health care priorities have to be achieved against the background of the differing objectives of consumers, providers and financiers of care. Social insurance companies are on the front line. Providing access to care for those with the greatest needs often requires mechanisms to deny access for those with less significant or non-existent needs. This challenge is greater where resources are more constrained, but the basic problem does exist and will continue to exist in all health care systems, throughout the world.

Health and health gains

The objective of health services is to improve conditions of health. Health care intervention is successful if it achieves longer life or better health-related quality of life. There are two main difficulties in assessing health gains:

1. Health gains must be measured against a situation of non-intervention; this may mean that the intervention may only achieve a slowing down or prevent a decline in health status, rather than improving it.

2. The production of health gains is complex. Some interventions have a wide range of outcomes: from great improvement to actual harm to the patient. It is necessary to have a means of measuring the expected outcome, rather than simply judging best or worst interventions.

The development of health care intervention means that, for many diseases, we have only an approximate idea of the possible course of events in the absence of care and it is not easy to compare an intervention to a situation of non-intervention, or to compare new interventions with existing practices. Additionally, many elements of care have never been subjected to rigorous evaluation.

As epidemiologists continue their attempts to understand the net effects of various health care strategies, the available data have gradually improved. There are some treatments for which current practice tells us little or nothing about what may be effective care. For example, comparisons of common procedures (such as hysterectomies and gall bladder surgery) show that there is very large variation in treatment rates in apparently similar Western European countries, which cannot be explained by differences in the pattern of underlying diseases. For emergency procedures, treatment patterns across countries are similar, suggesting that uncertainty about the effects of many interventions leads to different views on effectiveness.

The inability to measure the effectiveness of many common interventions is an obstacle, but it should not put a halt to the quest for careful analysis of the products of health services. At a minimum, it is possible to ask for evidence of effectiveness and to consider the range within which health gains may lie. There is a tendency to argue that poor data are a reason for accepting current practice, rather than as a reason to question it.

A fair and sensible analysis of health gains compares outcomes with assumptions on what would have happened in the absence of treatment. The starting point is therefore the natural history of the disease, or the pattern that would have resulted from an alternative treatment. This is particularly important when we realize that a large part of the patient population is relatively old and may have a range of chronic health problems. This fact has two implications. First, the health status of the elderly may be declining, and treatment may arrest the decline. Second, the effect of treating one aspect of health status (e.g., mobility) may be affected by the presence of other diseases. Focus should be not only on disease status but on health status. The existence of recognized but largely harmless pathologies is not a reason to intervene, as there is no strong correlation between the mere presence of a certain disease and the ability to live a fairly normal life (with notable exceptions, such as dementias).

Although health gains can be achieved through health services, the relationship is complex. Some patients recover fully, some partially, some not at all; still others are even harmed by the treatment. In general, judgements should be based on average health gains. For example, if heart surgery could extend life for up to 20 years, but on average extends life only two years, then the two-year figure is relevant for policy. However, we can also take the range and dispersion of gains and losses into account.

Health gains must be measured at the margin. This means that judgements regarding the expansion or contraction of services should be made on the basis of the likely health gain of the lowest-priority case treated, or the highest-priority case not treated. It is common, however, that the average effectiveness of a treatment is taken as an argument for expansion, despite any differences for those currently provided with or denied treatment.

In sum, health gains are the desired "product" of health services. By meeting the highest-priority needs, health gains are maximized, even though measurement of the maximization is often difficult due to scarce information on the results of non-treatment or alternative treatment, and the uncertain effects of treatment on health status.

Measuring health gains

In addition to the difficulties in measuring health gains outlined above, there are also problems related to the overall concept of health. The WHO definition, with its inclusion of all aspects of physical and mental health, is not an ideal starting point for the purposes of this book. As suggested above, the focus should be on measuring health and health gains in terms of social and physical functioning, rather than in terms of the presence or absence of disease. Health is best measured on the basis of three main features:

- ability to carry out tasks
- pain and distress
- life expectancy.

Health also gives access to other life-enhancing opportunities, another reason it is highly valued. This is not to say that arresting disease processes is unimportant, but rather to suggest that it is only a means to an end, and should be judged according to its ability to meet that end. The presence of a disease may be the cause of distress and alarm, especially if the disease is potentially life-threatening. The case for treatment, however, is the expectation that the treatment will lead to a longer life, better health, or both.

In measuring health gains, it is important to be careful in the use of terminology. In particular, it is useful to substitute the idea of extending life for that of saving life. Extending life is an important goal, and longer extension is better than shorter. The important question is not whether a treatment saves a life, but rather by how much it extends life. Research on the efficacy of medical intervention is often of only limited help, since it reports the number of survivors over a five- or ten-year period. In principle, we are interested in the years of life gained, rather than in survival at a particular time.

Lead time is an important source of difficulties in measuring years of life gained, especially in screening and secondary prevention programmes. Great care should therefore be given when considering data. Early detection of a disease means that, for any individual, there is an increased likelihood of survival from the point when the disease is discovered. This may or may not mean that an individual lives longer – it may simply increase the time over which a person is aware of the disease. Some of the early optimism about the effects of screening come from including lead time in estimates of extended life.

Extending life is an important part of health gains, however, only a relatively small proportion of all health services aim to extend life significantly. The objective of care, more often, is to improve health status, with little or no gain in life expectancy. Major advances in life expectancy are due only in small part to treatment interventions; they are rather predominantly the result of economic, social, environmental and public health factors. Measuring the health gains attributable to health services must, therefore, take into account their significant effects on health status and health-related quality of life.

By measuring health status as the ability to carry out the tasks of daily living, we can assess health gains in terms of increasing ability to carry out such tasks. Many scales have been devised, with a hierarchy of tasks according to their difficulty. For example, health gains are measured relying on scales of situations such as bed-bound, chair-bound, able to walk unaided, able to wash and dress, able to go shopping and able to work or take a holiday unaided. There may be many causes of an inability to carry out tasks, but the effects on health-related quality of life can be quite similar. It is often interesting how little effect a treatment has on the ability to carry out tasks. Sometimes, this is due to *co-morbidities*. For example, someone with both heart disease and arthritis is constrained by both conditions; the effectiveness of treating one of them is reduced accordingly.

Although health gains are normally measured as prolongation of life and improvement in health status, a further consideration is the quality of the patient's experience. Many people spend only a few days receiving treatment. Generally, benefits should be measured as the better outcome of treatment, and should not be too concerned with the process. But many other patients receive treatment over long periods, even for the rest of their lives. There may be cases in which current treatments are so distressing that a strong case for improving the experience of patients could be made. Continuous care under poor conditions may have a very significant effect on quality of life, but may have no impact on life expectancy or ability to carry out tasks.

Similarly, pain and distress may also have an important impact on quality of life, but little effect on the ability to carry out tasks. In any assessment of health gains, it is important to take into account reductions in pain and suffering. Several major treatments serve mainly to reduce pain (e.g. coronary artery surgery, resections of the prostate and hip replacement). Since relief of pain and distress is a different dimension than the ability to perform the daily tasks described above, it may be worth using a matrix to compare different combinations of pain and daily living skills.

The above approaches to the measurement of health status and health gains use simple dimensions. More complex instruments also exist for measuring health status, involving the creation of profiles and indexations of health status. These may be very useful in considering specific treatments, although simpler measures may be preferable when considering overall priorities.

Health gains: Combining longer life and better health

Measuring health gains is one basis for setting priorities among various health care needs. Two main dimensions of health gains have been discussed: extending life and improving health status. However, trade-offs may be necessary between interventions which mainly extend life and those which mainly improve health status. There are two basic approaches to such situations. The first is to seek consensus regarding the relative importance of extending life and varying degrees of improving health status. The second approach is to suggest that this type of decision is essentially political, and that it should be taken only after widespread public debate.

The feasibility of combining the two dimensions is not yet clear. Attempts to find a consensus have not yet been very successful and have also met with some resistance. Such a consensus, however, would bring great advantages for health policy. The best-known index of health gains, the Quality-Adjusted Life Year (QALY) has been calculated in various ways and is therefore a source of continuing debate. Years of life are weighted according to quality, so that additional QALYs are achieved by adding extra years to life, or adding extra quality to existing years. League tables have been drawn up, showing a ranking of treatments in terms of their cost per QALY gained. It will be several years before the role (if any) for QALYs in health planning becomes clear. With existing techniques, however, treatments which have a large impact on health status seem to score more QALY gains than those which offer some extension to life. In view of the difficulty of measuring the quality of life as an adjustment factor, some experts and agencies, such as the World Bank, have suggested using the absence of disability as a proxy for measurements of quality, and have thus introduced the concept of the Disability-Adjusted Life Year (DALY).

1.2 THE NATURE OF THE HEALTH CARE MARKET

Markets for health care services in all industrial countries are characterized by an element of government intervention and control. Health care is not treated simply as goods or services. This section deals with the main arguments concerning why health care is different and attempts to identify some of the implications of these arguments. We will cover the following topics:

- uncertainty in need and demand for services
- ignorance and information asymmetry
- professionalism and monopoly
- public goods and externalities
- derived demand, health care as a complementary good, and social equity.

Some health economics terminology has precise and specific meaning. In particular, the concept of *need* should be explained. Economists consider a need to exist if there is a capacity to benefit. A person with ischaemic heart disease has a need for surgery, if it reduces pain or disability, or increases life expectancy. Where treatment or care can do nothing to improve a condition, then no need for health services exists, regardless of the significance of the problem. Needs can be large or small, depending on the capacity to benefit.

Demand for health services may or may not reflect need. The distinguishing feature of demands is that they are decisions to seek services that are backed up by the ability to mobilize resources. Some people demand services in the mistaken belief that they have a capacity to benefit. Most demands do, in fact, represent needs, which may reflect greater or lesser capacities to benefit.

Uncertainty, the need for services, demand and pricing

The central problem for the consumer of health services is that it is often not possible to anticipate the need for treatment or care. Many diseases are wholly unexpected. Others are more predictable, but progress of disease and the need for treatment may still be very uncertain. This fundamental uncertainty distinguishes health care from many other services, such as housing, public utilities or nutrition, where the degree of uncertainty is only slight.

In addition, there is large variation in the cost of meeting needs. It is possible, even if unlikely, that an individual may face a very large bill for treatment. Despite the low probability of this happening, this prospect can be a significant source of anxiety.

Economists distinguish between uncertainty and risk. Uncertainty means that outcomes are unknown. Risk, on the other hand, means that the possible outcomes and their probabilities are known, although the outcome in a specific case unknown. In some ways, health care markets are risky rather than uncertain, since the patterns of many diseases are known to health care professionals at least. However, lay individuals seldom know the probabilities facing them and individual behaviour is more likely to reflect uncertainty than risk. In the presence of uncertainty, economists forecast that people tend to make wrong decisions.

Although a very low probability, medical conditions with very high potential treatment costs do occur. There is considerable evidence that it is difficult for people to make use of data concerning low probabilities, even when they are available. Crossing a busy road increases the probability of premature death, but it is not easy to calculate the additional risk caused by jaywalking across that road, as opposed to walking across the nearest bridge or pedestrian crossing.

The normal response to risk is insurance, and the normal response to uncertainty is to adopt strategies that reduce the difference in consequences between uncertain outcomes. Insurance also does that, by providing compensation in the form of money or access to services.

Insurance works best when positive and negative outcomes can be specified with precision, when probabilities are known with certainty, and when the distribution of various risks in the population is known in detail. The need for health services does not exhibit these characteristics. Little is known about the risks for different diseases for any given individual. The effects of treatment and care vary and may be hard to predict. Therefore, we do not know the exact nature of future problems or how often they may occur, and we can only estimate the effect of interventions. In these circumstances, it is not surprising that the market for health insurance is imperfect.

A particular difficulty occurs in markets that exhibit the features described above. Buyers of health insurance tend to be better informed than sellers in many respects – partly because of their knowledge of their family history, and partly because they know better how they feel. Faced with a high price, a person who feels well and whose relatives had long and apparently disease-free lives will be disinclined to purchase insurance. If those with low risks do not buy, however, the average risk for those who purchase insurance is greater. If premiums rise to reflect this, a further incentive not to buy is created, and more low-risk persons will be likely to exclude themselves. Eventually, those who remain in the pool of covered persons will be either high-risk cases or among the most risk-averse.

Because of the inherent level of risk and uncertainty in health matters, there is a need for an insurance framework. Difficulty in specifying risks, uncertainty about the outcomes of some interventions, and poorly defined products all mean that insurance markets will not work perfectly. This is particularly the case when providing coverage for elderly people, whose incomes tend to be low but whose use of medical services is high. It is also true for other people with low incomes. Many people cannot insure themselves or pay treatment bills. Even in the United States, where much of the financing for services is through private insurance schemes, there is a need for government-sponsored insurance for elderly and lower-income persons. In sum, even though the financing of health services requires some form of insurance, the conditions for efficient insurance markets are not met.

Another effect of the need to provide health services through a system of insurance is that the price faced by consumers is likely to be much lower than the cost. This is a general problem in markets dominated by insurance financing. Once insurance has been obtained, the incentive for the consumer (in the short run) is to collect the maximum amount of benefits possible. The price of consumption (to the consumer) is often zero or near zero.

Simple economic theory tells us that people will choose to consume goods and services as long as the price to them is below the benefit they expect to receive. Even if the benefit is expected to be quite small, something is still a good bargain if its price is zero. This has the important result that it is typical for health care systems to face *excess demand*. Therefore, some form of rationing or queuing is needed. From the point of view of welfare economics, the position is more serious – people want services at the margin where costs exceed benefits. Insurance, which is necessary because of the risk and uncertainty inherent in the provision of care, becomes the cause of excess demand for services and of inappropriate uses of resources.

Information asymmetry

Markets work best when the parties to a transaction are well informed and badly when they are not. In health services, neither doctor nor patient are adequately informed, but the tendency is to an asymmetry between the knowledge of each: patients know more about their symptoms, doctors know more about the underlying pathology and potential treatment. What also can cause the market to function poorly is that the provider, who gives advice on the need to treat, will also potentially benefit in financial terms from the decision to treat. Information asymmetry combined with incentives to over-treat are reasons why health care markets have always been subject to some degree of regulation, often in the form of self-regulation by professional organizations.

Professionalism and monopoly

The need for knowledge and expertise in the medical profession, combined with potential incentives for over-treatment or inappropriate treatment, leads to a system of licensing for doctors and other health care professionals. Licensing and standards-setting is justified in order to protect the patient and consumer. Licensing, however, also protects the provider. Restricting entry into a market, for whatever reason, gives providers an element of monopoly power. Economic theory suggests that one effect of monopoly power is to increase price and reduce output. There is no doubt that monopoly power in health care has this effect to some extent.

Professional organizations often have a mix of functions, including standards-setting, protecting the public, and carrying out certain functions of trade unions. These roles often lead to a degree of confusion between the use of restrictions and controls to improve services, as well as the quest for less competition and higher incomes for professionals.

A general feature of all markets, in all sectors, at all times, is the attempt by players in the market to reduce competition. People outside the markets want to be allowed to enter, but those inside have an incentive to restrict entry, thereby reducing competition.

Public goods and externalities

The economic concept of *externalities* applies to costs and benefits that are external to a given transaction – that is, costs or benefits that are not paid for or calculated into the transaction. For example, smoke from a neighbour's fire is "enjoyed" without compensation. In the area of health services, there are some external benefits, for example, those resulting from immunization. As a larger proportion of the population becomes protected individually, the entire population also becomes more protected from the spread of an infection.

In some extreme cases, all the benefits from an activity are shared. For example, nobody can be excluded from the benefits of national defence. However, citizens will not pay individually to support defence forces, since the benefits of such protection are available even to those who choose not to pay. If the benefits of a good or service can be consumed equally, regardless of whether a person has paid, then the good or service is referred to as a *public good.* Markets fail in cases of high externalities, and when public goods are produced.

As suggested above, public health programmes, especially those aimed at preventing the spread of communicable diseases, offer some benefits as externalities. There will therefore be few incentives for individuals to pay for such programmes.

In the area of treatment and care, however, most benefits are enjoyed by the individual, and offer little in the way of external benefits. The one significant exception is the benefit of individual health enjoyed by families, friends and loved ones, which may be an important reason to provide treatment and care.

Although the presence of externalities and public goods can be important factors in decisions made on financing, particularly for public health services, they are not the main reason for widespread government control of the financing and provision of modern health care services.

Derived demand, complementarity and equity

There are other arguments for more equitable access to health services. Needs are greater in poorer and older populations, which have the least ability to pay. As well, many elderly people have contributed in the past to the funding of services, and expect to be able to use them later when the need arises.

Another reason why health care is sometimes considered to be a different good or service is the close link of health and the ability to enjoy other aspects of life. Health is in this sense a *complementary good* – it is not consumed only for its own sake, but also for the access it allows to other enjoyable and productive activities. Thus it can be argued that denying someone health and health care is to deny them much more. Although partly true, the main drawback to this argument is that the link between health and health care is quite weak.

Almost no-one particularly enjoys health care as an end in itself, but rather as a necessary process for the sake of health. The demand for health care is therefore a form of *derived demand* – the main desire is for health and health care is merely a means for obtaining good health.

1.3 DEMAND FOR HEALTH CARE GOODS AND SERVICES

In economic theory, the demand for a good depends on its price, the price of other goods, incomes, tastes and preferences. The last two are seen as exogenous, although it is recognized that this may not be the case in the long run. Demand is normally higher when the price is low, or when incomes are high. The effect of the price of other goods depends on whether they are substitutes or complements (goods consumed in conjunction with the good being analysed).

These principles also apply to health care goods, although the effects are influenced by some special features of the market. These include: the role of professionals as advisers on the need for services (with the corresponding danger of supplier-induced demand), the fact that demand for health care is derived demand for health, and the importance of third-party payers and the consequent hazards for system morality. It is also difficult to observe some characteristics of demand for health services in the industrialized countries, because there is a tendency for prices to be fixed at zero or at a low level.

It is very important to consider demand for health services in the context of alternative systems of finance. If co-payments are planned at a significant level, then it is useful to know whether this will deter people with greater needs, or only those who stand to benefit little.

Price and income elasticities

The economic theory of demand can be applied in various useful ways to the analysis of health-related goods and services as well as of funding mechanisms. Demand for health services is a derived demand for health. The question is, how much are people prepared to pay to improve their health? This depends on how healthy they are, how much they value their health, how effective available health care is at achieving health gains, and how much money they have to spend – or more importantly, how much they can persuade others to pay on their behalf.

People value health for itself, but also because it is consumed in conjunction with other goods. The theory of demand suggests that the existence of complementary goods tends to be accompanied by low price elasticity of demand. This has been observed in all Western countries. Calculations typically show a low price elasticity of demand for health services, reflecting a low price elasticity of demand for health. Put another way, if the price of health services is increased by 10 per cent, the use of services would typically fall by around 5–6 per cent, or even less. However, low overall elasticities must be treated with caution, since their effect on people with low incomes is likely to be higher, while affecting relatively rich persons less. Higher co-payments will therefore reduce use by relatively little in total, but will change the pattern of use.

Although the price elasticity of demand for health services is quite low, demand for health services seems to rise more than proportionately to income. That is to say, the income elasticity of demand is greater than one. A manifestation of this phenomenon is that countries with higher incomes not only spend more on health services in absolute terms, they also spend a higher proportion of their income on health care. This suggests that as an economy develops, the funding of health services must increase if the demands of the public are to be met, which may be important in the design of funding systems. If social insurance is linked to payrolls, payments will grow approximately in line with income – but the preference of the public may be for a more rapid increase. Access to supplementary private insurance through voluntary payments, or a change in contribution rates as incomes rise, may allow this additional growth. Most rich countries are concerned that spending on health care is growing too fast. Therefore, it may not be difficult to meet the additional demand for services, but it is useful to remember that health care is income-elastic.

Consumers in the health care market have a lack of information. Indeed, one product they demand is better information about their needs. Improving information to consumers increases demand where needs are identified, but it can also reduce demand when it becomes clear that a health problem is not a need – that is, when no capacity to gain exists.

There is asymmetry between the information of suppliers of health care services (doctors and other health care professionals) and that of the consumer or patient. The tastes of the consumer are therefore to some extent determined by the producer. The producer of health care may have an incentive to encourage consumption. This is most likely in cases where the treatment to be provided would fall outside the "basic" package of services. Most countries limit the use of advertising in health services, but some demand can result from the promotional activities of suppliers. Supplier-induced demand for health services is a particular concern when structures of provision are undergoing change, where there is an attempt to reduce regulation and where suppliers are moving into the private sector. Fee-for-service payment systems hold particular temptations for suppliers to induce demand, while capitation systems do the opposite. The demand for health services is related to need (the capacity to benefit), prices and incomes – but also to tastes, which may be formed in conjunction with suppliers.

Demand curves show the quantity of goods that will be bought by consumers at any given price. They tell us the values put on consumption at present levels and distribution of income in the economy. Very high prices might lead to very low consumption, but at any (still reasonable) price level, there will always be people ready to buy services. If the price of health care goods is set at zero (to patients, but of course not to suppliers or third-party financiers), consumption will probably be very high – but not unlimited, since even at zero price, people will not spend their entire lives in doctors' offices or hospital waiting rooms. In any case, at zero price to the consumer, the benefits in terms of health gains (however loosely the term is defined) would be less than the cost.

Thus, if the price of health services is set at zero, people will demand services up to the point where the demand curve cuts the quantity axis. In this case, the benefit to the last person consuming will be zero. Even those who benefit a little will not benefit enough to justify the use of resources. The benefits they receive are lower than the costs of providing them. Services should not be supplied if their cost exceeds the benefit they produce.

It is not easy to measure benefits in health services, not least because it is seldom possible to discover what people would be willing to pay for a particular health gain. If prices were charged for some services, however, it could be possible to observe a demand curve, and calculate benefits as perceived by consumers.

Demand and the financing system

In the case of health care, income usually has an indirect influence on the quantity of care demanded, since financing normally uses a third-party payer (such as social or private insurance). In some sense, variations in the ability to mobilize resources from third parties are the equivalent of income in the determination of demand for health care services.

If demand for health care depends on claims for payment by third parties, the structure of entitlements and the overall resources of the payers is important. Where the system is open-ended, there is effectively infinite income to draw on from the point of view of the individual consumer or patient. In this case, the consumer faces a price of zero and no income constraint, and will consume as long as the benefit is greater than zero. Open-ended, fee-for-service arrangements allow this behaviour. In capitation payment systems, the patient may still want to use a large amount, but this does not materialize in the form of demand since he or she is not able to mobilize resources to back up the desire for services.

Third-party payment systems effectively set the price of care at or near zero. The theory of demand predicts that this means that all people with needs will want them to be met. It is the ability to mobilize resources, however, that turns needs into demands. A good financing system within a good policy framework allows only those needs with sufficient priority to become demands.

1.4 SUPPLY OF HEALTH CARE GOODS AND SERVICES

The economic theory of supply suggests that providers of goods and services will be willing to increase supply as the price rises. Existing suppliers will be willing to expand services and new suppliers will enter the market if a higher price is offered.

Supply is described as elastic if there is a large effect on quantity of a small increase in price. The response of suppliers to changes in price will depend on many factors, such as the need for capital investment, training of staff and the availability of inputs. In the case of health services, supply responses are likely to be quite slow, especially in the more technological parts of health care, since large investments in staff development, equipment and buildings may be necessary. Countries with a surplus of staff and buildings may find supply is very price-elastic, even for acute care, since it is easy to mobilize resources.

The interaction of supply and demand, in principle, can determine the price of a good or service. Health policy makers aim to achieve maximum health gains from all resources. If purchasers of services pay prices to suppliers that are above necessary levels, then the total volume of services is reduced and health gains are less than what could have been achieved. It is therefore useful to consider underlying principles in the supply of health services.

In this section, we will examine the factors that influence the price at which suppliers are willing to provide health care services. In particular, we will consider costs, which affect the price at which they can supply services and still avoid a loss.

Supply and cost

Providers of services will only be willing to supply if they are able to cover their costs. In centrally managed health systems, it is common to give providers a budget, and the volume of services is constrained by that budget. Providers should not be faced with a loss, since their supply is that which exactly uses all their resources. A more pluralistic system, with a range of public or private suppliers, involves agreements or contracts for the supply of care. In principle, a financing agency cannot force providers to supply, but instead must make agreements with them to cover the price and volume of care. Most contracts involve different prices for different volumes. Financing organizations should avoid open-ended commitments for supply, since they make it difficult to maintain control of overall spending. Likewise, providers of care normally avoid open-ended commitments, since these can lead to losses.

Staff are normally the largest area of cost for health services, at around 60–80 per cent of total costs for most types of care. The rest is accounted for by buildings and equipment and by consumables. In primary care, pharmaceuticals can be the highest element of cost. The cost of health services depends on the quantity of inputs needed and the price of these inputs. Thus, it is possible to lower costs, either by reducing the quantity of inputs needed or by lowering the price of inputs. If costs are controlled, it can lead to lower prices, and thereby increased service.

In addition to lowering inputs, costs can be reduced by improving the mix of inputs used. For example, it may be possible to use fewer trained and more untrained staff, or to use fewer staff and more equipment, and still produce the same quantity and quality of service. Other substitutions may be possible. In some countries, there are controls on prescribing brand-name drugs where cheaper generic versions exist. Other countries go even further, with schemes to substitute different but equally effective drugs.

Supply, costs and economies of scale

For some services, there are advantages in large-scale provision. Laboratories can then afford large and efficient machines and there is good evidence that outcomes of some surgical procedures improve when teams carry out a large volume of the same type of work. There is, however, a mistaken belief that large-scale provision in health care is generally efficient and cheap. It is certainly not the case that great advantages apply to large hospitals (with more than 300–400 beds), although there may be advantages if certain departments within hospitals are large. Costs can be saved from the shared use of imaging and pathology, and from the use of specialized equipment in some areas of specialty. However, a portion of these savings can be achieved without facilities being located on a large hospital site.

Despite these doubts about economies of scale in the provision of health services, it is worth considering agreements for certain services to be provided at only a few hospitals, with lower prices to take advantage of economies of scale. It should not be a surprise that potential scale economies are limited, because staff account for a large part of the total cost of health services, and there are only limited possibilities for improving staff efficiency by putting them together in a large building.

Barriers to entry and supply

Economies of scale, where they exist, can make it difficult for new providers to enter the market. Large-scale capital investment can only be financed if significant returns are expected: there is little competition to an established provider where entry is expensive. Scale economies normally imply that only large providers will survive; there may only be room in the market for a few suppliers, or indeed sometimes only one.

Economies of scale form barriers that may restrict the entry of suppliers and thereby make the supply price inelastic. Some other forms of barriers are important in health care, especially those that result from measures taken to protect patients. Licences for doctors, health care facilities, drugs and other inputs on the other hand can make it difficult or sometimes impossible to enter the market. Barriers to entry make supply less elastic, and tend to raise prices. It is therefore important to ensure that regulations which are there to protect customers from poor or incompetent practices do not become simple barriers to entry, thereby reducing competition in the market.

Supply, costs and factor substitution

Health care professionals and other staff account for a large part of health care costs. In principle, it is inefficient to use highly trained staff for tasks that could be performed by unskilled or semi-skilled persons. It may also be inefficient to use staff for tasks which could be performed more cheaply using equipment.

The traditional view of health services has been that there is a "right" way of doing things. Staffing has often been determined using norms and quotas. An advantage of allowing more control to providers in the supply of services is that this rigid approach may be replaced with a more flexible one. Many habits regarding staff deployment have no real relevance; they simply result from patterns that were desirable when working with older technologies. For example, some modern blood-testing equipment is automatic and can be used for routine inspections without expert input from pathology specialists.

Finding ways in which costs and, therefore, prices can be lowered by using different mixes of inputs is a job for hospitals and other health care providers. The role of the financing agency is to know that these opportunities exist, and to expect that changes and lower costs should be available as providers gain control over the production of services. In many cases, it is reasonable to expect that the price of routine and well-understood services will fall as factor substitution takes place and costs are lowered.

Supply, costs and technology

Economic theory sees technical progress and the advent of new technologies as a source of lower costs, and thereby increased services. This is as true for health care as it is for any other good or service. For any given type, quantity and quality of service, new technologies may lower costs. If a new technology raises costs without any improvement in health, then it should not be adopted.

New technologies may legitimately lead to higher costs for services if there is an improvement in quality, or where the new approach allows a useful intervention where none previously existed. For example, new imaging techniques may allow less painful investigation, and advances in immuno-suppressant drugs have allowed more successful transplant surgery. These may allow significant health gains and become priorities for services.

Those responsible for financing health services should view with scepticism the argument that costs are rising due to new technology. Rather, they should expect new technology to result in a lowering of costs for some services.

Supply, costs and the incomes of professionals

Given the major share of salaries in overall health care costs, it is not possible to increase salaries without overall costs rising unless staff become more productive. It is important to note that higher salaries mean higher costs and a lower volume of services within any budget.

Rising salaries in the production of goods and services may occur without raising costs if staff productivity rises in proportion. In many industries, especially those subject to a high degree of technical change, it is possible to have lower costs and higher salaries. Given that many elements of health services cannot enjoy technical progress or increases in productivity, salaries that rise in line with those in other services and industries will inevitably increase costs relative to those elsewhere in the economy. In most countries, it is accepted that labour-intensive services gradually become more expensive, in order to allow salaries to rise in line with those elsewhere in the economy.

Supply analysis has been applied to the supply of health services in the sections above. It can also be applied to the market for health professionals (and indeed for other inputs). Surplus buildings, equipment and skilled staff may lead to lower costs; where skilled staff are in short supply, salaries may be expected to rise.

Short-run and long-run supply

The theory of supply suggests instant response to changes in the price of a good or service. This is rarely the case. It may therefore be useful to examine the behaviour of suppliers in terms of longer-term objectives. Since it is sometimes possible to induce demand by changing the knowledge or tastes of consumers, some services may be offered in order to do so. Low-priority cases may be chosen in order to increase the activity level, thereby increasing payments by third parties in future years. For example, providers that are paid on the basis of cost and volume contracts may choose to supply more than the agreed volume, in the hope of demonstrating greater needs for the future. And where there is a degree of monopoly, as there always is in the provision of health services, suppliers may try to protect their market share, and therefore be slow to reduce quantity when prices fall.

In effect, the problem is that health care information is always scarce and supply behaviour is sometimes used as a proxy for the need for services. It is important to consider the extent to which there may be incentives or possibilities to pursue longer-term goals.

1.5 MARKET CHARACTERISTICS AND THE FINANCING OF HEALTH CARE: AN ECONOMIC DISCUSSION

The analysis of the health care market, the desired output of health care (health gains), supply and demand for health services, and the health care labour force all show that there are important ways in which health care differs from other goods and services. These differences have effects on the ways in which services should be financed and provided. It is also important to note ways in which health care services are *not* different from other goods, because in these aspects health care can be expected to follow basic principles of economics. This section outlines the consequences of the particular characteristics of health care markets for the financing of health services.

The most important distinctive features on the health services market result from the uncertain nature of demand for health care. It is not consumed for its own intrinsic qualities, but in order to restore good health and many (although not all) needs for services are very uncertain.

Although health care is seen as a necessity and has a low price elasticity of demand, its relatively high income-elasticity of demand suggests that it also exhibits some characteristics of luxury goods. This is not very surprising, for two reasons. First, health care ranges from major life-extending and health-status-enhancing activities, to cosmetic and minor comfort-giving treatments. Second, much of the increase in spending is often to improve the quality of processes, with little or no effect on outcomes. It is therefore quite possible for health care to be seen as both a necessity and a luxury.

Optimal level of health spending

The appropriate level of spending on health care is a matter of dispute in most countries, and is of special relevance when health care structures and mechanisms are facing change and reform. Comparisons between countries are often quoted in arguments about the correct level of spending. There is wide variation between countries in health spending, both in absolute terms and as a proportion of GDP. The choices of other countries are at best a rough guide to appropriate spending levels.

In principle, it is easy to define the optimal level of health care spending and, by implication, the optimal proportion of GDP that should be spent on health in any country. Assuming that the goal of health policy is to maximize health gains, and assuming that spending is efficient in pursuing that objective, then the health gain associated with a marginal dollar spent can be calculated. Similar calculations for other government and private spending programmes can also be made to compare the gain added by the last dollar. If the value of the health gain is considered larger than the gain realized in other, non-health programmes, then health spending is too low; if it is lower, funds should be transferred out of health services.

This type of reasoning, of course, involves a number of value judgements, and can never be objectively quantified. Even if health gains can be measured in QALYs or DALYs, putting a quantitative value on these gains involves subjective judgements. Likewise, measuring the value of other benefits derived from the use of resources, such as security, also involves using value judgements. Therefore, the ideal economic cost-benefit analysis often has to be approximated in reality, often by applying weighted preferences in a political decision-making process which reacts to pressure in varying degrees from various groups. This is not an ideal substitution for a strictly economic analysis, but if transparency can be introduced in the decision-making criteria, it is certainly one step towards a more rational approach to the allocation of public resources.

This approach offers a means for analysing the appropriate level of health spending. It emphasizes that increasing the health gains achieved with any amount of resources is a priority, and that unmet high-priority needs (i.e. where a significant capacity to benefit exists) can be compared to the benefits produced in other public or private spending. Especially as economies grow, and basic needs are met, it is likely that a high priority for additional spending will be in the area of health care.

Financing prevention and health promotion

The appropriate level of financing for health promotion can, in principle, be determined in the same way as that for health spending in total. If greater health gains are available per dollar in health promotion than in other health programmes, then more should be devoted to this type of activity. It is often argued that this is indeed the case, and that spending on health promotion is too low. However, data on the effectiveness of health promotion activities are poor. It is also difficult to achieve private spending on health promotion, and there is little incentive for insurance companies and social insurance funds to give it priority. Since the benefits of health promotion tend to be available regardless of payment, this category of services exhibits many of the characteristics of public goods. Therefore, government funding, or funding with government assistance, is appropriate.

The argument that health promotion is a good investment capable of lowering health care spending is not strong and is unlikely to lead to more than token spending by insurance funds on these activities. This argument is largely wrong. Health promotion is more likely to increase rather than decrease the need for services, as more people survive beyond their economically active life and proceed to develop more expensive health care needs. Health promotion is more likely to yield benefits in the form of longer life and better health than in lower costs.

Schemes to tax health-damaging activities for health promotion may be useful in increasing the acceptability of health promotion spending, but are best seen as a particular way of organizing taxation. The fact that the funds are coming from those most likely to benefit appeals to theories of justice and adds poignancy to policy. However, the main point is that this type of activity must be financed from a tax source or a compulsory levy.

Financing health services

Uncertainty about the need for health services is a reason for basing the financing of health services on an insurance system. The choice therefore remains between private insurance, solidarity-based social insurance, and tax-funded schemes. Any of these can be the main source of insurance, with contributions from other sources. Payments or co-payments by patients may also be added into the financing mix, with only the three above options being serious candidates as the prominent source for insurance-based financing.

Private, actuarial insurance is the main source of funding in the United States, and in no other major Western country. It is associated with high administrative costs, problems in achieving coverage, and serious problems in containing costs. The reasons for this are simple. Insurance markets do not work well when information is scarce, and it is difficult to organize the complex insurance arrangements that transfer spending power across time. Funds to make contributions are available when a person is earning, and when health risks are quite small. A mechanism must be found to allow current contributions and future benefits. Actuarial insurance is unlikely to be a good vehicle for this. However, it may have a useful role in supplementing other sources. Reliance on mainly fee-for-service payments to providers, without a global ceiling on expenditure, can cause the loss of control over the costs of the system.

Solidarity-based systems, whether based on social insurance or tax financing, can achieve universal or near-universal coverage, despite information shortages and uncertainty. There is an element of income redistribution in such systems, since payment is according to the ability to pay, and services are, in principle, provided according to need. If the nature of health consumption as a complementary good is a reason for more equitable access, these mechanisms help. If some health services are considered to be merit goods, the subsidization of services for poorer patients by richer ones may help to encourage consumption.[1]

Perverse incentives to over-treat conditions, and for patients to demand services where costs exceed benefits, mean that any financing systems must have a variety of controls or incentives to ration care. Incentives to over-treat are, at least in part, handled by professional and ethical rules, but it may be necessary to ensure that the payment mechanisms avoid creating such incentives. What cannot be avoided is the need for the financing system to recognize the inevitability of excess demand for health care services, and therefore the desirability of some form of rationing.

Some countries choose private or not-for-profit organizations to manage the collection of insurance payments, even though the system is based on solidarity and is regulated by the State. Theories of markets suggest that effective competition can lower costs. It is not clear whether such competition is sufficient to offset the additional costs in administration that result when competing organizations support their own administrative infrastructure and staffs. On the whole, it is better to avoid too great a level of diversity in social insurance providers, since problems of adverse selection may then arise. If contributions are fixed, but risks are different, then companies have an incentive to refuse or deter some customers from joining their scheme. Rules normally require that all those who request coverage be accepted, but there are many ways to avoid taking on poor risks. Differences in the benefit package may be used, or there may be subtle methods for deterring older or disabled people from joining.

The choice between tax and social insurance financing should depend on costs and on the desired characteristics of the system. At one level, there is little or no difference between the two systems, and social insurance can be seen as simply a hypothecated payroll tax. Tax financing may draw on a wider tax base. However, financing of social insurance through contributions may be more equitable if only a part of the population is covered by the scheme.

Note

[1] A merit good is a commodity, the consumption of which is regarded as socially desirable irrespective of consumers' preferences. Governments sometimes suspend consumers' sovereignty by subsidizing the provision of certain goods and services. G. Bannock et al., *The Penguin Dictionary of Economics* (London, Penguin, 1992).

ISSUE BRIEF 2

FINANCIAL MANAGEMENT AND ACCOUNTING FOR HEALTH SCHEMES

The effective management of a health insurance scheme is impossible without accurate and up-to-date financial information. For example, without information on current income and expenditure, it is not possible to determine whether contributions are sufficient to cover medical benefits, or whether benefits may be extended. The maintenance of accounts and records of financial transfers has two main objectives:

- Accountability
- Financial management (including budgetary control).

The following discussions often make implicit referral to social insurance schemes. This is because the income-side accounting of these schemes is more complex than that of public health service schemes. However, all concepts discussed here can be adapted to fit public health service systems as well.

2.1 BASICS FOR THE MANAGEMENT OF INSURANCE SCHEME FINANCES

Accountability

A social security health care scheme receives income from contributions, investments and possibly contributions from the government. It must account for this income by clearly showing what it is used for. The accounts should, therefore, give precise and detailed information regarding the following:

a. amounts and sources of income as well as amounts and types of expenditure, suitably classified to allow checks on financial operations to be performed accurately and within legal and regulatory requirements

b. acquisition of, or changes in, investments and other assets during the period covered by the accounts

c. the balance of assets and liabilities at the end of the period, and a record of where and in what form the assets exist.

Financial management and budgetary control

The accounting system should provide information for planning and decision making at all levels of management. This information is based primarily on analyses of data regarding past transactions and events. Such information will have to be made available to two main groups of parties:

a. those responsible for administering the scheme – such as the board, the chief executive and senior officers of the institution (i.e. management), and those responsible for longer-term financial planning (i.e. actuaries or modellers)

b. the responsible minister, the government, employers, insured persons and other interested parties (e.g. international organizations).

Managers need to be informed in more detail on the scheme's financial situation and equilibrium. Management also plays an important role in controlling the cost of specific categories of activities and performs other general supervisory functions. The second group of interested parties requires information in considerably less detail. Essential features should be summarized in one or two pages, at most. Therefore, it is crucial that the accounting system follow standard accounting guidelines and provide financial information as required by statutes.

2.2 THE IMPORTANCE OF FINANCIAL MANAGEMENT

Under public financing of health services and insurance, public officials and insurance managers are responsible for ensuring that resources are used in the best way possible to achieve programme and ministry objectives. Financial management is a vital aspect of this task. Managers need to plan, direct and monitor the generation, safekeeping and use of funds. They must also be able to provide proper financial reports to insured persons, employers and government authorities. Only proper use of financial resources will allow the strategic planning objectives of a ministry or an insurance manager to be achieved.

Financial management defined

Financial management refers to the management of the resources of an insurance scheme in order to meet its goals and objectives as effectively as possible. Financial management also ensures that there are adequate resources available to carry out activities that have been outlined by the organization during the planning process. Financial management involves two basic elements: *decision making* with regard to financial resources, and *accountability* for those decisions. The tools and techniques of financial management are used to ensure that adequate funds are available to achieve planned objectives in the most cost-effective way.

Basic financial management skills

Financial management requires managers to plan, control, and monitor the use of funds, and provide reports on the use of resources to insured persons, employers and government authorities. The basic elements of financial management include:

- *engaging in strategic planning* by setting long-term objectives with corresponding programme development initiatives
- *preparing and using budgets* to achieve objectives and control expenses
- *projecting revenues and monitoring cash flow*
- *determining and comparing the cost of services* to assess cost-effectiveness and monitor efficiency
- *controlling and managing* the use of funds
- *reporting on the use of financial resources* by maintaining proper accounting records and preparing financial reports for the government and donors.

2.3 THE FINANCIAL MANAGEMENT CYCLE

The *planning process* serves to define service objectives and describe the activities necessary to achieve them. The expenses incurred in carrying out these activities are financed either from income from the services provided or by outside sources. The financial management cycle therefore consists of providing services, receiving budget allocations and contributions, paying expenses, and reporting to insured persons, employers and government authorities on the use of the funds that have been provided.

The *financial management cycle* is a framework for understanding the various elements of financial management. The cycle is composed of four interrelated stages:

- programming
- budget formulation
- operations and measurement
- reporting and evaluation.

Within the context of a social health insurance scheme, the financial planning cycle involves nine interrelated steps.

1. determining the beneficiary group of the insurance scheme, or the *catchment population*
2. establishing the *benefit levels* of the scheme

3. determining the *price* for each of the services and benefits provided

4. ascertaining the expected service *utilization rates*

5. calculating the *total cost* of the services expected to be utilized, based on their price

6. establishing *premiums and contributions*

7. determining the *qualifications for benefits*

8. considering subsidies and other *revenue sources* to be received

9. reviewing benefits, price and utilization with a view to reducing costs, and/or raising premiums and contributions to increase revenues, in order to *bring total costs in line with revenues.*

2.4 BUDGET FORMULATION

The viability of a long-term plan cannot be assured without taking into account the financial implications of the strategies and the activities required for implementing them. The process of allocating resources according to the programme development plan requires the use of the most basic of all financial management tools: the budget. A budget specifies the financial requirements of each strategy, permitting the manager to determine which strategy is most appropriate, given the financial constraints established by the organization.

When integrated into the management structure of an organization, the budget formulation process can promote decision making in a systematic, structured and comprehensive way. This is because the budget presents information about costs, prices, service types and service levels explicitly and understandably, while enabling policy decisions concerning current and future programme activities. This is essential in a rapidly changing environment.

All budgets itemize the costs that are expected to be incurred in a set of activities. Most budgets also specify the sources of income to cover these costs. The income and cost implications of the long-term plan will be reflected in a long-term budget or financial plan. An *operating budget* is based on an annual work plan. It itemizes costs for one year, including all activities and the expected income that will pay for them.

The purposes of budgets

Budgets perform the following functions:

1. clearly enunciate short-range plans, priorities and required resources for management and staff

2. establish benchmarks for the monitoring and control of ongoing activities

3. set criteria for management performance at various levels of the organization

4. motivate managers to achieve the objectives and goals of the organization.

Budgeting is important for a number of reasons:

a. The exercise of preparing a budget forces managers to think each activity through in detail, committing their thoughts to paper.

b. Budgets provide managers with essential information on the projected expenses and income associated with planned activities. This information lets managers know whether all planned activities are financially feasible, and whether more income needs to be raised or costs reduced.

c. When developed in accordance with work plans, budgets help managers to ensure that organizational resources are spent only on planned activities.

d. The planner is forced to differentiate between essential and non-essential activities, and give essential activities a higher priority.

e. By providing a detailed listing of projected expenses and funding sources, budgets help the organization prepare to secure the resources needed to meet its expenses.

f. Budgets allow managers to evaluate the actual costs of activities and thus to consider alternatives if the planned activities are too costly.

g. By having a realistic, updated budget and comparing it with actual expenses, managers can be forewarned of potential shortfalls in the resources that are available for specific activities.

Budget preparation and costs

The process of budgeting requires managers to take a number of factors into account. These include:

- levels of spending (current level for ongoing projects, anticipated level for new projects)
- expected changes in costs (estimated in percentages) for salaries, drugs, etc.
- projected changes in project activities (e.g. new clinics, new activities)
- other relevant factors that may change, e.g. the population served, fertility rates, etc.
- contingencies (funds set aside for unexpected additional expenses)
- inflation, including any differential between local inflation and the rate of price rises for imported goods
- hard currency availability for the purchase of imported pharmaceuticals or equipment; if hard currency is in short supply, it may be appropriate to prepare the long-term budget conservatively
- timing of supply purchases; if supplies are regularly purchased and used for programme activities, it is important to consider working capital

requirements and to plan accordingly – insufficient working capital may create shortages of supplies, which can drastically affect services

- cash flow; when organizations are financially dependent on revenues generated by programme activities (such as training programmes), cash flow analysis must be an ongoing administrative process – if necessary, the cost of financing operations must also be taken into account.

2.5 AN ACCOUNTING FRAMEWORK FOR A NATIONAL HEALTH INSURANCE SCHEME

The accounting framework is a reporting system that enables the budget to be monitored, and is set up to produce other necessary financial reports, e.g. the income and expenditure report and a balance sheet. Before an accounting framework can be drawn up, a system of accounting must be decided upon, for this will affect the design of the reports. The most crucial elements of the accounting framework are the income and expenditure account, and the balance sheet.

Systems of financial accounting

The main systems of financial accounting used in the public sector are:

- commitment accounting
- accruals accounting
- cash accounting
- fund accounting.

The first three systems differ from each other according to the time at which income and expenditure are registered in the accounts. For example, expenditure under the different systems may be registered when:

a. an order is placed, i.e. the commitment to pay has been recognized (commitment accounting)

b. goods or services are received (accruals accounting)

c. an invoice is paid (cash accounting).

Similarly, income may be registered when:

a. a contribution becomes due from an employer, or interest on investments becomes due (accruals accounting)

b. the payment is actually received (cash accounting).

Commitment accounting is normally used to record only commitments of expenditure, with income due normally being recorded on an accrual basis.

Table IB2.1 Systems of financial accounting

Accounting system	Transaction registered when:	Advantages	Disadvantages
Commitment (may also be seen as a form of accruals accounting)	The organization commits itself to a transaction	• Aids management decisions throughout the year	• More difficult and time-consuming • More subjective • Reversed at year-end, as accounts are usually prepared on accruals basis and commitments without invoices reversed
Accruals	When goods or service are provided	• Provides more information on all aspects of organization, including operating costs • Allows for production of complete balance sheet and income and expenditure account	• More difficult and time-consuming • More subjective
Cash	Cash is actually paid or received	• Simple to understand and administer • Objective • Provides essential information	• Does not give complete information on income, capital or operating costs • Expenses incurred at the end of year may be charged to next year – possible manipulation of budgets

Fund accounting is a system that reports on individual funds, rather than the organization as a whole. For example, if there were separate funds for cash benefits and medical benefits, a system of fund accounting would report on the two funds separately. Since any of the three systems described above could be applied separately to the two funds, the same system would not necessarily need to be used for both. Although it can be an advantage to have separate accounts for each fund, the trade-off is that it is cumbersome and creates additional work. Table IB2.1 summarizes the different systems and the advantages and disadvantages of each.

All organizations need to decide on the most appropriate accounting system for preparing their financial statements. The following factors should be considered:

a. The legislation of the scheme may require separate fund accounts to be maintained for each branch of benefits.

b. Many government accounting systems use the cash accounting system. If the health insurance scheme or the health care scheme is operated within a government by a ministry, they will probably use the government accounting scheme. Where a separate institution is set up, the executive may have a choice regarding the system used.

The recommended option for an accounting system is:

Contribution income:	cash basis
Other income:	accrual basis
Expenses:	accrual basis
Benefits:	accrual basis

It is recommended that contribution income be recorded on a cash basis because, when using the accrual system, contributions due but not yet received would also be treated as received. However, some of these debts may have to be written off, and therefore accounting for this type of income on accrual basis would lead to overestimation of the scheme's eventual income. Rather, a footnote should be added to the income and expenditure account, giving the amount of contributions that are due but have not yet been received or written off.

The accounting framework

Once a system for accounting has been decided, the *accounting framework* should be designed. A blueprint of accounts should be drawn up for the following statements:

a. Income and expenditure account

b. Balance sheet

c. Other management accounts.

The income and expenditure account shows the results of the financial operations carried out *during the period* covered, and measures the (accounting) surplus or deficit for the period. The balance sheet shows the financial position at a *particular point in time*, that is, it lists all assets and liabilities at the date of the balance sheet. The balance sheet is derived from the income and expenditure account, incorporating information on accruals, assets, liabilities, reserves, depreciation and stock balances.

If the scheme involves a substantial amount of capital expenditure, a separate capital expenditure account may be required to record capital expenditure incurred since the beginning of the financial year. Each major item should be shown separately and should be analysed by type of expenditure – e.g. purchase of property, office equipment, etc.

It is also recommended that management accounts be produced. These perform the following functions:

- support the monitoring and evaluation of the financial aspects of the scheme, together with the income and expenditure account
- enable a more detailed understanding of the financial status of the scheme, by providing an analysis of costs.

The contents of management accounts will depend on the nature of the scheme, but may include, for example, tables on primary health care expenditure classified into broad components and by geographic region, or average primary health care costs per visit or per insured person by region.

The layout of statements of account differs from one scheme to another and from one country to another – institutions may also be required by legislation to observe a particular format for their accounts.

Income and expenditure account

The income and expenditure account is based on information in the ledgers, summarizing credit and debit transfers for each item. (More information on ledgers is given in the following section.) If the *cash accounting* system is used, the balances on the accounts are transferred without amendment. If the *accrual accounting* system is used, each account in the ledger needs to be examined and the appropriate accrual (adjustment) needs to be made before the balance is transferred to the income and expenditure account.

On the annual account, adjustments to balances may also include items such as financial reserves and the calculation of depreciation. The entries in the income and expenditure account from the ledger will need to be analysed, summarized and presented in the prescribed format. The items which one would expect to find in the summary of the income and expenditure account are as follows:

Income
- Employers contributions
- Government contributions
- Interest and other investment income
- Other income

Expenditure
- Total cash benefits awarded during the year
- Total contributions refunded
- Total expenditure incurred on:
  - Provision of medical care
  - Administration
    - Maintenance of properties (with expenditure on broad categories shown for each property)
  - Transfers to reserves or development funds
  - Amounts written off

As stated above, the amount of contributions due, but not yet written off or received, should also be shown in a footnote to the accounts.

An example of an income and expenditure account is given at the end of this Issue Brief. The level of detail, for example, under the provision of medical care, will depend largely on the system for delivering health benefits, i.e. on whether the organization uses its own clinics and hospitals, or contracts with other organizations or individuals for the provision of medical care.

The balance of the income and expenditure account is either a surplus (if income is greater than expenditure) or a deficit (if expenditure is greater than income). This balance is transferred to the health insurance reserves at the end of the year.

The balance sheet

As stated earlier, the balance sheet lists all assets and liabilities outstanding at the balance sheet date. After this information has been summarized in the income and expenditure account, and transfers (adjustments) have been made relating to accruals, depreciation and stock balances, individual accounts are balanced. These balances are then organized into a specific format, to produce the balance sheet.

Balance sheet format varies from country to country and may be regulated by legislation. One recommended format is:

Liabilities

Cash benefits awarded but unpaid and still outstanding at the balance sheet date
Amounts due to other creditors
Contingency reserves
Development fund, if any
Health insurance reserves, shown as:

- Amount of funds at the beginning of the financial year,
  plus surplus from income and expenditure account, or
  minus deficit from income and expenditure account, yielding
- Amount in health insurance fund at the end of the financial year.

Assets

Cash on hand
Balances on current accounts at banks
Balances on deposit accounts at banks
Any amounts due from sundry debtors
Investments, with different types shown separately
Stocks of pharmaceuticals, medical appliances and other medical supplies
Medical equipment

Office furniture and equipment
Motor vehicles (and ambulances)
Office buildings
Hospitals, clinics, dispensaries and other premises used in connection with the provision of medical care.

Fixed assets are depicted according to their book value at the end of the previous financial year, plus the cost of additions, minus depreciation.

Capital expenditure account

This should show the total capital expenditure for the year, with expenditure on various projects (e.g. construction, purchase of buildings) shown separately. Items to be included in a capital expenditure account are as follows:

Investments
Deposits
Purchase of fixed-interest securities
Other investments

Purchases
Pharmaceutical products, medical appliances and other medical supplies
Furniture and equipment for hospitals, clinics, etc.
Furniture and equipment for offices
Ambulances
Other motor vehicles

Construction, purchase, or adaptation of buildings
Hospitals and other premises for use in the provision of medical care
Office premises

Management accounts

The format of management accounts is largely determined by the structure of the scheme. These accounts should support management in monitoring and evaluating the scheme and in considering options for future development and cost containment. The information will be largely based on expenditure, but some corresponding activity tables will need to be prepared.

Management accounts can be separated into those tables which specifically assist the monitoring of monthly expenditure and those which enable a better understanding of scheme expenditure. The design of such tables will largely depend on the organization of the scheme. The main factors affecting the design are whether health care is provided directly by the organization in its own facilities or indirectly by other organizations or individuals, and the extent to which regional monitoring is necessary. Some possible tables include the following:

1. *Monitoring monthly expenditure*
   - Actual income and expenditure, compared to expected levels
   - Actual detailed expenditure, compared to expected levels (i.e. in more detail than in the income and expenditure account)
   - Summarized income and expenditure, compared to expected levels, for each geographic region or centre
2. *Breakdown of income and expenditure (produced quarterly)*
   - Income and expenditure per insured person
   - Income and expenditure by region
   - Primary care costs (total and per person)
   - Hospital costs (total and per person or unit)
   - Contributions due and collected
3. *Corresponding activity tables (should generally be prepared quarterly)*
   - Primary care activity
   - Hospital activity
   - Health care facilities (number of clinics, etc.)
   - Number of insured persons
   - Membership (number of joiners and leavers – annual only)
   - Number of complaints, primary and secondary care (annual)
   - Number of insured persons by age and sex (annual)
   - Income distribution of employees covered (annual)

Timetable for production of accounts

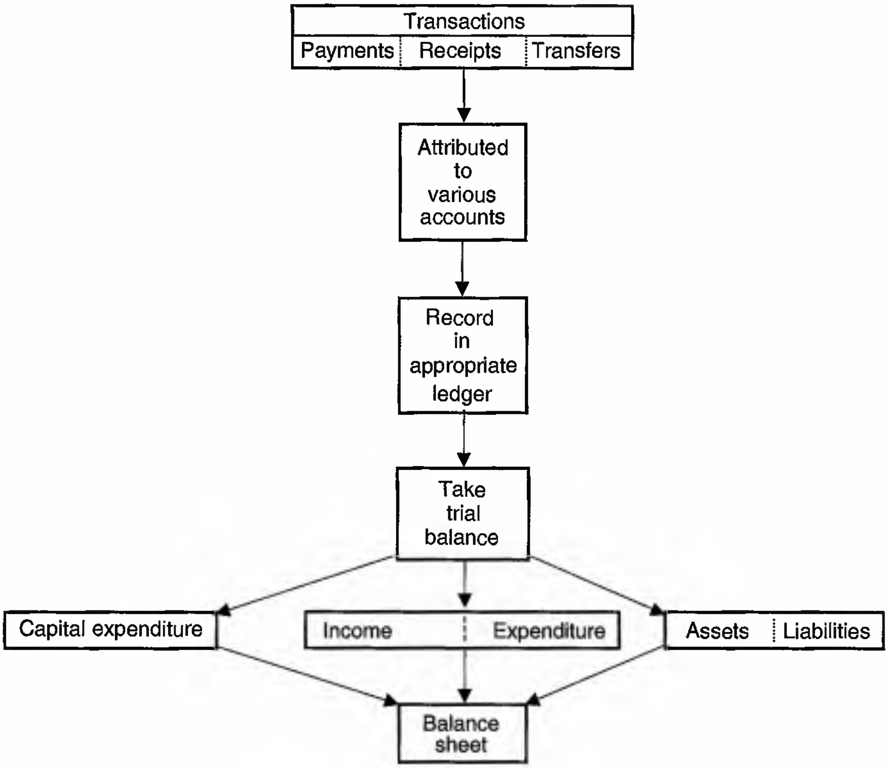
The choice of the year to be adopted for purposes of finance, accounting and contributions will depend on the circumstances in which the scheme is launched, and the date on which it comes into operation. Two obvious possibilities are the calendar year (1 January to 31 December) and the financial year used in many public sector organizations (e.g. 1 April to 31 March). If there is a standard financial year adopted by many organizations in the country, that is probably the most appropriate choice.

Monthly accounts are interim statements. The final accounts for the year are produced as soon as possible after the end of the financial year. These accounts incorporate adjustments such as transfers to specific reserves, or provisions for the depreciation of fixed assets, which are normally made once a year. Generally, these final accounts serve as the basis for projection models that are estimated on an annual basis.

How accounts are established

The previous section described the end products of the accounting system. In this section, we will consider the establishment of the accounts in more detail, so that the relevant reports can be produced. Figure IB2.1 summarizes the stages involved in producing the reports.

Figure IB2.1 Summary of the accounting process



Types of accounts

Debits and credits (or transactions) are entered into accounts based on their type – that is, there are different accounts for different types of transactions. For example, the office rent account is a record of the payments for the office rent. Separate accounts should be maintained for each heading in the income and expenditure account, such as:

Income
Employer contributions
Government contributions
Income from investments
Other income

Expenditure
Cash benefits awarded
Contributions refunded

Provision of medical care
- salaries of medical staff
- running expenses of premises
- drugs and appliances
- running expenses of vehicles
- payments for provision of medical care
  - primary
  - secondary
- other expenses

Administration
- salaries of administrative staff
- expenses of the governing board
- running expenses of offices
- running expenses of vehicles
- maintenance of properties

The ledger

The ledger is the record of all the accounts. In large organizations, it is subdivided into logical sections. For a health insurance scheme, it is recommended that the following ledgers be kept:

- *cash book* for cash accounts and current accounts at banks
- *expenditure ledger* for expenditure accounts (besides capital expenditure)
- *cash benefits ledger* for expenditure accounts regarding the various cash benefits of the system (if applicable)
- *employers in arrears ledger* for personal accounts of employers in arrears
- *sundry debtors ledger* for personal accounts of debtors other than employers in arrears
- *sundry creditors ledger* for personal accounts of suppliers and other creditors
- *investments, buildings and equipment ledger* for accounts of assets (including capital expenditure)
- *general ledger* for all other accounts, including income from contributions and investments, other income, reserve accounts, the income and expenditure account and the health insurance fund account

Ledgers may be maintained manually or in electronic form on a computer.

As stated earlier, the accounts system has to support the production of the income and expenditure account, the balance sheet, and possibly a capital expenditure account. An account must be maintained for each of the main categories of income and expenditure. In addition, management may require more detailed information, for example, on the various elements of administrative costs. To assist in producing the required accounts and subsequent reports, a coding system for the accounts should be created. Each transaction is then coded and recorded in the appropriate account.

The double-entry bookkeeping system

It is recommended that the double-entry system of bookkeeping be used for recording transactions. This system registers the dual aspect of every transaction, i.e. that somebody pays and somebody receives. In other words, it reflects that there is a transfer from one account to another. Transactions may be described in the following ways:

a. Increase one asset and decrease another asset, e.g. obtain cash by selling an investment

b. Increase an asset and increase a liability, e.g. purchase stationery on credit

c. Reduce an asset and reduce a liability, e.g. pay an outstanding creditor for the stationery.

For each transaction, there are always two entries: one debit and one credit. For example, if a building is rented for office premises, each payment of the rent by cheque would be recorded as debit to the "bank" column of the cash book, and a credit to the rent account.

The list of balances compiled in this way is called a trial balance. If the trial balance shows that the totals of the two columns do not agree, a mistake has been made in bookkeeping, and needs to be corrected. However, the agreement of the trial balance does not provide conclusive evidence that the bookkeeping is correct, as the following types of errors would not show up:

- omission of a transaction altogether
- recording of a transaction by double-entry more than once
- entry of a correct amount, but on the wrong account
- errors of entry or of calculation which exactly compensate each other.

Auditing

In drawing up procedures relating to payments, receipts and transfers, systems should be incorporated to prevent or detect errors and fraud. It is the responsibility of the internal auditor to ensure that procedures which provide such safeguards are followed. The internal audit service is there to perform the following main functions:

a. act as a preventive audit by examining and approving every payment voucher before payment takes place

b. check financial operations in matters such as arithmetical accuracy and adherence to the law and regulations

c. check that all income due to the organization has either been received and recorded in the accounts, or written off as not recoverable under the proper procedures

d. produce the necessary reports so that the governing board can exercise effective budgetary control

e. examine and certify the monthly and annual accounts

f. verify that the procedures relating to accounting controls and safeguards against error or fraud are followed.

2.6 MONITORING

Operating and measurement

The successful management of an insurance scheme and maintenance of its financial viability requires a sound financial management system. Good financial controls and a sound accounting system serve as the basis for effective financial management. The information and financial data generated by the system are used in the management and performance monitoring of the organization. While accountants are responsible for the financial control and accounting systems, the general manager must be sufficiently conversant with these processes to supervise staff and to detect problems.

Standardized financial controls and accounting procedures will help ensure that resources are used properly and that a complete and accurate financial picture of operations, assets and liabilities can be obtained.

An autonomous health care delivery system can normally establish its own accounting and reporting procedures to provide managers with financial information that can be compared against prepared budgets. However, government insurance schemes must often follow uniform accounting procedures. Government accounting systems generally do not provide adequate information on transactions or assets and do not allow performance to be measured adequately. In order to satisfy management needs, supplementary records may need to be kept and additional reports produced.

Reporting and evaluation

The reporting and evaluation stage of the financial management cycle is where information from the first round of implementation (programming, budgeting and operations) is reviewed, analysed and modified in a comprehensive way. Financial analysis undertaken at this stage compares statistical information on services provided and information on staff and supply inputs with financial information, in order to monitor operating trends. For instance, if the budget of a hospital is established to provide 10,000 days of inpatient care for the year, and it appears that only 7,000 days of care will be provided but that the budget will be fully spent, it would indicate that expenses for each day of care are much greater than expected. Corrective action would be needed to reduce expenditure for the lower-than-anticipated volume of hospitalizations.

Reporting

To obtain information on overall performance and achievements during the first round of implementation, several types of reports are generated in various parts of the organization. From the financial perspective, the accounting system should produce a number of basic reports which provide information needed to review financial progress and status. While it is common for financial information from these reports to be included in technical progress reports, there are specific financial summaries which clearly indicate if the programme is:

- meeting its financial objectives (e.g. generating a surplus)
- operating efficiently and effectively
- overseeing the proper use of its assets
- generating and using resources properly
- meeting donor requirements.

Financial reports should be produced not less than quarterly, and always on an annual basis. The most common standard reports are as follows:

a. *Income and expense report.* This shows all income and expenses to date, and the cumulative surplus or deficit. For comparative purposes, figures for the previous year and the current year budget are shown.

b. *Balance sheet.* This report states the condition of the programme at a single point in time. It shows the balances at the end of the period for all assets, liabilities, reserves and funds.

c. *Accounts payable and receivable.* These additional reports support the figures shown in the balance sheet and show the balance for each debtor and creditor, with a breakdown of the balance by month of origin.

Evaluation

The above information should be used to compare the actual performance of the organizations or programmes with expected levels. This comparison can be both internal and external. For instance, the average cost of providing care for each outpatient visit can be reviewed for a single institution, examining how the costs changed in each quarter over the past year and comparing figures with the previous year. As well, costs may be compared with those of other institutions, to determine whether costs within the programme appear to be lower than, consistent with, or higher than those of other providers. Comparisons of different institutions and programmes can be useful in monitoring performance. There are three types of comparison that are generally useful for such monitoring:

1. Comparisons of actual operating costs, revenues and key statistics with prior periods and with the budget
2. Comparisons of the financial position of the institution through accounting reports, such as balance sheets
3. Comparisons of capital expenditure levels with the capital budget and with recurrent costs.

Cost analysis is an essential financial management tool during the evaluation period. Just as a technical review of a programme or project examines the achievement of objectives, cost analysis allows managers to measure the efficiency of their programmes. Efficiency can be understood as getting the most output for a given quantity of resources (e.g. delivering more services with a constant budget), or achieving a given level of output at minimum cost (e.g. treating bacterial infections at the lowest cost). By determining the cost of each unit of output, managers can compare the efficiency of their

Table IB2.2 Sample components for annual reports

Statement of income and expenditure	

Income
Contributions
Transfers
  from state budget
  from other schemes
Reimbursements
Co-payments, charges and fees
Transfers from reserves
Interests on reserve
	Expenditure
	Benefits and services
	Administrative costs
	Staff costs
	Other administrative costs
	Transfers to other schemes
	Transfers to reserve
	Interests on credits

Deficit	**Surplus**

Balance sheet of assets and liabilities	
Assets Real estate Equipment Other assets	*Liabilities* Outside capital Equity capital Unpaid claims Reserves
Loss	**Surplus**

Box IB2.1 Examples of practices in financial and reporting and accounting

1. Financial reporting and accounting in Quebec, Canada

In Quebec, some services are provided directly (e.g. hospital care, long-term care and social services), while others are publicly financed but provided by private practitioners (e.g. medical services, dental care and pharmaceuticals). Both direct and indirect expenditures are considered public expenditure, and are subject to the usual government reporting and auditing procedures. Financial information on health care is part of the government's budget and financial statements, which are presented to the National Assembly and audited by the Auditor General. Statistics are also published on how the money is spent (e.g. according to consumption patterns by region or age).

A public expenditure model has been developed by the Ministry of Finance (MOF) and the Treasury Board. It is used for policy and financial planning, and applies to all public expenditure (not only on health care).

Complementary projection models were developed by the health authorities for planning purposes. In particular, there is a projection model that is used to negotiate physicians' remuneration in medical associations, with annual expenditure ceilings negotiated on a triennial basis. The main variable of this model is the supply of physicians (i.e. it is treated as a supply-driven market).

Official documents (a budget and financial statements) are published by the MOF and the Treasury Board. Other documents are published by the Ministry of Health and Social Affairs and the public organization that administers the reimbursement of indirectly provided services. Auditing is performed by the Auditor General or by private auditing firms.

2. Financial reporting and accounting in Germany

In Germany, the overwhelming majority of total health expenditure is financed and administered by a system of statutory sickness funds, of which there are more than 1,000. Benefits, financing regulations, accounting and publishing rules are standardized (although there are a few benefits which may differ), and are the same for all funds.

Aggregated accounts and statistics are published annually by the Ministry of Health (MOH) in a financial and statistical report, and by federations of sickness funds for each group of funds. The data published by the MOH are aggregated up to the levels of regions and sickness fund federations (there are eight different groups of sickness funds, each organized in a federation). The statistical data published by the MOH not only include accounting information, but also performance and coverage data such as the number of cases, hospital days, etc.

Accounting data consist of a statement of revenue and expenditure and a statement of assets and liabilities. The structures of these statements are as follows:

A. Statement of revenue and expenditure

Revenue data

1. Contributions, for:
    - statutory insured members
    - recipients of unemployment insurance benefits

- pensioners
- young and disabled persons
- students
- persons in military service
- voluntarily insured members
- persons in rehabilitation
- artists and journalists

2. Revenue from assets and other sources, including:
    - interest
    - benefits from scheme-owned enterprises
    - refunds
    - fines
    - revenues from risk equalizations
    - other revenues

Expenditure data

1. Ambulatory care
2. Dental care
3. Dental prostheses
4. Drugs, medical aids and supplies
5. Hospital care
6. Sick pay
7. Expenditures for health care abroad
8. Transportation
9. Spas
10. Social services and health promotion
11. Preventive checkups
12. Contraception, sterilization, abortion
13. Rehabilitation
14. Benefits to pregnant women and mothers
15. Home care
16. Death grants
17. Other benefits
18. Expenditures for assets and other items
19. Administrative costs

Expenditure data are further disaggregated according to categories of insured persons (active members, dependants of active members, pensloners and dependants of pensioners).

B. Statement of assets and liabilities

Assets

1. Cash reserves
2. Short-term investments
3. Claims
4. Other investments
5. Other assets
6. Administrative assets (buildings and equipment)

Liabilities

1. Short-term credits
2. Short-term liabilities
3. Other liabilities

Accounting data are audited on a yearly basis by federal and regional agencies. The federal and regional ministries of health supervise the funds and their federations. Moreover, published statistical reports include:

1. Membership according to sex, age group, region, insurance status and sickness fund
2. Contribution rates according to sickness fund group
3. Assessment base according to insurance status, region and groups of sickness funds
4. Consumption and performance patterns, such as number of days of sick leave, number of days of sick pay, number of cases of sick pay, number of cases and days of inpatient treatment, number of recipients of certain grants, allowances and services, etc.

The reporting procedures are as follows:

- The various funds report to their federations on a quarterly basis.
- The federations report to the MOH on a quarterly basis.

Projections of revenues and expenditures are made quarterly and annually by the MOH.

programmes over time or with that of other organizations. Cost figures can also be used to estimate the financial impact of different patient volumes, patient types or disease types, as well as to set prices. During the analysis, several key questions should be responded to:

What does the organization spend its money on, by:

- programme area
- facility
- line item
- geographic area.

How does this allocation compare to:

- the previous period (quarter, month, year)
- other programmes
- other facilities
- other geographic areas
- established standards (national, regional or organizational).

Is the organization spending its resources efficiently, in terms of costs:

- per patient
- per day
- per procedure
- per prescription.

If there are variances, are they caused by:

- external factors (e.g. inflation, availability of foreign exchange, national disasters)
- internal factors (e.g. poor management, lack of financial controls, competing forces).

Finally, when performing cost analysis, the following should be kept in mind:

- Costs should be allocated according to what they were *used for*.
- When developing a budget for a future period, funds should follow categories of *management responsibility*.

Table IB2.2 shows sample structures of key financial reports, and is followed by a box discussing the financial reporting and accounting systems used in two countries.

Note

[1] Definitions of accounting terms are found in the Glossary, including the formal definition of depreciation and other concepts.

ISSUE BRIEF 3

A PRIMER ON THE MATHEMATICS OF PRIVATE HEALTH INSURANCE

3.1 THE CHARACTERISTICS OF PRIVATE HEALTH INSURANCE

The difference between social and private health insurance financing, inter alia, lies in the actuarial calculation of the *premium* and in the pattern of *reserve accumulation.*

Contributions in private health insurance are related to individual risks. Private insurance contributions are calculated on the basis of *individual equivalence*, meaning that the present value of expected contributions and expenditure over a defined period or the entire expected duration of the insurance policy must be equal for each individual. Usually, contributions are not related to income, and are called *premiums.*

Social health insurance, on the other hand, may be characterized by mutual support. The level of the contribution is not related to risk, but is most generally related to the ability of the insured to pay. The contribution for a social insurance scheme is calculated on the basis of the principle of *collective equivalence* between income and expenditure and contribution levels are graduated according to ability to pay (e.g. through contribution rates as a percentage of insurable earnings).

There are many ways in which private health insurance premiums may be calculated. Some private health insurance schemes calculate flat premiums for specified age groups and have a limitation on entry age into the scheme; others calculate premiums according to detailed schedules by age and sex. Some private health insurance schemes build up reserves, in order to avoid high premiums for the elderly members of the scheme; others charge premiums that change each year in accordance with the age of the insured person.

Normally, in addition to the calculation of the premium itself, there are some elements in private health insurance schemes, such as co-payments, exclusions of risks by not covering pre-existing illnesses, and health examinations upon entry into the scheme, which sometimes form part of an individual insurance policy. Some health insurance schemes reserve the right to cancel the contract when an individual falls ill, or annually renew individual contracts, while other insurance schemes guarantee life-long, full service as long as the premium is paid. In this context, national insurance legislation and the nature of public insurance supervision play an important role.

Although only premium calculations are dealt with in the following chapters of this Issue Brief, it should be noted that all the above-mentioned elements may have an impact on the premium. First, the calculation of the *risk premium* (RP) is described in such a way that the average amount of claims per person in a particular age group is covered by the premium every year. Next, *constant individual premiums*, which are stable in theory throughout the span of individual policies, are dealt with. These take into account the fact that private insurance systems that charge premiums based exclusively on risk cannot guarantee long-term stable premiums to insured persons. The final section describes the pattern of reserve accumulation in private health insurance schemes with constant premiums.

3.2 CALCULATION OF THE RISK PREMIUM (RP)

One of the main determining factors of private health insurance premiums is the average amount of claim per capita. The per capita claim is the expected value of insurance payments for a single risk during a certain period, normally for a calendar year. If the group of insured persons is large enough, according to the law of large numbers, the expected value can be estimated as the average per capita claim:

$$C = \frac{P}{L} \tag{1}$$

where:

C = Average per capita claim
P = Total payments in a period
L = Number of insured persons

The above formula could be interpreted as the overall risk premium (RP) for the entire insured population of a specific health insurance scheme. However, premiums are, in practice, set for each subgroup of insured persons. The level of disaggregation is based on an analysis of the claim structure for various subgroups of insured persons. General patterns may be observed, such as a significant correlation between per capita claims and sex or age of the insured person, or the type and nature of the specific benefit (e.g. ambulatory care or inpatient care). Another determinant of utilization may be the profession of a beneficiary, especially for daily sickness cash benefits.

The general trend of increase in health care costs is also very important, especially for tariffs without upper ceilings on total annual reimbursement.

Pre-existing illnesses are another factor that influence personal risk. Although it may be important, in theory, to distinguish as many influencing factors as possible, in practice there is a limitation on the depth of differentiation of risks, because the law of large numbers is only applicable for a certain number of samples of each risk group. A compromise should be made, taking the limited number of insured persons into consideration.

Thus, the various risk groups should be determined, so that on the one hand each group is large enough, while on the other hand the differentiation according to risk is sufficient to allow prudent future premium calculations. Individual risks to a large extent are usually related to the age and sex of the insured persons, directly or indirectly. Hence, average per capita claim amounts must be determined according to age and sex. Each per capita claim amount, for the group in age x and sex s, is defined as:

$$C_{s,x} = \frac{P_{s,x}}{L_{s,x}} \tag{2}$$

Taking into account special effects in the starting period of every insurance policy (e.g. any waiting period, or savings due to selection), per capita claims are usually computed using data that exclude new contracts – for example, those with a duration of less than one year.

The structures of claims may vary according to the type of benefits, age and sex. For example, in many countries, although there is no great difference between the development of costs according to age and sex in ambulatory care, the cost patterns of men and women by age in hospital care are normally quite different, because of deliveries in hospitals and lower health costs of women aged 60 and more.

The RP necessary to cover a subscribed risk in the short term is equivalent to the average per capita claim amount. It is composed of a series of average per capita claim amounts, classified by type of benefit, age and sex. The formula of the RP is as follows:

$$C_{s,x} = \sum_{i=1}^{n} C^{i}_{s,x} \tag{3}$$

where i represents the various categories of benefits.

In the case of pre-existing illnesses, the normal premium may be adjusted by risk-related surcharges. More detailed, differentiated statistics are necessary in order to calculate these surcharges. If a private insurance company were to work on an RP basis, it would also multiply the above net risk premium by a certain factor in order to cover administrative expenditure.

3.3 CALCULATION OF THE NET CONSTANT INDIVIDUAL PREMIUM (CIP)

The calculation of the constant individual premium (CIP), which reflects average risk over the life span of an insurance policy, follows a methodology similar to that for the calculation of the constant contribution rate of the social insurance scheme, as seen in Formula 6.24 (Chapter 6). The difference lies in the fact that the calculation of private insurance premiums is not based on the entire insured population, but on smaller groups classified by age and sex. Before the basic formula for the net individual premium (i.e. the premium without risk or administrative surcharges) is developed, some basic actuarial techniques are explained below.

The decrement

Other than administrative costs, the (net) risk premium reflects the individual risk of a group of insured persons. As the risk premium leads to unbearably high premiums for older insured persons, the annual premium actually charged is usually not set at the level of the RP.

Annual premiums are generally as a constant individual premium. The CIP is defined as the premium which leads to an equivalence of premium income and costs of claims for each group of insured persons (say, for each group of the same age cohort), over the duration of the policy after an insured person enters the scheme.

In order to calculate the CIP, it is necessary to calculate the present value of total expected expenditures and premiums from the year of entrance until the end of the contract, by using discount factors. In addition, income and expenditures are influenced by the development of the group of insured persons. Some of them leave the scheme before the expiration of the policy, for example, by premature death, or cancellation of the policy by the insurer. Therefore, two random variables by age and sex have to be determined:

- Probability of death (mortality)
- Probability of cancellation (return) of the insurance policy.

The expected values of these random variables may be determined on the basis of experience. The mortality rate of age x and sex s is a random value-dependent age x and sex s: ($q_{s,x} = d_{s,x}/l_{s,x}$). In practice, mortality tables are used in order to determine this variable.

There is no generic probability distribution for the return (and cancellation) of insurance policies, other than through death, which may be applied to any given insurance scheme. Returns are heavily influenced by the quality of service and administration of the insurer. Nevertheless, the return of the single insurer is a random variable and the expected value of this variable is called the probability of return $r_{s,x}$ of age x and sex s.

Even for a single insurer, the probability of return is often different for each type of benefit tariff (which together make up the total premium), depending on how vital the different products are for insured persons. In addition, the probability of return is also different for certain professional groups. However, we may make generalizations about some aspects of the probability of return, especially with regard to the age of the insured persons and duration of the insurance contract. Normally, the probability of return decreases as these two factors increase. with increasing age and contract duration. In practice, it is usually sufficient to calculate a probability of return related to the age of the insured persons. Some specific factors of a particular company may also be taken into account. Greater probability of return and mortality leads to a reduction of the premium, because it leads to lower realization of payments (due to death or return).

Let us define the final age as ω. From this age on, there are no more insured persons for calculation purposes. In practice, ω is often set at 100. At mortality $q_{s,x}$, probability of return $r_{s,x}$ and final age ω, the expected development of a stock of insured persons $l_{s,x}$ for all $x \leq \omega - 1$ is described as:

$$l_{s,x+1} = l_{s,x}(1 - q_{s,x} - r_{s,x}) \qquad (4)$$

The actuarial interest rate

In order to calculate the present value of income and expenditure, an actuarial interest rate is assumed. Since actual interest rates change remarkably over time, the actuarial rate should be assumed prudently, and with a margin of safety.

The present value

In order to calculate the net premium, we need the present value of the benefit and premium, until the end of the insurance policy. The claim amounts increase due to ageing of the group, as well as any general increase in the cost of medical care.

Let us denote the constant premium of a person of sex s who enters the scheme at age x as $P_{s,x}$. We assume, for simplicity of argument, that the flow of money, such as for benefit or premium payments, occurs at the beginning of each period. (However, a similar line of argument can be followed when the timing of cash flows is different.) The present value of the premium is:

$$V_{p,s,x} = P_{s,x}\ddot{a}_{s,x} \qquad (5)$$

where $\ddot{a}_{s,x}$ is a factor representing the present value of an annuity in the amount of one currency unit.

As the present value of the premium must equal the present value of the benefits $V_{b,s,x}$, we arrive at the following:

$$V_{b,s,x} = V_{p,s,x} = P_{s,x}\ddot{a}_{s,x} \qquad (6)$$

Therefore,

$$P_{s,x} = \frac{V_{b,s,x}}{\ddot{a}_{s,x}} \qquad (7)$$

Since the variable $\ddot{a}_{s,x}$ is defined as the lump sum from which a constant payment of amount one can be made until the expiration date of the insurance policy, its value depends on the entry age into the scheme and life expectancy. The decrement rates to calculate the surviving number $l_{s,x}$ until the final year of the policy are necessary for calculation, as well as a discount factor. The discount factor v is defined as follows:

$$v = \frac{1}{(1+i)} \qquad \textbf{(8)}$$

where i is the actuarial interest rate. The single premium for an annuity of amount one for all of the persons $l_{s,x}$ of entry age x and sex s is:

$$l_{s,x}\ddot{a}_{s,x} \qquad \textbf{(9)}$$

The present value of an annuity for all insured persons of entry age x and sex s is calculated as:

$$\sum_{\mu=0}^{\omega-x} l_{s,x+\mu}v^{\mu} \qquad \textbf{(10)}$$

where ω is the actuarial end age.

Since the present value of the premiums equals the present value of the annuity:

$$l_{s,x}\ddot{a}_{s,x} = \sum_{\mu=0}^{\omega-x} l_{s,x+\mu}v^{\mu} \qquad \textbf{(11)}$$

or

$$\tilde{a}_{s,x} = \frac{\sum_{\mu=0}^{\omega-x} l_{s,x+\mu}v^{\mu}}{l_{s,x}} \qquad \textbf{(12)}$$

We compute the present value of benefits paid over the duration of the insurance policy by using per capita claims $C_{s,x}$. By analogy to equation 11:

$$l_{s,x}V_{b,s,x} = \sum_{x+\mu}^{\omega-x} l_{s,x+\mu}C_{s,x+\mu}v^{\mu} \qquad \textbf{(13)}$$

or

$$V_{b,s,x} = \frac{\sum_{\mu=0}^{\omega-x} l_{s,x+\mu}C_{s,x+\mu}v^{\mu}}{l_{s,x}} \qquad \textbf{(14)}$$

The constant annual net premium is then computed according to equations 7, 12 and 14 as:

$$P_{s,x} = \frac{\sum_{\mu=0}^{\omega-x} l_{s,x+\mu} C_{s,x+\mu} v^{\mu}}{\sum_{\mu=0}^{\omega-x} l_{s,x+\mu} v^{\mu}} \tag{15}$$

3.4 CALCULATION OF THE ANNUAL GROSS PREMIUM

The net premium exclusively covers the cost of benefits. A supplement to the net premium must be computed to cover administrative costs. Moreover, a security margin must be added in order to cover possible fluctuations in the costs. The addition of these items to the net premium results in the gross premium.

Administrative costs may include costs of the operation of the insurance scheme, sales costs (provisions) as well as depreciation and other adjustments to the value of inventory and other assets. The recording and calculation of these costs may be different in each country.

We assume that supplemental costs are composed of the following two components:

a. A fixed cost supplement β during the period of payment of the premium, regardless of the amount of the premium.

b. A variable cost supplement γ during the period of payment of the premium, proportionate to a gross premium of amount one.

Let us denote the gross annual premium by $P_{g,s,x}$. Since the present value of the gross premium is the summation of the present value of the net premium and that of the supplement, we have the following:

$$P_{g,s,x}\ddot{a}_{s,x} = P_{s,x}\ddot{a}_{s,x} + \beta\ddot{a}_{s,x} + \gamma P_{g,s,x}\ddot{a}_{s,x} \tag{16}$$

Therefore,

$$P_{g,s,x} = \frac{P_{s,x} + \beta}{1 - \gamma} \tag{17}$$

3.5 RESERVE CALCULATIONS

The constant individual premium, discussed above, leads to a buildup of reserves in younger ages, when the premium is higher than the actual costs of benefits. These reserves are reduced in older ages.

The level of saving depends on the internal redistribution pattern in the insurance scheme. Savings of young insured persons could be used to finance higher costs for elderly insured persons. In many countries, however, by analogy to life insurance, a reserve is built up, and each single cohort insurance policy is kept financially separate in order to avoid cross-subsidies between groups of insured persons.

The constant premiums calculated using the individual equivalence principle lead to reserves accumulated in the earlier years, because premiums are set higher than the benefits paid for actual risk. This reserve with investment returns, called the **premium reserve**, finances negative balances between annual premiums and claim amounts in the long run, as the insured persons get older.

The constant annual premium is calculated in such a way that the expected value of premium income equals the expected value of the expenditure for benefits. Individual equivalence should be valid not only at the beginning of an insurance contract, but also at any point in time during the duration of a policy. The generalized **individual equivalence principle** might then be formulated as follows:

- *At any given point in time during the life span of an insurance policy, the expected present value of the premium income plus the premium reserve equals the expected present value of benefit expenditure.*

If we define:

ω as the actuarial end age of the contracts
n as the age of the (cohort) insurance policy
x as the entry age of the insured persons into the scheme
$V_{s,x+n}$ as the present value of the benefits at the moment $x+n$
${}_nV_{s,x}$ as the premium reserve at time n

then the following equation holds for each $n \geq 0$ and $x+n \leq \omega$:

$$V_{s,x+n} = P_{s,x}\ddot{a}_{s,x+n} + {}_nV_{s,x} \tag{18}$$

or

$${}_nV_{s,x} = V_{s,x+n} - P_{s,x}\ddot{a}_{s,x+n} \tag{19}$$

This means that the premium reserve equals the difference between the expected present value of the benefit expenditure and the expected present value of premium income.

The relationship between the net premium, the risk premium and the premium reserve is investigated as follows. By multiplying the both sides of equation 1 by $l_{s,x+n}$, we obtain:

$$l_{s,x+n} \cdot {}_nV_{s,x} = l_{s,x+n}(V_{s,x+n} - P_{s,x}\ddot{a}_{s,x+n}) \tag{20}$$

The following holds, because of equations 12 and 14:

$$\ddot{a}_{s,x+n} = \frac{\sum_{\mu=0}^{\omega-x-n} l_{s,x+n+\mu}v^{\mu}}{l_{s,x+n}} \tag{21}$$

$$V_{s,x+n} = \frac{\sum_{\mu=0}^{\omega-x-n} l_{s,x+n+\mu} C_{s,x+n+\mu} v^{\mu}}{l_{s,x+n}} \tag{22}$$

By inserting these formulas into the right side of the equation 20, we obtain:

$$l_{s,x+n} \cdot {}_nV_{s,x} = l_{s,x+n}(C_{s,x+n} - P_{s,x}) + l_{s,x+n+1} \cdot v \cdot {}_{n+1}V_{s,x} \tag{23}$$

Taking equation 4 into consideration:

$$l_{s,x+n} \cdot {}_nV_{s,x} = l_{s,x+n}(C_{s,x+n} - P_{s,x}) + l_{s,x+n} \cdot (1 - q_{s,x+n} - r_{s,x+n}) \cdot v \cdot {}_{n+1}V_{s,x} \tag{24}$$

Therefore,

$$P_{s,x} = C_{s,x+n} + ({}_{n+1}V_{s,x} \cdot v - {}_nV_{s,x}) - (q_{s,x+n} + r_{s,x+n}) \cdot {}_{n+1}V_{s,x} \cdot v \tag{25}$$

According to this formula, the net premium is composed of:

- the risk premium $C_{s,x+n}$
- the savings $({}_{n+1}V_{s,x} \cdot v - {}_nV_{s,x})$
- the inheritance of reserves from insured persons leaving the scheme due to deaths and returns, $(q_{s,x+n} + r_{s,x+n}) \cdot {}_{n+1}V_{s,x} \cdot v$.

3.6 THE INFLUENCE OF CHANGE IN THE BASIC VARIABLES

Some of the basic variables in the formulas might vary over time, so it is therefore necessary to know the effect of variables on the premium. The following variables have an influence on the premium:

- costs of health care (inflation and changes in consumption) which influence the risk premium $C_{s,x}$
- decrement (mortality and return)
- actuarial interest rate.

Health insurance premiums reimbursing costs without upper limits on claims are heavily influenced by changes in consumption (e.g. morbidity, higher life expectancy) and changes in the prices of health goods and services. Both of these directly influence the risk premium, which is the actuarial basis of the net constant premium. In practice, these effects are incorporated into the calculation by a trend factor which influences per capita claims.

Higher costs for treatment lead to higher premiums. An increasing actuarial interest rate leads to a decreasing premium. This effect becomes smaller if the entry age into the scheme is higher. An increasing (decreasing) decrement leads to a decreasing (increasing) premium.

It should be stressed that the difference between the nominal interest rate and the cost increase heavily influences private health insurance premiums, in the assumption of reserve formation. Most private insurers find it difficult to project the correct inflation rate, in particular medial inflation above the development of the consumer price index (CPI). Cost increases for elderly insured persons should be noted in particular, as they lead to especially steep contribution increases for elderly insured persons.

Many contribution rates for existing policies have to be revised to take into account the deviation between actual developments and assumptions on key variables, even though the assumptions included that the rates would be constant. Thus, even for premium calculations for private insurance schemes, sound modelling of future costs is crucial. The methods used for these projections are essentially the same as those described in Chapter 6.

ISSUE BRIEF 4

REGRESSION ANALYSIS

This issue brief summarizes standard techniques of regression analysis, as a reference for modellers. Some theories or formulas are mentioned without proofs, since this brief focuses on the mathematical interpretation of the regression technique. This should help the modeller to acquire some basic understanding of what regression techniques actually "do" with observed data. If necessary, please refer to standard statistics textbooks for more detailed explanations and proofs.[1]

4.1 LINEAR REGRESSION (FOR ONE INDEPENDENT VARIABLE)

We may treat the simplest of cases as an introduction to regression analysis. This involves two variables (x and y) that are correlated – more specifically, one *dependent variable* (y) is supposed to be linearly related to the *independent variable* (x). The problem is determining the constant coefficients in the following equation (a and b, called *sample regression coefficients*), given n sample points (x_i, y_i, where $i = 1, \ldots, n$):

$$y = ax + b \qquad (1)$$

One way of fitting this line is the method of *least squares*, i.e. finding values for a and b which will minimize the sum of squares of the difference between y_i and $ax_i + b$. This is equivalent to finding values for (a,b) that minimize the following equation:

$$Q(\alpha, \beta) = \sum_{i=1}^{n} (y_i - \alpha - \beta x_i)^2 \qquad (2)$$

Let us define the sample averages of x_i and y_i as $\underline{x}$ and $\underline{y}$, the sample variances of x_i and y_i as s_x^2 and s_y^2, the sample covariance of x_i and y_i as s_{xy}, and the sample correlation coefficient as r_{xy}:

$$\underline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \tag{3}$$

$$\underline{y} = \frac{1}{n}\sum_{i=1}^{n} y_i \tag{4}$$

$$s_x^2 = \frac{1}{n-1}\sum_{i=1}^{n} (x_i - \underline{x})^2 \tag{5}$$

$$s_y^2 = \frac{1}{n-1}\sum_{i=1}^{n} (y_i - \underline{y})^2 \tag{6}$$

$$s_{xy} = \frac{1}{n-1}\sum_{i=1}^{n} (x_i - \underline{x})(y_i - \underline{y}) \tag{7}$$

$$r_{xy} = \frac{s_{xy}}{s_x s_y} \tag{8}$$

By taking partial differentials of $Q(\alpha,\beta)$ with respect to α and β, and setting each equation equal to zero at (a,b), the following solutions of a and b are obtained:

$$a = \underline{y} - b\underline{x} \tag{9}$$

$$b = \frac{s_{xy}}{s_x^2} = r_{xy}\frac{s_y}{s_x} \tag{10}$$

Therefore, the regression line is expressed as:

$$y - \underline{y} = r_{xy}\frac{s_y}{s_x}(x - \underline{x}) \tag{11}$$

or:

$$\frac{y - \underline{y}}{s_y} = r_{xy}\frac{x - \underline{x}}{s_x} \tag{12}$$

It should be noted that the regression line goes through the point ($\underline{x}$, $\underline{y}$), corresponding to the mean of the samples x_i and $y_i (i = 1, \ldots, n)$, and that the sum of the deviations of the values of y from the regression line is zero, i.e.:

$$\sum_{i=1}^{n} (y_i - a - bx_i) = 0 \tag{13}$$

Standard error of the estimate

The standard error of the estimate s_{ey} for the regression line is defined as:

$$s_{ey}^2 = \frac{1}{n-2}\sum_{i=1}^{n} (y_i - a - bx_i)^2 \tag{14}$$

Then, the next equation follows:

$$s_{ey}^2 = \frac{n-1}{n-2} s_y^2 (1 - r_{xy}^2) \tag{15}$$

or:

$$r_{xy}^2 = 1 - \frac{n-2}{n-1}\frac{s_{ey}^2}{s_y^2} = 1 - \frac{\sum_{i=1}^{n}(y_i - a - bx_i)^2}{\sum_{i=1}^{n}(y_i - \underline{y})^2} \tag{16}$$

The variables x and y are referred to as positively or negatively correlated, if r_{xy} is strictly positive or negative. They are said to have no linear correlation if $r_{xy} = 0$, and to have perfect positive or negative linear correlation if $r_{xy} = 1$ or -1. It is seen from equations 12 and 16 above that the tangent of the regression line is positive/negative according whether x and y are positively/negatively correlated, that all sample points are on the regression line if x and y are perfectly correlated, and that the tangent of the regression line is zero if x and y have no linear correlation.

Assumptions for further analysis

The above-mentioned regression analysis is a largely mechanical process of fitting a line to the data. In this section, the assumptions of a theoretical model for regression analysis are provided, in order to measure the error associated with using the regression line in making estimates. Basic assumptions include the following:

1. The value of x is known in advance.
2. Successive sample observations are independent.
3. For $\forall x$, Dist (y) $\sim$ Norm($\alpha + \beta$x, σ^2), where α, β, σ^2 are constants, irrespective of x.

These are implicitly assumed hereinafter, unless stated otherwise.

Let us define the density function of y given x by $f(y|x)$. Then:

$$f(y|x) = \frac{1}{\sqrt{2\pi}\sigma} \exp\left[-\frac{1}{2\sigma^2}(y - \alpha - \beta x)^2\right] \tag{17}$$

Point estimates of α, β and σ^2

The joint probability density function for the samples of (x_i, y_i, where $i = 1, \ldots, n$) is as follows:

$$\begin{aligned}\prod_{i=1}^{n} f(y_i|x_i) &= \prod_{i=1}^{n} \frac{1}{\sqrt{2\pi}\sigma} \exp\left[-\frac{1}{2\sigma^2}(y_i - \alpha - \beta x_i)^2\right] \\ &= \left(\frac{1}{\sqrt{2\pi}\sigma}\right)^n \exp\left[-\frac{1}{2\sigma^2}\sum_{i=1}^{n}(y_i - \alpha - \beta x_i)^2\right] \end{aligned} \tag{18}$$

If the method of maximum likelihood estimation is applied in order to estimate α and β, the maximum value should be attained in equation 18 – i.e. the minimum should be attained in the following equation, in parentheses of the exponential in equation 18:

$$\sum_{i=1}^{n}(y_i - \alpha - \beta x_i)^2 \tag{19}$$

This is the same as equation 2. Hence, it is shown that the "mechanical" use of the method of least squares produces the same results as the maximum likelihood estimator under the above-mentioned assumptions. The maximum likelihood estimators a and b are expressed in equations 9 and 10. It is easily seen that the next equation follows:

$$b = \sum_{j=1}^{n} \frac{(x_j - \underline{x})}{\sum_{i=1}^{n}(x_i - \underline{x})^2} y_j \tag{20}$$

Since each y_i is an independent random variable with the distribution function of Norm($\alpha + \beta x_i$, σ^2), and each x_i is not a random variable but a definite constant, equation 20 is a linear combination of the Gaussian random variables $y_1, \ldots, y_n$. Therefore, a standard theorem of probability tells us the following:

$$b \sim \mathrm{Norm}\left(\beta, \frac{\sigma^2}{\sum_{i=1}^{n}(x_i - \underline{x})^2}\right) \tag{21}$$

This demonstrates that b is the unbiased estimator of β. In the same way, it is easy to show the following:

$$a \sim \mathrm{Norm}\left(\alpha, \left[\frac{1}{n} + \frac{\underline{x}^2}{\sum_{i=1}^{n}(x_i - \underline{x})^2}\right]\sigma^2\right) \tag{22}$$

It should be also noted that a is the unbiased estimator of α. Since the following equation can be shown (see equation 14 for the definition of s_{ey}^2):

$$E[s_{ey}^2] = \sigma^2 \tag{23}$$

the variable s_{ey}^2 is an unbiased estimator of σ^2. In addition, it can be further proved that the following equation is a random variable with the χ^2 (chi-square) distribution with the degree of freedom of $n - 2$ and independent of the random variables a, b and $a + bx_0$:

$$\frac{\sum_{i=1}^{n}(y_i - a - bx_i)^2}{\sigma^2} = \frac{(n-2)s_{ey}^2}{\sigma^2} \tag{24}$$

Confidence intervals for α, β and $E(y|x_0)$

From the above, we know that:

1. $(n-2)s_{ey}^2/\sigma^2$ is a random variable with the χ^2 (chi-square) distribution with the degree of freedom of n – 2 (refer to equation 24),

2. a is a random variable with the average and distribution mentioned in equation 22, and

3. $(n-2)s_{ey}^2/\sigma^2$ and a are independent.

It then follows that the following random variable obeys the law of the t distribution with the degree of freedom of n – 2:

$$\frac{a-\alpha}{\sigma\sqrt{\dfrac{1}{n}+\dfrac{\underline{x}^2}{\sum\limits_{i=1}^{n}(x_i-\underline{x})^2}}} \div \sqrt{\frac{s_{ey}^2}{\sigma^2}} = \frac{a-\alpha}{s_{ey}\sqrt{\dfrac{1}{n}+\dfrac{\underline{x}^2}{\sum\limits_{i=1}^{n}(x_i-\underline{x})^2}}} \tag{25}$$

Therefore, the $100(1-\gamma)\%$ confidence interval of α is equal to:

$$a \pm t_{n-2;\gamma/2} s_{ey}\sqrt{\frac{1}{n}+\frac{\underline{x}^2}{\sum\limits_{i=1}^{n}(x_i-\underline{x})^2}} \tag{26}$$

The $100(1-\gamma)\%$ confidence interval of β is equal to:

$$b \pm t_{n-2;\gamma/2} s_{ey}\sqrt{\frac{1}{\sum\limits_{i=1}^{n}(x_i-\underline{x})^2}} \tag{27}$$

The $100(1-\gamma)\%$ confidence interval of $\alpha+\beta x_0$ for $x = x_0$ is equal to:

$$a + bx_0 \pm t_{n-2;\gamma/2} s_{ey}\sqrt{\frac{1}{n}+\frac{(x_0-\underline{x})^2}{\sum\limits_{i=1}^{n}(x_i-\underline{x})^2}} \tag{28}$$

It is worth noting that equation 26 is deduced by setting $x_0 = 0$ in equation 28. The above values for α and β can be used to put a confidence band around the regression line, within which $100(1-Y)\%$ of the values x_i can be expected to lie.

Extension to more general regression problems

The methodology of the above-mentioned linear regression analysis is applied to more general problems by transforming variables. For example, by setting $x = f(t)$, the same methodology applies to the form of:

$$E(y|t) = \alpha + \beta f(t) \tag{29}$$

Another example is to use an exponential function as a regression curve:

$$u = \gamma \exp(\delta v) \tag{30}$$

where γ and δ are to be estimated. We take a logarithm of the equation:

$$\log u = \log \gamma + \delta v \tag{31}$$

Setting $y = \log u$, $x = v$, $\alpha = \log \gamma$, $\beta = \delta$, equation 31 is transformed to a standard formula:

$$y = \alpha + \beta x \tag{32}$$

4.2 MULTIPLE REGRESSION ANALYSIS

The linear regression techniques for one dependent variable discussed above may be expanded to include multiple regression analysis. The form of the regression for *m* independent variables is as follows:

$$E(y \mid x_1, x_2, \ldots, x_m) = \alpha + \sum_{i=1}^{m} \beta_i x_i \tag{33}$$

The discussion of multiple regression parallels that given above for a single independent variable. An important point of difference is that s_{ey}^2 is obtained by the following formula:

$$s_{ey}^2 = \frac{\sum_{i=1}^{n} \left(y_i - a - \sum_{i=1}^{m} b_i x_i \right)}{(n - m - 1)} \tag{34}$$

The degree of freedom is taken as $(n - m - 1)$ for computing the standard errors or finding t_α for the confidence interval.[2] It should be noted that there are no limitations on choosing $x_1, \ldots, x_m$. Therefore, by choosing $x_i = t^i$ $(i = 1, \ldots, m)$, a polynomial of the degree of *m* is obtained as a regression curve. As the computation necessary for regression analysis is tedious to perform by hand, there are ready-made computer programs to perform these tasks.

4.3 EXAMPLE: ESTIMATING THE UTILIZATION OF PHYSICIAN SERVICES

In this exercise, we will try to relate the number of visits to the doctor per capita to the number of physicians per 1,000 population, the number of compensated sickness days per capita in the active insured population, and the share of persons older than 65 in the total population. The time sequence of input data is given in table 1.

Year	Visits per capita	Physicians per 1 000 population	Compensated sickness days per capita in active population	Share of persons over 65 years of age	Working area								
	y_i	$x_{1,i}$	$x_{2,i}$	$x_{3,i}$	$x_{1,i}^2$	$x_{2,i}^2$	$x_{3,i}^2$	$x_{2,i} * x_{3,i}$	$x_{3,i} * x_{1,i}$	$x_{1,i} * x_{2,i}$	$y_i * x_{1,i}$	$y_i * x_{2,i}$	$y_i * x_{3,i}$
1970	3.2	1.283	13.3	12.8	1.6	176.9	163.8	170.2	16.4	17.1	4.1	42.6	41.0
1971	3.2	1.342	13.2	12.9	1.8	174.2	166.4	170.3	17.3	17.7	4.3	42.2	41.3
1972	3.3	1.368	13.5	13.0	1.9	182.3	169.0	175.5	17.8	18.5	4.5	44.6	42.9
1973	3.4	1.411	13.7	13.1	2.0	187.7	171.6	179.5	18.5	19.3	4.8	46.6	44.5
1974	3.5	1.471	17.3	13.3	2.2	299.3	176.9	230.1	19.6	25.4	5.1	60.6	46.6
1975	3.8	1.534	18.3	13.4	2.4	334.9	179.6	245.2	20.6	28.1	5.8	69.5	50.9
1976	3.8	1.632	17.4	13.5	2.7	302.8	182.3	234.9	22.0	28.4	6.2	66.1	51.3
1977	3.8	1.723	16.7	13.6	3.0	278.9	185.0	227.1	23.4	28.8	6.5	63.5	51.7
1978	4.0	1.770	16.8	13.8	3.1	282.2	190.4	231.8	24.4	29.7	7.1	67.2	55.2
1979	4.0	1.817	15.5	13.9	3.3	240.3	193.2	215.5	25.3	28.2	7.3	62.0	55.6
1980	4.1	1.937	14.9	14.0	3.8	222.0	196.0	208.6	27.1	28.9	7.9	61.1	57.4
1981	4.4	2.002	14.9	13.8	4.0	222.0	190.4	205.6	27.6	29.8	8.8	65.6	60.7
1982	4.5	2.084	15.1	13.5	4.3	228.0	182.3	203.9	28.1	31.5	9.4	68.0	60.8
1983	4.7	2.167	13.9	13.2	4.7	193.2	174.2	183.5	28.6	30.1	10.2	65.3	62.0
Total					**40.7**	**3 324.6**	**2 521.1**	**2 881.7**	**316.8**	**361.4**	**92.1**	**824.7**	**721.8**

Matrix	40.7	361.4	316.8	Inverse	1.1328	0.0222	−0.168	b_1	1.58643
	361.4	3 324.6	2 881.7		0.0222	0.0329	−0.04	b_2	0.01996
	316.8	2 881.7	2 521.1		−0.168	−0.04	0.0676	b_3	0.06419

Although this regression analysis can be easily undertaken using a standard software package (e.g. the regression facility in Excel and other spreadsheet packages), the numerical calculations are here made in spreadsheet format to facilitate the understanding of the standard calculations usually to be carried out in exercises of this kind. Let us define the sample points ($i = 1, \ldots, n$) as follows:

y_i = Number of visits to the doctor's per capita
$x_{1,i}$ = Number of physicians per 1,000 population
$x_{2,i}$ = Number of compensated sickness days per capita in the active insured population
$x_{3,i}$ = Share of persons older than 65 in the total population.

For simplicity, it is assumed that $a = 0$ (the intercept of the regression hyperplane). It is necessary to find b_1, b_2 and b_3, which minimize the following formula:

$$Q(\beta_1, \beta_2, \beta_3) = \sum_{i=1}^{n} (y_i - \beta_1 x_{1,i} - \beta_2 x_{2,i} - \beta_3 x_{3,i})^2 \qquad (35)$$

By taking partial differentials with respect to β_1, β_2 and β_3, and setting these partial differentials equal to zero at (b_1, b_2, b_3), the following three linear equations follow:

$$\sum_{i=1}^{n} x_{1,i}^2 b_1 + \sum_{i=1}^{n} x_{1,i}\, x_{2,i} b_2 + \sum_{i=1}^{n} x_{3,i}\, x_{1,i} b_3 = \sum_{i=1}^{n} y_i x_{1,i} \qquad (36)$$

$$\sum_{i=1}^{n} x_{1,i}\, x_{2,i} b_1 + \sum_{i=1}^{n} x_{2,i}^2 b_2 + \sum_{i=1}^{n} x_{2,i}\, x_{3,i} b_3 = \sum_{i=1}^{n} y_i x_{2,i} \qquad (37)$$

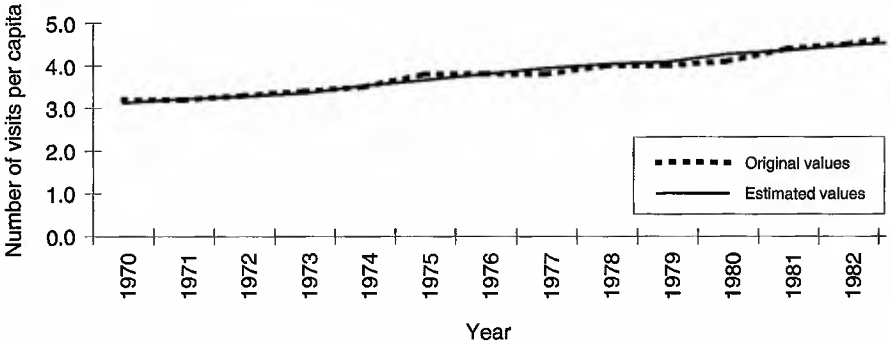
$$\sum_{i=1}^{n} x_{3,i}\, x_{1,i} b_1 + \sum_{i=1}^{n} x_{2,i}\, x_{3,i} b_2 + \sum_{i=1}^{n} x_{3,i}^2 b_3 = \sum_{i=1}^{n} y_i x_{3,i} \qquad (38)$$

These equations can be solved by calculating the inverse matrix, which can easily be done using ready-made functions in spreadsheet software packages. Finally, the equation is obtained as:

$$y = 1.58643 x_1 + 0.01996 x_2 + 0.06419 x_3, \qquad (39)$$

which is mapped in figure 1. The coefficient of multiple determination R-square for this exercise is 0.96, indicating a fairly good fit of the regression and a level of high explanatory power of the independent variables. If one assumes that future utilization rates will follow the same trends as those observed in the past, then one can use the above polynomial to project utilization rates for future projection years.

Figure IB4.1 Result of sample regression



Notes

[1] Some of these include Lawrence L. Lapin, *Statistics, meaning and method* (New York, Harcourt, Brace, Jovanovich, 1975); Irwin Guttman, S.S. Wilks, and J. Stuart Hunter, *Introductory engineering statistics* (New York, John Wiley & Sons, 1982); and Murray R. Spiegel, *Schaum's outline of theory and problems of probability and statistics* (New York, McGraw-Hill, 1980).

[2] For a more detailed discussion and examples of applications, please refer to Carl Allen Bennett and Norman L. Franklin, *Statistical analysis in chemistry and the chemical industry* (New York, John Wiley and Sons, 1954).

ANNEX

INTERNATIONAL REFERENCE STATISTICS

GLOBAL HEALTH STATISTICS: BASIC INDICATORS

A

These basic health care indicators on demographic and economic situations, trends and basic health expenditure and infrastructures will help modellers and quantitative health case analysts to place the data in a global context. This section provides a global quantitative orientation frame which should permit the modeller to judge whether highly aggregated national health expenditure and infrastructure data of a country are plausible in comparison with countries at a similar stage of economic development and with a similar demographic status. The crude utilization and infrastructure data for OECD countries were added for comparative purposes.

Basic indicators: Demography

Country	Population (millions)				Life expectancy at birth		Total fertility rate			Infant mortality /1 000 live births		Under-5 child mortality/ 1 000
	Past		Projected						Pro- jected			
	1980	1995	2000	2025	1991	1995	1970	1991	2000	1970	1991	1995
Low-income economies												
Mozambique	12	16.2	21	43	47	47	6.7	6.5	6.7	171	149	190
Tanzania, United Rep.	19	29.6	33	59	51	51	6.4	6.3	6.6	132	115	133
Ethiopia	38	56.4	67	130	48	49	5.8	7.5	7.3	158	130	188
Uganda	13	19.2	23	48	46	42	7.1	7.3	6.6	109	118	160
Bhutan	–	0.7	2	3	48	–	5.9	5.9	5.4	182	132	–
Guinea-Bissau	1	1.1	1	2	39	38	5.9	6	6	185	148	233
Nepal	15	21.5	24	38	53	55	6.4	5.5	4.6	157	101	131
Burundi	4	6.3	7	14	48	49	6.8	6.8	6.6	138	107	162
Chad	4	6.4	7	14	47	48	6	5.9	6.1	171	124	197
Madagascar	9	13.7	15	26	51	52	6.6	6.2	5.2	181	114	127
Sierra Leone	3	4.2	5	10	42	40	6.5	6.5	6.5	197	145	236
Bangladesh	87	119.8	131	180	51	58	7	4.4	3.3	140	103	115
Lao PDR	3	4.9	6	10	50	52	6.1	6.7	6	146	100	147
Malawi	6	9.8	12	24	45	43	7.8	7.6	7.4	193	143	225
Rwanda	5	6.4	9	17	46	46	7.8	6.4	7.6	142	111	200
Mali	7	9.8	11	24	48	50	6.5	7	7	204	161	192
Burkina Faso	7	10.4	12	23	48	49	6.4	6.5	6.3	178	133	164
Niger	6	9	11	24	46	47	7.2	7.4	7.3	170	126	200
India	687	929.4	1 017	1 365	60	62	5.8	3.9	3	137	90	95
Kenya	17	26.7	34	73	59	58	8	6.5	5.5	102	67	90
Nigeria	71	111.3	128	217	52	53	6.9	5.9	5	139	85	176
China	981	1 200.2	1 290	1 569	69	69	5.8	2.4	2.1	69	38	43
Haiti	5	7.2	8	10	55	57	5.9	4.7	4.2	141	94	101
Benin	3	5.5	6	11	51	50	6.9	6.3	5.2	155	111	156
Cent. African Rep.	2	3.3	4	7	47	48	4.9	5.8	5.3	139	106	160
Ghana	11	17.1	20	36	55	59	6.7	6.2	5.1	111	83	116
Pakistan	83	129.9	148	244	59	60	7	5.7	4.6	142	97	127
Togo	3	4.1	5	9	54	56	6.5	6.6	5.5	134	87	128
Guinea	4	6.6	8	14	44	44	6	6.5	6.5	181	136	220
Nicaragua	3	4.4	5	8	66	68	6.9	5.1	4.2	106	56	61
Sri Lanka	15	18.1	19	24	71	72	4.3	2.5	2.1	53	18	19
Mauritania	2	2.3	3	5	47	51	6.5	6.8	6.8	165	119	158
Yemen	9	15.3	17	37	52	53	7.8	7.5	7.5	175	109	145
Honduras	4	5.9	7	11	65	67	7.2	5	4.1	110	49	59
Lesotho	1	2	2	3	56	61	5.7	5.1	4.5	134	81	121
Indonesia	148	193.3	206	265	60	64	5.5	3	2.4	118	74	75
Egypt	41	57.8	65	92	61	63	5.9	4.2	3.1	158	59	76
Zimbabwe	7	11	12	18	60	57	7.7	4.7	3.4	96	48	83
Sudan	–	26.7	34	60	51	54	6.7	6.3	5.4	149	101	109
Zambia	6	9	11	21	49	46	6.7	6.5	6.1	106	106	180

Source: World Bank: *World Development Report*, various years.

table cont.

Basic indicators: Demography (continued)

Country	Population (millions) Past		Projected		Life expectancy at birth		Total fertility rate		Projected	Infant mortality /1 000 live births		Under-5 child mortality/ 1 000
	1980	1995	2000	2025	1991	1995	1970	1991	2000	1970	1991	1995
Middle-income economies – (lower-middle)												
Bolivia	5	7.4	9	14	59	60	6.5	4.8	3.7	153	83	96
Côte d'Ivoire	8	14	17	32	52	55	7.4	6.6	5.8	135	95	138
Senegal	6	8.5	10	18	48	50	6.5	6.1	6.3	135	81	97
Philippines	48	68.6	74	102	65	66	6.4	3.6	2.7	66	41	53
Papua New Guinea	3	4.3	5	7	56	57	6.1	4.9	4	112	55	95
Cameroon	9	13.3	16	29	55	57	5.8	5.8	5.3	126	64	86
Guatemala	7	10.6	12	21	64	66	6.5	5.4	4.3	100	60	58
Dominican Rep.	6	7.8	8	11	67	71	6.3	3.1	2.4	90	54	44
Ecuador	8	11.5	13	18	66	69	6.3	3.7	2.8	100	47	45
Morocco	19	26.6	31	45	63	65	7	4.3	3.4	128	57	75
Jordan	2	4.2	5	9	69	70	–	5.3	5.6	–	29	33
Tajikistan	–	5.8	7	13	69	–	5.9	5.3	–	–	50	61
Peru	17	23.8	26	36	64	66	6	3.4	2.8	108	53	62
El Salvador	5	5.6	6	9	66	67	6.3	4.1	3.2	103	42	42
Congo	2	2.6	3	6	52	51	5.9	6.6	6.3	126	115	144
Syrian Arab Rep.	9	14.1	17	34	67	68	7.7	6.3	5.4	96	37	40
Colombia	28	36.8	38	50	69	70	5.3	2.7	2.2	77	23	31
Paraguay	3	4.8	6	9	67	68	6	4.4	4	57	35	52
Uzbekistan *(pe)*	16	22.8	26	42	69	70	5.7	4.3	–	–	44	48
Jamaica	2	2.5	2	3	73	74	5.3	2.7	2.1	43	15	15
Romania	22	22.7	23	25	70	70	2.9	1.9	2.1	49	27	29
Namibia	1	1.5	2	3	58	59	6	5.7	4.8	118	72	78
Tunisia	6	9	10	13	67	69	6.4	3.5	2.7	127	38	50
Kyrgyzstan *(pe)*	4	4.5	5	7	66	68	4.9	3.9	–	–	40	42
Thailand	47	58.2	65	82	69	69	5.5	2.3	2.1	73	27	42
Georgia *(pe)*	5	5.4	6	6	73	73	2.6	2.1	–	–	16	21
Azerbaijan *(pe)*	6	7.5	8	11	71	70	4.7	2.8	–	–	33	31
Turkmenistan *(pe)*	–	4.5	5	8	66	–	6	4.5	–	–	56	65
Turkey	44	61.1	68	91	67	67	4.9	3.4	2.7	147	58	63
Poland	36	38.6	39	43	71	70	2.2	2.1	2.1	33	15	16
Bulgaria	9	8.4	9	8	72	71	2.2	1.8	1.9	27	17	19
Costa Rica	2	3.4	4	5	76	77	4.9	3.2	2.3	62	14	16
Algeria	19	28	33	53	66	70	7.4	5	3.7	139	64	42
Panama	2	2.6	3	4	73	73	5.2	2.9	2.2	47	21	28
Armenia *(pe)*	3	3.8	4	5	72	71	3.2	2.7	–	–	22	24

Notes: *(pe)*: preliminary estimates.

Source: World Bank: *World Development Report*, various years.

table cont.

Basic indicators: Demography (continued)

Country	Population (millions) Past		Projected		Life expectancy at birth		Total fertility rate		Projected	Infant mortality /1 000 live births		Under-5 child mortality/ 1 000
	1980	1995	2000	2025	1991	1995	1970	1991	2000	1970	1991	1995
Middle-income economies – (lower-middle)												
Chile	11	14.2	15	19	72	72	4	2.7	2.1	78	17	15
Iran, Islamic Rep.	–	64.1	78	160	65	–	6.7	6.2	5.6	131	68	59
Moldova, Rep. *(pe)*	4	4.3	4	5	69	69	2.6	2.5	–	–	23	26
Ukraine *(pe)*	50	51.6	52	52	70	69	2.1	1.8	–	–	18	21
Mauritius	1	1.1	1	1	70	71	3.6	2	1.8	60	19	20
Czechoslovakia	–	–	–	–	72	–	2.1	1.9	2	22	11	–
Czech Republic	10	10.3	–	–	–	73	–	–	–	–	–	10
Slovak Republic	5	5.4	–	–	–	72	–	–	–	–	–	15
Kazakhstan *(pe)*	15	16.6	18	22	69	69	3.4	2.8	–	–	32	35
Malaysia	14	20.1	22	31	71	71	5.5	3.7	3	45	15	14
Middle-income economies – (upper-middle)												
Botswana	1	1.5	2	3	68	68	6.9	4.8	3.1	101	36	74
South Africa	29	41.5	47	69	63	64	5.7	4.1	3.4	79	54	67
Lithuania	3	3.7	4	4	71	69	2.4	2	–	–	14	19
Hungary	11	10.2	10	10	70	70	2	1.8	1.8	36	16	14
Venezuela	15	21.7	23	32	70	71	5.3	3.7	2.7	53	34	25
Argentina	28	34.7	36	43	71	73	3.1	2.8	2.3	52	25	27
Uruguay	3	3.2	3	4	73	73	2.9	2.4	2.1	46	21	21
Brazil	121	159	172	224	66	67	4.9	2.8	2.4	95	58	57
Mexico	67	91.8	99	136	70	72	6.5	3.2	2.4	72	36	41
Belarus	10	10.3	11	11	71	70	2.4	1.9	–	–	15	20
Russian Fed.	139	148	149	153	69	65	2	1.7	–	–	20	21
Latvia	3	2.5	3	3	69	69	1.9	2	–	23	16	20
Trinidad and Tobago	1	1.3	1	2	71	72	3.6	2.8	2.3	44	19	18
Gabon	1	1.1	2	3	54	55	4.2	5.8	6.1	138	95	145
Estonia	1	1.5	2	2	70	70	2.1	2.1	–	20	14	16
Portugal	10	9.9	10	10	74	75	2.8	1.4	1.6	56	11	11
Oman	1	2.2	2	5	69	70	7.2	6.8	5.9	159	31	22
Puerto Rico	–	3.7	4	5	76	–	3.2	2.3	2.1	29	14	15
Korea, Rep.	38	44.9	47	53	70	72	4.3	1.8	1.8	51	16	14
Greece	10	10.5	10	10	77	78	2.3	1.4	1.6	30	10	10
Saudi Arabia	9	19	21	41	69	70	7.3	6.5	5.9	119	32	31
Yugoslavia	–	*22*	–	–	73	–	2.3	2	2	56	21	22

Notes: *(pe)*: preliminary estimates.

Source: World Bank: *World Development Report*, various years.

table cont.

Basic indicators: Demography (continued)

Country	Population (millions) Past		Projected		Life expectancy at birth		Total fertility rate		Projected	Infant mortality /1 000 live births		Under-5 child mortality/ 1 000
	1980	1995	2000	2025	1991	1995	1970	1991	2000	1970	1991	1995
High-income economies/OECD members												
Ireland	3	3.6	4	4	75	77	3.9	2.1	2.1	20	8	7
Israel	4	5.5	6	8	76	77	3.8	2.8	2.3	25	9	9
New Zealand	3	3.6	4	4	76	76	3.2	2.1	2	17	9	9
Spain	37	39.2	39	39	77	77	2.8	1.3	1.5	28	8	9
Hong Kong, China	5	6.2	6	7	78	79	3.3	1.4	1.5	19	7	6
Singapore	2	3	3	4	74	76	3.1	1.8	1.9	20	6	6
United Kingdom	56	58.5	58	60	75	77	2.4	1.8	1.8	19	7	7
Australia	15	18.1	19	23	77	77	2.9	1.9	1.9	18	8	8
Italy	56	57.2	58	55	77	78	2.4	1.3	1.4	30	8	8
Netherlands	14	15.5	16	16	77	78	2.6	1.6	1.6	13	7	8
Belgium	10	10.1	10	10	76	77	2.2	1.7	1.6	21	8	10
Austria	8	8.1	8	8	76	77	2.3	1.6	1.6	26	8	7
France	54	58.1	59	63	77	78	2.5	1.8	1.8	18	7	9
Canada	25	29.6	29	34	77	78	2.3	1.9	1.7	19	7	8
United States	228	263.1	274	319	76	77	2.5	2.1	1.9	20	9	10
Germany	78	81.9	80	75	76*	76	2.1	1.4	1.6	23	7	7
Denmark	5	5.2	5	5	75	75	1.9	1.7	1.6	14	8	7
Finland	5	5.1	5	5	76	76	1.8	1.9	1.8	13	6	5
Norway	4	4.4	4	5	77	78	2.5	1.9	1.8	13	8	8
Sweden	8	8.8	9	10	78	79	1.9	2.1	1.9	11	6	5
Japan	117	125.2	127	126	79	80	2.1	1.5	1.6	13	5	6
Switzerland	6	7	7	7	78	78	2.1	1.6	1.7	15	7	7

Notes: Germany: Data marked '*' refer to FRG before unification.

Source: World Bank: *World Development Report*, various years.

Basic indicators: Economy and health care expenditure

Country	GDP (million $)		GNP per capita ($)		Total health expenditure, 1990:					Health expend. as % of total govt. exp.	
					million	$ per	as % of GDP:				
	1980	1995	1991	1995	$	capita	Total	Public	Private	1980	1991
Low-income economies											
Mozambique	2028	1469	80	80	85	5	5.9	4.4	*1.5*	–	–
Tanzania, United Rep.	*5702*	3602	100	120	109	4	4.7	3.2	*1.5*		–
Ethiopia	*5179*	5287	120	100	229	4	3.8	2.3	*1.5*	3.7	–
Uganda	1267	5655	170	240	95	6	3.4	1.6	1.8	5.1	–
Bhutan	*240*	–	180	420	–	–	–	–	–	*5.0*	4.8
Guinea-Bissau	105	257	180	250	–	–	–	–	–	–	*1.4*
Nepal	1946	4232	180	200	141	7	4.5	2.2	2.3	3.9	4.7
Burundi	920	1062	210	160	36	7	3.3	1.7	1.6	–	–
Chad	727	1138	210	180	76	13	6.3	*4.7*	*1.6*	–	–
Madagascar	4042	3198	210	230	79	7	2.6	1.3	1.3	–	6.6
Sierra Leone	1166	824	210	180	22	5	2.4	1.7	0.8	*9.1*	*9.6*
Bangladesh	12950	29110	220	240	715	7	3.2	1.4	1.8	604	*4.8*
Lao PDR	–	1760	220	350	22	5	2.5	1	*1.5*	–	–
Malawi	1238	1465	230	170	93	11	5	2.9	2.1	5.5	*7.4*
Rwanda	1163	1128	270	180	74	10	3.5	1.9	*1.6*	4.5	–
Mali	1629	2431	280	250	130	15	5.2	2.8	2.4	3.1	–
Burkina Faso	1709	2325	290	230	219	24	8.5	7	*1.5*	5.8	–
Niger	2538	1860	300	220	126	16	5	3.4	*1.6*	4.1	–
India	172321	324082	330	340	17740	21	6	1.3	4.7	1.6	*1.6*
Kenya	7265	9095	340	280	375	16	4.3	2.7	1.6	7.8	*5.4*
Nigeria	93082	26817	340	260	906	9	2.7	1.2	*1.6*	–	–
China	201688	697647	370	620	12969	11	3.5	2.1	1.4	–	–
Haiti	1462	2043	370	250	193	30	7	3.2	3.8	*4.5*	–
Benin	1405	1522	380	370	79	17	4.3	2.8	*1.6*	–	–
Cent. African Rep.	797	1128	390	340	55	18	4.2	*2.6*	*1.6*	*5.1*	–
Ghana	4445	6315	400	390	204	14	3.5	1.7	1.8	7	–
Pakistan	23690	60649	400	460	–	–	–	–	–	1.5	1
Togo	1136	981	410	310	67	18	4.1	2.5	*1.6*	*5.3*	–
Guinea	–	3686	460	550	106	19	3.9	*2.3*	*1.6*	–	–
Nicaragua	2144	1911	460	380	133	35	8.6	6.7	*1.9*	14.6	–
Sri Lanka	4024	12915	500	700	305	18	3.7	1.8	1.9	4.9	4.8
Mauritania	709	1068	510	460	–	–	–	–	–	–	–
Yemen	–	4790	520	260	–	–	–	–	–	–	–
Honduras	2566	3937	580	600	134	26	4.5	2.9	*1.6*	–	–
Lesotho	368	1029	580	770	–	–	–	–	–	*6.2*	11.5
Indonesia	78013	198079	610	980	2148	12	2	0.7	1.3	2.5	*2.4*
Egypt	22913	47349	610	790	–	–	–	–	–	2.4	*2.8*
Zimbabwe	5355	6522	650	540	416	42	6.2	3.2	3	5.4	*7.6*
Sudan	–	–	–	–	300	12	3.3	0.5	2.8	1.4	–
Zambia	3884	4073	–	400	117	14	3.2	2.2	1	6.1	–

Notes: Figures in italics are for years other than those specified.

Source: World Bank: *World Development Report*, various years.

table cont.

Basic indicators: Economy and health care expenditure (continued)

Country	GDP (million $)		GNP per capita ($)		Total health expenditure, 1990:					Health expend. as % of total govt. exp.	
					million	$ per	as % of GDP:				
	1980	1995	1991	1995	$	capita	Total	Public	Private	1980	1991
Middle-income economies – (lower-middle)											
Bolivia	3 074	6 131	650	800	181	25	4	2.4	*1.6*	–	3.3
Côte d'Ivoire	10 175	10 069	690	660	332	28	3.3	1.7	*1.6*	3.9	–
Senegal	3 016	4 867	720	600	214	29	3.7	2.3	1.4	4.7	–
Philippines	32 500	74 180	730	1 050	883	14	2	1	1	4.5	4.2
Papua New Guinea	2 548	4 901	830	1 160	142	36	4.4	2.8	*1.6*	8.6	–
Cameroon	6 741	7 931	850	650	286	24	2.6	1	*1.6*	5.1	*3.4*
Guatemala	7 879	14 489	930	1 340	283	31	3.7	2.1	1.6	–	*9.9*
Dominican Rep.	6 631	11 277	940	1 460	263	37	3.7	2.1	*1.6*	9.3	*14*
Ecuador	11 733	17 939	1 000	1 390	441	43	4.1	2.6	*2.6*	7.8	*11*
Morocco	18 821	32 412	1 030	1 110	661	26	2.6	0.9	*1.6*	3.4	–
Jordan	–	*6 105*	1 050	1 510	149	48	3.8	1.8	2	*3.7*	*5*
Tajikistan	–	–	1 050	–	532	100	6	4.4	*1.6*	–	–
Peru	20 661	57 424	1 070	2 310	1 065	49	3.2	1.9	1.3	5.6	*5.6*
El Salvador	3 574	9 471	1 080	1 610	317	61	5.9	2.6	3.3	9	7.7
Congo	1 706	2 163	1 120	680	–	–	–	–	–	*5.1*	–
Syrian Arab Rep.	13 062	16 783	1 160	1 120	283	23	2.1	0.4	*1.6*	0.8	*1.9*
Colombia	33 399	76 112	1 260	1 910	1 604	50	4	1.8	2.2	*3.9*	–
Paraguay	4 579	7 743	1 270	1 690	160	37	2.8	1.2	*1.6*	3.6	*4.3*
Uzbekistan *(pe)*	–	21 590	1 350	970	2 388	116	5.9	4.3	*1.6*	–	–
Jamaica	2 679	4 406	1 380	1 510	–	–	–	–	–	–	–
Romania	–	35 533	1 390	1 480	1 455	63	3.9	2.4	1.5	–	9.2
Namibia	2 190	3 033	1 460	2 000	–	–	–	–	–	–	9.7
Tunisia	8 743	18 035	1 500	1 820	614	76	4.9	3.3	*1.6*	7.2	6.3
Kyrgyzstan *(pe)*	–	3 028	1 550	700	517	118	5	3.3	*1.6*	–	–
Thailand	32 354	167 056	1 570	2 740	4 061	73	5	1.1	3.9	4.1	7.4
Georgia *(pe)*	–	2 325	1 640	440	830	152	4.5	2.8	*1.7*	–	–
Azerbaijan *(pe)*	–	3 475	1 670	480	785	98	4.3	2.6	*1.7*	–	–
Turkmenistan *(pe)*	–	–	1 700	–	459	125	5	3.3	*1.7*	–	–
Turkey	68 790	164 789	1 780	2 780	4 281	76	4	1.5	2.5	3.6	3
Poland	57 068	117 663	1 790	2790	3 157	83	5.1	4.1	*1*	–	–
Bulgaria	20 040	12 366	1 840	1 330	1 154	131	5.4	4.4	*1*	–	*4.8*
Costa Rica	4 831	9 233	1 850	2 610	–	–	–	–	–	28.7	32
Algeria	42 345	41 435	1 980	1 600	4 159	166	7	5.4	1.6	–	–
Panama	3 592	7 413	2 130	2 750	–	–	–	–	–	12.7	*20.5*
Armenia *(pe)*	–	2 058	2 150	730	506	152	4.2	2.5	*1.7*	–	–

Notes: Figures in italics are for years other than those specified. *(pe)*: preliminary estimates.

Source: World Bank: *World Development Report*, various years.

table cont.

Basic indicators: Economy and health care expenditure (continued)

Country	GDP (million $)		GNP per capita ($)		Total health expenditure, 1990:					Health expend. as % of total govt. exp.	
					million	$ per	as % of GDP:				
	1980	1995	1991	1995	$	capita	Total	Public	Private	1980	1991
Middle-income economies – (lower-middle)											
Chile	27 572	67 297	2 160	4 160	1 315	100	4.7	3.4	1.4	7.4	–
Iran, Islamic Rep.	*96 989*	–	2 170	–	3 024	54	2.6	1.5	1.1	6.4	7.9
Moldova, Rep. *(pe)*	–	3 518	2 170	920	623	143	3.9	2.9	*1*	–	–
Ukraine *(pe)*	–	80 127	2 340	1 630	6 803	131	3.3	2.3	*1*	–	–
Mauritius	1 132	3 919	2 410	3 380	–	–	–	–	–	7.5	8.7
Czechoslovakia	–	–	2 470	–	2 711	173	5.9	5	0.9	–	*0.4*
Czech Republic	29 123	44 772	–	3 870	–	–	–	–	–	–	–
Slovak Republic	–	17 414	–	2 950	–	–	–	–	–	–	–
Kazakhstan *(pe)*	–	21 413	2 470	1 330	2 572	154	4.4	2.8	*1.7*	–	–
Malaysia	24 488	85 311	2 520	3 890	1 259	67	3	1.3	1.7	–	–
Middle-income economies – (upper-middle)											
Botswana	971	4 318	2 530	3 020	–	–	–	–	–	5.4	*5.1*
South Africa	78 744	136 035	2 560	3 160	5 671	158	5.6	3.2	2.4	–	–
Lithuania	–	7 089	2 710	1 900	594	159	3.6	2.6	*1*	–	–
Hungary	22 163	43 712	2 720	4 120	1 958	185	6	5	0.9	*2.7*	*7.9*
Venezuela	69 377	75 016	2 730	3 020	1 747	89	3.6	2	1.6	8.8	–
Argentina	76 962	281 060	2 790	8 030	4 441	138	4.2	2.5	*1.7*	–	*3*
Uruguay	10 132	17 847	2 840	5 170	383	124	4.6	2.5	2.1	4.9	*4.5*
Brazil	235 025	688 085	2 940	3 640	19 871	132	4.2	2.8	1.4	8	*6.7*
Mexico	194 914	250 038	3 030	3 320	7 648	89	3.2	1.6	1.6	2.4	*1.9*
Belarus	–	20 561	3 110	2 070	1 613	157	3.2	2.2	*1*	–	–
Russian Fed.	–	344 711	3 220	2 240	23 527	157	3	2	*1*	–	–
Latvia	–	6 034	3 410	2 270	–	–	–	–	–	–	–
Trinidad and Tobago	6 236	5 327	3 670	3 770	–	–	–	–	–	5.8	–
Gabon	4 285	4 691	3 780	3 490	–	–	–	–	–	–	–
Estonia	–	4 007	3 830	2 860	–	–	–	–	–	–	–
Portugal	28 526	102 337	5 930	9 740	3 970	383	7	4.3	2.7	10.3	–
Oman	5 982	12 102	6 120	4 820	–	–	–	–	–	2.9	5.4
Puerto Rico	–	–	6 320	–	–	–	–	–	–	–	–
Korea, Rep.	63 661	455 470	6 330	9 700	16 130	377	6.6	2.7	3.9	1.2	2
Greece	40 147	90 550	6 340	8 210	3 609	358	5.5	4.2	1.3	10.3	*8.7*
Saudi Arabia	156 487	125 501	7 820	7 040	4 784	322	4.8	3.1	*1.7*	–	–
Yugoslavia	*82 317*	–	–	–	4 512	205	4	3	*1*	0	*0*

Notes: Figures in italics are for years other than those specified.

(pe): preliminary estimates.

Source: World Bank: *World Development Report*, various years.

table cont.

Basic indicators: Economy and health care expenditure (continued)

Country	GDP (million $)		GNP per capita ($)		Total health expenditure, 1990:					Health expend. as % of total govt. exp.	
					million $	$ per capita	as % of GDP: Total	Public	Private		
	1980	1995	1991	1995						1980	1991
High-income economies/OECD members											
Ireland	20 080	60 780	11 120	14 710	3 068	876	7.1	5.8	1.4	*13.7*	*13*
Israel	22 579	91 965	11 950	15 920	2 301	494	4.2	2.1	2.1	3.6	3.7
New Zealand	22 469	57 070	12 350	14 340	3 150	925	7.2	5.9	1.3	15.2	12
Spain	211543	558617	12450	13580	32375	831	6.6	5.2	1.4	0.7	*13.7*
Hong Kong, China	28 495	143 669	13 430	22 990	4 060	699	5.7	1.1	4.6	–	–
Singapore	11 718	83 695	14 210	26 730	658	219	1.9	1.1	0.8	7	*4.6*
United Kingdom	537 382	1 105 822	16 550	18 700	59 623	1 039	6.1	5.2	0.9	13.5	*13.3*
Australia	160 109	348 782	17 050	18 720	22 736	1 331	7.7	5.4	2.3	10	12.7
Italy	452 648	1 086 932	18 520	19 020	82 214	1 426	7.5	5.8	1.7	12.6	–
Netherlands	171 861	395 900	18 780	24 000	22 423	1 500	7.9	5.7	2.2	11.7	12.4
Belgium	118 022	269 081	18 950	24 710	14 428	1 449	7.5	6.2	1.3	1.6	–
Austria	76 882	233 427	20 140	26 890	13 193	1 711	8.3	5.5	2.8	13.3	12.9
France	664 597	1 536 089	20 380	24 990	105 467	1 869	8.9	6.6	2.3	14.8	*15.3*
Canada	263 193	568 928	20 440	19 380	51 594	1 845	9.1	6.8	2.4	6.7	*5.2*
United States	2 708 150	6 952 020	22 240	26 980	690 667	2 763	12.7	5.6	7	10.4	13.8
Germany	–	2 415 764	23 650*	27 510	120 072	1 511	8	5.8	2.2	19*	_18.1*_
Denmark	66 322	172 220	23 700	29 890	8 160	1 588	6.3	5.3	1	1.8	*1.1*
Finland	51 306	125 432	23 980	20 580	10 200	2 046	7.4	6.2	1.2	10.5	*11.2*
Norway	63 283	145 954	24 220	31 250	7 782	1 835	7.4	7	0.3	10.6	*10.3*
Sweden	125 557	228 679	25 110	23 750	20 055	2 343	8.8	7.9	0.9	2.2	0.8
Japan	1 059 253	5 108 540	26 930	39 640	189 930	1 538	6.5	4.8	1.6	–	–
Switzerland	101 646	300 508	33 610	40 630	16 916	2 520	7.5	5.1	2.4	11.7	–

Notes: Figures in italics are for years other than those specified.

Germany: Data marked '*' refer to FRG before unification.

Source: World Bank: *World Development Report*, various years.

Basic indicators: Health care infrastructure

Country	Population per									
	Doctor				Nurse				Hospital beds	
	1970	1980	1990	1993	1970	1980	1990	1993	1980	1993
Low-income economies										
Mozambique	18 860	39 142	–	36 225	4 280	4 629	–	4 937	918	1 156
Tanzania, United Rep.	22 600	–	24 880	–	3 310	–	5 470	–	716	976
Ethiopia	86 120	88 124	32 650	32 499	–	4 998	–	13 628	3 384	4 141
Uganda	9 210	21 405	–	22 399	–	2 009	–	6 762	661	760
Bhutan	–	–	13 110	–	–	–	–	–	–	–
Guinea-Bissau	17 500	7 491	–	–	2 820	1 130	–	–	562	671
Nepal	51 360	30 062	16 830	13 634	17 700	7 783	2 760	2 257	5 728	4 210
Burundi	58 570	–	–	17 153	6 870	–	–	4 778	–	1 519
Chad	61 900	–	30 030	30 030	8 010	–	–	64 403	–	1 373
Madagascar	10 120	9 891	8 130	8 385	240	1 721	–	3 736	–	1 072
Sierra Leone	17 830	17 305	–	–	2 700	1 869	–	–	823	–
Bangladesh	8 450	8 424	–	12 884	65 780	14 750	–	11 549	4 702	5 479
Lao PDR	15 160	–	4 380	4 446	1 390	–	490	493	–	405
Malawi	76 580	53 605	45 740	44 205	5 330	3 024	1 800	–	–	1 184
Rwanda	59 600	31 482	72 990	24 967	5 610	10 314	4 190	8 133	654	1 152
Mali	44 090	25 444	19 450	18 376	2 590	2 322	1 890	5 297	–	–
Burkina Faso	97 120	54 819	57 320	34 804	–	3 073	1 680	9 649	–	3 300
Niger	60 090	–	34 850	53 986	5 610	–	650	3 765	–	–
India	4 890	2 694	2 460	2 459	3 710	4 674	–	3 323	1 299	1 371
Kenya	8 000	10 071	10 130	21 970	2 520	983	–	8 675	–	602
Nigeria	19 830	8 853	–	5 208	4 240	1 089	–	1 450	1 154	157
China	–	1 100	–	1 063	2 500	2 100	–	1 490	500	612
Haiti	12 520	9 079	–	10 855	7 410	–	–	8 945	1 350	1 251
Benin	28 570	16 980	–	14 216	2 600	2 157	–	4 182	684	4 182
Cent. African Rep.	44 740	23 364	25 930	25 920	2 460	1 826	–	11 309	642	1 140
Ghana	12 910	–	22 970	22 970	690	621	1 670	3 608	–	685
Pakistan	4 310	3 500	2 940	1 923	6 600	5 870	5 040	3 330	1 742	1 769
Togo	28 860	18 813	–	11 385	1 590	1 225	–	3 060	–	664
Guinea	50 010	45 457	–	7 445	3 720	5 056	–	5 166	–	1 712
Nicaragua	2 150	2 308	1 450	2 039	–	598	–	–	–	549
Sri Lanka	5 900	7 172	–	6 843	1 280	1 262	–	1 745	340	365
Mauritania	17 960	–	–	15 772	3 740	–	–	2 261	–	1 486
Yemen	34 790	6 912	–	4 498	–	2 014	–	1 833	–	1 196
Honduras	3 770	3 100	3 090	1 266	1 470	–	–	4 582	775	1 276
Lesotho	30 400	–	–	24095	3 860	–	–	2 040	–	–
Indonesia	26 820	12 458	7 030	7 028	4 810	–	–	2 732	–	1 423
Egypt	1 900	939	1 320	1 316	2 320	762	490	489	493	517
Zimbabwe	6 300	6 105	7 180	7 384	640	921	1 000	1 594	–	–
Sudan	14 520	8 803	–	–	990	1 408	–	–	1 086	919
Zambia	13 640	13 221	11 290	10 917	1 730	1 693	600	4 937	289	–

Notes: Data refer to year indicated or closest year available.

Source: World Bank: *World Development Report*, various years.

table cont.

Basic indicators: Health care infrastructure (continued)

Country	Population per									
	Doctor				Nurse				Hospital beds	
	1970	1980	1990	1993	1970	1980	1990	1993	1980	1993
Middle-income economies – (lower-middle)										
Bolivia	2 020	1 911	–	2 348	3 070	–	–	7 048	–	709
Côte d'Ivoire	15 520	–	–	11 739	1 930	–	–	3 244	–	1 223
Senegal	15 810	12 683	17 650	18 192	1 670	1 931	–	13 174	–	1 923
Philippines	9 270	7 848	8 120	8 273	2 690	2 591	–	–	589	780
Papua New Guinea	11 640	16 073	12 870	12 754	1 710	1 000	1 180	1 569	180	290
Cameroon	28 920	–	12 190	11 996	2 560	–	1 690	1 999	–	381
Guatemala	3 660	–	–	3 999	–	1 360	–	7 087	–	1 191
Dominican Rep.	–	–	–	949	1 400	1 239	–	9 423	–	506
Ecuador	2 910	–	980	652	2 680	–	620	1 853	524	608
Morocco	13 090	18 558	4 840	4 665	–	898	1 050	–	814	775
Jordan	2 480	1 272	770	554	870	875	500	548	795	533
Tajikistan	–	422	350	424	–	152	–	139	100	95
Peru	1 920	1 395	–	939	–	–	–	–	–	664
El Salvador	4 100	3 046	–	1 515	890	–	–	3 233	–	680
Congo	9 510	8 425	–	3 713	780	595	–	1 401	–	306
Syrian Arab Rep.	3 860	2 243	1 160	1 159	1 790	1 372	870	1 047	905	920
Colombia	2 260	–	–	1 105	–	–	–	2 717	627	732
Paraguay	2 300	1 746	–	1 231	2 210	–	–	7 098	–	762
Uzbekistan *(pe)*	–	347	280	282	–	118	–	86	87	106
Jamaica	2 630	2 786	–	6 420	530	–	–	489	–	476
Romania	840	678	560	538	430	280	–	–	114	127
Namibia	–	–	4 620	4 328	–	–	–	317	–	207
Tunisia	5 930	3 694	1 870	1 549	940	956	300	411	470	350
Kyrgyzstan *(pe)*	–	343	280	303	–	115	–	105	83	92
Thailand	8 290	6 803	5 000	4 416	1 170	2 280	550	1 067	651	765
Georgia *(pe)*	–	208	170	182	–	90	–	85	94	95
Azerbaijan *(pe)*	–	298	250	257	–	118	–	106	103	96
Turkmenistan *(pe)*	–	349	290	306	–	125	–	100	94	93
Turkey	2 230	1 642	1 260	976	1 010	1 239	–	1 098	445	403
Poland	700	560	490	451	250	227	–	189	178	180
Bulgaria	540	407	320	306	240	190	–	162	90	101
Costa Rica	1 620	–	1 030	1 133	460	–	–	2 213	302	–
Algeria	8 100	–	2 330	1 062	–	–	330	330	–	390
Panama	1 660	1 010	840	562	1 560	–	–	1 069	–	–
Armenia *(pe)*	–	284	250	261	–	122	–	101	119	120

Notes: Data refer to year indicated or closest year available.

(pe): preliminary estimates.

Source: World Bank: *World Development Report*, various years.

table cont.

Basic indicators: Health care infrastructure (continued)

Country	Population per									
	Doctor				Nurse				Hospital beds	
	1970	1980	1990	1993	1970	1980	1990	1993	1980	1993
Middle-income economies – (lower-middle)										
Chile	2 160	–	2 150	942	460	–	340	–	293	320
Iran, Islamic Rep.	3 270	2 949	3 140	3 142	1 780	1 179	1 150	–	675	724
Moldova Rep. *(pe)*	–	320	250	250	–	105	–	90	83	80
Ukraine *(pe)*	–	274	230	227	–	97	–	87	80	77
Mauritius	4 190	1 920	1 180	1 165	610	627	–	392	320	347
Czechoslovakia	470	–	310	–	170	–	–	–	–	–
Czech Republic	–	–	–	273	–	–	–	–	–	122
Slovak Republic	–	–	–	287	–	–	–	105	–	11
Kazakhstan *(pe)*	–	312	250	254	–	99	–	91	76	75
Malaysia	4 310	3 917	2 700	2 441	1 270	570	380	480	439	437
Middle-income economies – (upper-middle)										
Botswana	15 220	8 122	5 150	5 151	1 900	700	–	480	421	635
South Africa	–	–	1 750	–	300	–	–	–	–	–
Lithuania	–	255	220	235	–	92	–	92	83	84
Hungary	510	400	340	306	210	157	–	321	110	97
Venezuela	1 120	1 188	630	633	440	–	330	329	2 969	385
Argentina	530	–	–	330	960	–	–	1 783	–	218
Uruguay	910	501	–	–	–	–	–	–	–	221
Brazil	2 030	1 301	–	844	4 140	–	–	3 379	–	299
Mexico	1 480	1 149	–	615	1 610	–	–	–	–	1 704
Belarus	–	295	250	236	–	102	–	89	80	80
Russian Fed.	–	248	210	222	–	88	–	90	77	77
Latvia	–	242	200	278	–	102	–	118	73	82
Trinidad and Tobago	2 250	1 377	–	1 520	190	381	–	247	–	308
Gabon	5 250	2 184	–	1 987	570	225	–	–	–	305
Estonia	–	239	210	253	–	95	–	127	80	104
Portugal	1 110	494	490	353	820	–	–	–	–	227
Oman	8 380	2 142	1 060	1 131	3 420	907	400	–	617	398
Puerto Rico	–	–	–	–	–	–	–	–	–	–
Korea, Rep.	2 220	1 690	1 370	951	1 190	–	–	454	586	300
Greece	620	411	580	312	990	370	–	403	161	197
Saudi Arabia	7 460	1 819	660	749	2 070	738	420	329	686	401
Yugoslavia	1 000	290	530	232	420	–	110	810	71	73

Notes: Data refer to year indicated or closest year available.

(pe): preliminary estimates.

Source: World Bank: *World Development Report*, various years.

table cont.

Basic indicators: Health care infrastructure (continued)

Country	Population per								
	Doctor				Nurse			Hospital beds	
	1970	1980	1990	1993	1970	1980	1993	1980	1993
High-income economies/OECD members									
Ireland	980	784	630	632	160	141	153	103	101
Israel	410	401	–	–	–	130	–	197	164
New Zealand	870	638	–	518	150	81	–	–	149
Spain	750	361	280	261	–	281	262	–	209
Hong Kong, China	1 510	1 211	–	–	560	795	–	249	234
Singapore	1 370	1 111	820	714	250	321	–	239	275
United Kingdom	810	611	–	–	240	207	202	107	161
Australia	830	559	–	–	–	146	–	–	178
Italy	550	750	210	207	–	250	333	–	131
Netherlands	800	480	410	399	300	168	123	80	170
Belgium	650	401	310	274	–	130	–	107	121
Austria	540	440	230	230	300	170	70	90	95
France	750	462	350	334	270	110	–	–	109
Canada	680	560	450	464	140	122	107	–	150
United States	630	549	420	420	160	196	121	171	194
Germany	580	452	370	367	–	–	–	–	118
Denmark	690	420	390	360	–	140	153	–	177
Finland	960	530	410	406	130	100	101	64	93
Norway	720	524	–	308	160	70	73	67	210
Sweden	730	454	370	394	140	107	108	68	161
Japan	890	740	610	608	310	210	–	89	64
Switzerland	700	–	630	580	–	128	–	–	93

Notes: Data refer to year indicated or closest year available.

Source: World Bank: *World Development Report*, various years.

Basic indicators: Health care utilization, OECD only. (Average length of stay of inpatient care (days), 1970–1995)

Country	1970	1980	1990	1991	1992	1993	1994	1995
Australia				15.9	15.9	15.9	15.7	15.6
Austria	22.2	17.9	13.0	12.4	12.0	11.5	11.2	10.9
Belgium		19.5	13.8	13.0	12.3	12.0	11.7	11.5
Canada	11.5	13.1	13.0	12.7	12.6			12.2
Czech Republic		16.4	15.4	15.0	14.4	14.0	13.5	12.8
Denmark	18.1	12.7	8.0	7.8	7.5	7.6	7.5	7.3
Finland	24.4	21.6	18.2	18.8	16.6	14.8	13.1	11.8
France	18.3	16.7	13.3	11.9	11.7	11.7	11.7	11.2
Germany	23.7	19.0	17.2	16.9	16.3	15.8	15.4	15.0
Greece	15.0	13.3	9.9	9.9	9.2	8.8	8.5	8.2
Hungary	15.4	14.2	12.6	12.4	12.0	11.8	11.3	10.8
Iceland	28.3	23.0	18.3	17.8	16.8			
Ireland	13.3	9.7	7.9	7.8	7.7	7.6	7.4	7.2
Italy	19.1	13.5	11.7	11.6	11.2	11.1	10.8	10.1
Japan	55.3	55.9	50.5	49.3	47.9	46.4	45.5	44.2
Korea, Rep.		11.0	13.0	13.0	13.0	13.0	13.0	13.0
Luxembourg	27.0	23.2	17.6	17.6	16.5	15.7	15.5	15.3
Mexico			4.4	4.4	4.5	4.4	4.3	4.2
Netherlands	38.2	34.7	34.1	33.8	33.5	33.3	32.7	32.8
New Zealand	15.8	12.5	9.6	8.9	8.2	7.7	7.5	6.9
Norway	21.0	14.3					10.1	10.0
Poland			12.5	12.3	11.8	11.4	11.0	10.8
Portugal	23.8	14.4	10.8	10.5	10.1	9.9	9.5	9.8
Spain		14.8	12.2	11.9	11.5	11.5	11.3	11.2
Sweden	27.2	23.2	18.0	16.8	10.1	9.4	8.1	7.8
Switzerland	26.0	24.7						
Turkey	9.0	9.0	6.9	6.8	6.9	6.7	6.5	6.4
United Kingdom	25.7	19.1	15.6	14.1	12.4	10.2	10.0	9.9
United States	14.9	10.0	9.1	9.0	8.8	8.5	8.2	8.0

Source: OECD Health Data 1998.

Basic indicators: Health care utilization, OECD only. (Number of bed days of inpatient care per capita, 1970–1995)

Country	1970	1980	1990	1991	1992	1993	1994	1995
Australia	3.4	3.4	3.9	2.7	2.8	2.8	2.7	2.6
Austria	3.4	3.5	3.0	2.9	2.9	2.8	2.7	2.7
Belgium	2.3	2.7	2.6	2.5	2.4	2.4	2.4	2.3
Canada	2.0	2.1	2.0	2.0	2.0	2.0	1.9	1.9
Czech Republic		3.4	3.0	2.9	2.8	2.8	2.8	2.7
Denmark	2.6	2.3	1.7	1.6	1.6	1.6	1.5	1.5
Finland	5.0	4.9	4.1	3.3	3.9	3.6	3.3	3.2
France	3.4	3.6	2.9	2.8	2.8	2.7	2.7	2.6
Germany	3.6	3.6	3.3	3.1	3.1	3.0	3.0	3.0
Greece	1.6	1.5	1.2	1.3	1.3	1.3	1.3	1.3
Hungary	2.6	2.7	2.8	2.7	2.7	2.6	2.6	2.5
Iceland	4.6	5.1	5.2	5.0	5.0	4.9	4.7	4.5
Ireland			1.2	1.2	1.2	1.2	1.1	1.1
Italy	3.0	2.5	1.8	1.7	1.7	1.8	1.7	1.6
Japan	3.0	3.4	4.1	4.1	4.1	4.1	4.1	4.1
Korea, Rep.		0.2	0.7	0.7	0.7	0.8	0.9	0.8
Luxembourg	3.6	3.9	3.7	3.7	3.3	3.3	3.0	2.8
Mexico		0.2	0.2	0.2	0.2	0.2	0.2	0.2
Netherlands	3.8	4.1	3.7	3.7	3.7	3.7	3.7	3.6
New Zealand	3.0	2.7	2.1	1.6	1.6	1.6	1.6	1.5
Norway	2.8	5.3	5.0	5.0	4.9	4.8	4.6	4.5
Poland							2.6	2.6
Portugal	1.6	1.2	1.1	1.1	1.1	1.1	1.1	1.1
Spain	1.3	1.4	1.2	1.2	1.2	1.2	1.1	1.1
Sweden	4.5	4.3	3.5	3.4	2.0	1.8	1.6	1.4
Switzerland	3.4	3.0	2.9	2.9	2.8	2.8	2.8	2.7
Turkey	0.4	0.3	0.4	0.4	0.4	0.5	0.4	0.4
United Kingdom	2.9	2.4	2.0	2.0	1.9	1.9	1.9	1.7
United States	2.3	1.7	1.2	1.2	1.2	1.1	1.1	1.1

Source: OECD Health Data 1998.

Basic indicators: Health care utilization, OECD only. (Inpatient care: beds per 1,000 population, 1970–1995)

Country	1970	1980	1990	1991	1992	1993	1994	1995
Australia	11.4	12.3		9.2	8.9	8.9	8.8	8.8
Austria	10.8	11.2	10.2	9.9	9.7	9.5	9.4	9.3
Belgium	8.3	9.4	8.0	7.9	7.7	7.7	7.4	7.3
Canada	7.0	6.7	6.2	6.3	6.0	5.6	5.4	5.1
Czech Republic		11.3	11.3	11.1	10.7	10.4	10.2	9.5
Denmark	8.1	8.1	5.6	5.4	5.1	5.0	5.0	4.9
Finland	15.1	15.6	12.5	11.3	11.0	10.0	10.0	9.3
France		11.1	9.7	9.6	9.4	9.2	9.0	8.9
Germany	8.8	9.0	8.3	10.1	9.9	9.7	9.7	9.7
Greece	6.2	6.2	5.1	5.0	5.0	5.0	5.0	5.0
Hungary	8.1	9.1	10.1	10.0	9.8	9.8	9.9	9.2
Iceland	13.0	14.9	16.7	16.3	15.9	15.5	15.2	15.0
Ireland		5.2	3.9	3.9	3.9	3.8	3.8	3.8
Italy	10.5	9.7	7.2	6.8	6.8	6.7	6.5	6.2
Japan	12.7	13.8	16.0	16.1	16.2	16.2	16.2	16.2
Korea, Rep.		1.7	3.1	3.3	3.5	3.7	4.1	4.4
Luxembourg	12.6	12.8	11.7	11.5	11.3	11.5	11.0	10.8
Mexico		0.9	0.7	1.0	1.1	1.2	1.2	1.2
Netherlands	11.4	12.3	11.5	11.4	11.4	11.3	11.3	11.3
New Zealand	10.8	10.2	8.5	7.6	7.2			
Norway		16.5		16.4	16.2	15.9	15.4	15.1
Poland	5.2	5.6	5.7	5.7	5.6	5.6	5.6	5.5
Portugal	6.3	5.2	4.6	4.5	4.5	4.4	4.3	4.1
Spain	4.7	5.4	4.3	4.2	4.1	4.1	4.0	4.0
Sweden	15.3	15.1	12.4	11.9	7.6	7.0	6.5	6.1
Switzerland				20.6				
Turkey	2.0	2.2	2.1	2.4	2.4	2.5	2.5	2.5
United Kingdom	9.4	8.1	5.9	5.6	5.4	5.1	4.9	4.7
United States	7.9	6.0	4.9	4.8	4.6	4.5	4.3	4.1

Source: OECD Health Data 1998.

Basic indicators: Health care utilization, OECD only. (Inpatient occupancy rate: % of available beds, 1970–1995)

Country	1970	1980	1990	1991	1992	1993	1994	1995
Australia				81.5	85.3	85.6	85.2	82.9
Austria	86.4	84.4	81.7	81.0	80.7	80.3	80.0	79.4
Belgium		85.7	86.5	86.0	84.6	83.5	83.4	83.6
Canada		82.8	84.7	84.1	83.6	84.2		
Czech Republic		81.1	71.9	71.6	72.9	73.6	75.2	77.6
Denmark		78.7	82.7	83.5	86.3	84.8	83.8	81.3
Finland	91.0	86.0	82.0	80.3	79.7	84.9	90.3	87.7
France		81.1	80.4	80.4	80.5	80.5	80.8	81.1
Germany	88.6	84.9	86.5	84.3	84.6	84.0	83.2	83.3
Greece	76.0	69.0	68.0	71.0	70.0	69.0	69.4	
Hungary	89.8	86.0	77.7	77.1	76.4	73.9	74.2	74.4
Iceland	98.3	94.3	86.2	84.0				
Ireland		80.1	85.3	83.7	84.0	84.3	83.6	83.2
Italy	77.9	68.9	70.4	70.0	71.4	72.5	72.7	72.0
Japan	81.6	83.3	83.6	83.6	82.8	82.5	83.1	83.6
Korea, Rep.		60.7	80.6	78.8	77.3	75.1	75.8	65.5
Luxembourg		82.6	82.9	82.2	81.4	73.4	75.0	
Mexico		52.9	67.2	64.5	66.3	66.7	67.9	66.5
Netherlands		90.9	88.5	88.7	88.7	88.6	88.6	88.5
New Zealand			57.3	57.3				
Norway		86.3	82.9	82.8	82.2	83.8	83.0	82.2
Poland								
Portugal	74.1	62.6	69.4	69.4	68.6	70.3	68.7	71.0
Spain		70.0	76.2	76.7	76.8	77.6	76.7	
Sweden		83.0	84.2	84.7	81.7	83.0	82.1	82.1
Switzerland		84.6	82.4	82.6				
Turkey	52.0	42.0	56.9	53.8	57.5	57.8	57.4	57.4
United Kingdom	82.1	81.4						
United States	80.3	77.7	69.7	69.1	68.7	67.6	66.0	66.0

Source: OECD Health Data 1998.

TEN COUNTRY PROFILES

B

This section provides more details on the health care sector in ten selected countries, i.e. in roughly 10% of the countries listed in Section A of this statistical annex. The scope and structure of national health data varies greatly from country to country, ranging from schemes or systems which provide very detailed mappings of utilization and provider behaviour to those which only publish highly aggregated data. This section intends to give modellers the utmost possible information. Thus, all available useful data were collected but no effort was made to subject them to a fully identical structure although, whenever feasible, information is grouped under three headings:

- demography,
- health care infrastructures and
- health care utilization and cost.

The data provided may not be fully compatible with the country data displayed in Section A, owing to different data sources. Nevertheless, these ten country profiles will help the modeller to judge the plausibility of data being worked within a national context. The statistics can also be used to establish provisional model hypotheses in cases where national or scheme-specific data are not available. For example, age specific utilization or expenditure profiles of another country or scheme can be used to test the sensitivity of the overall cost of a scheme to different utilization or cost patterns.

1. Australia

I. Australia: Demography

AUS 1
Resident population[1] by age and sex, 1996/1997

Ages	Males	Females	All	Percentage
0–4	674 481	640 113	1 314 594	7.09
5–9	677 911	645 266	1 323 177	7.13
10–14	678 902	646 494	1 325 396	7.14
15–19	663 786	632 039	1 295 825	6.98
20–24	718 001	697 093	1 415 094	7.63
25–34	1 449 778	1 450 354	2 900 132	15.63
35–44	1 421 099	1 427 053	2 848 152	15.35
45–54	1 187 096	1 152 403	2 339 499	12.61
55–64	783 808	774 450	1 558 258	8.40
65–74	621 580	690 882	1 312 462	7.07
74+	350 238	569 501	919 739	4.96
Total	**9 226 680**	**9 325 648**	**18 552 328**	**100.00**

[1] Preliminary population estimates at 30.6.97.

II. Australia: Health care infrastructure

AUS 2
Persons employed in selected health occupations, 1986

Occupation	Number	Percentage	Rate per 1 000 population
Dental nurses	8 880	3.5	0.55
Dentists	6 310	2.5	0.39
Medical practitioners			
General practitioners	23 790	9.4	1.49
Specialists	9 000	3.5	0.56
Nurses			
Enrolled	35 220	13.9	2.20
Registered	138 220	54.4	8.63
Occupational therapists	2 770	1.1	0.17
Pharmacists	10 640	4.2	0.66
Physiotherapists	5 930	2.3	0.37
Radiographers	4 270	1.7	0.27
Speech pathologists	1 320	0.5	0.08
Total employed in all health occupations	253 972	100	15.86
Total population (adjusted mid-year estimates)	16 018 000		

Source: Australia Institute of Health and Welfare: *Australia's health* 1992; population data: UN.

AUS 3
Hospitals and beds: 1982/83 to 1988/89

	82/83	83/84	84/85	85/86	86/87	87/88	88/89
Number of hospitals							
Public	771	748	745	34	720	729	723
Private	341	338	335	333	333	335	337
All	1 112	1 086	1 080	1 067	1 053	1 064	1 060
Number of beds (000s)							
Public hospitals	74.2	71.0	70.8	69.7	66.2	65.8	65.0
Private hospitals	20.1	20.6	20.7	21.0	21.4	21.7	22.1
All hospitals	94.4	91.7	91.5	90.8	87.6	87.5	87.1
Beds per 1 000 population	6.1	5.9	5.8	5.7	5.4	5.3	5.2

Source: Department of Health, Housing and Community Services Annual Reports.

III. Australia: Health care utilization and cost

AUS 4
Number of services by age and sex, average number per resident, and percentage distribution, 1996/1997

Ages	Male			Female			All	
	No. services	Average	%	No. services	Average	%	No. services	%
0–4	6 376 452	9.45	3.21	5 556 815	8.68	2.80	11 933 267	6.00
5–9	3 501 566	5.17	1.76	3 325 937	5.15	1.67	6 827 503	3.43
10–14	3 006 374	4.43	1.51	2 942 277	4.55	1.48	5 948 651	2.99
15–19	3 184 833	4.8	1.60	5 286 423	8.36	2.66	8 471 256	4.26
20–24	3 698 464	5.15	1.86	7 987 382	11.46	4.02	11 685 846	5.88
25–34	8 512 087	5.87	4.28	19 403 577	13.38	9.76	27 915 664	14.04
35–44	10 004 005	7.04	5.03	17 288 660	12.11	8.70	27 292 665	13.73
45–54	11 246 469	9.47	5.66	16 224 713	14.08	8.16	27 471 182	13.82
55–64	11 295 703	14.41	5.68	13 050 150	16.85	6.56	24 345 853	12.25
65–74	11 729 346	18.87	5.90	13 914 815	20.14	7.00	25 644 161	12.90
75+	7 290 715	20.82	3.67	13 973 701	24.54	7.03	21 264 416	10.70
Total	**79 846 014**	**8.65**	**40.16**	**118 954 450**	**12.76**	**59.84**	**198 800 464**	**100.00**

Source: Health Insurance Commission: *Annual Report 1996–97.*

AUS 5

Value of benefits by age and sex of patient, average value of benefits per resident, and percentage distribution of benefit value, 1996/1997

Ages	Male			Female			All	
	Value $m	Average value $	%	Value $m	Average value $	%	Value $m	%
0–4	163.870	242.96	2.66	138.904	217		302.774	4.92
5–9	93.521	137.95	1.52	84.431	130.85	1.37	177.952	2.89
10–14	86.981	128.12	1.41	81.280	125.72	1.32	168.261	2.73
15–19	93.284	140.53	1.51	141.765	224.3	2.30	235.049	3.82
20–24	107.054	149.1	1.74	215.633	309.33	3.50	322.687	5.24
25–34	253.840	175.09	4.12	579.946	399.87	9.42	833.786	13.54
35–44	313.070	220.3	5.08	558.345	391.26	9.07	871.415	14.15
45–54	371.800	313.2	6.04	531.789	461.46	8.64	903.589	14.67
55–64	382.301	487.75	6.21	422.236	545.21	6.86	804.537	13.07
65–74	401.273	645.57	6.52	450.655	652.29	7.32	851.928	13.83
75+	241.217	688.72	3.92	444.761	780.97	7.22	685.978	11.14
Total	**2 508.211**	**271.84**	**40.73**	**3 649.745**	**391.37**	**59.27**	**6 157.956**	**100.00**

Source: Health Insurance Commission: *Annual Report 1996–97.*

AUS 6

Medicare-enrolled persons by number of services, age and sex for services 1 July 1995 to 30 June 1996 (percentages)

Number of services	Age range											
	0–4	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65–74	75+	Total
Male												
0	6.56	13.97	18.26	18.78	20.06	21.88	19.59	15.17	11.29	12.95	20.03	16.83
1	6.65	12.54	15.03	14.58	13.69	13.60	12.56	10.65	6.81	4.56	3.87	11.07
2	7.28	11.68	12.84	11.96	10.98	10.61	9.65	8.14	5.49	3.87	3.23	9.07
3	7.49	10.21	10.44	9.72	8.89	8.39	7.68	6.60	4.77	3.45	2.70	7.52
4	7.28	8.75	8.40	7.85	7.34	6.87	6.46	5.74	4.56	3.39	2.70	6.44
5	6.93	7.26	6.69	6.49	6.14	5.80	5.65	5.78	4.43	3.28	2.51	5.61
6	6.42	6.01	5.40	5.32	5.12	4.86	4.88	4.87	4.36	3.34	2.46	4.91
7	5.85	4.99	4.32	4.34	4.28	4.07	4.25	4.43	4.11	3.26	2.42	4.27
8	5.30	4.09	3.44	3.53	3.59	3.41	3.65	3.93	3.90	3.21	2.42	3.71
9	4.74	3.36	2.74	2.88	2.97	2.88	3.10	3.52	3.63	3.10	2.34	3.22
10	4.26	2.79	2.23	2.40	2.46	2.40	2.67	3.17	3.36	2.97	2.27	2.81
11–12	7.03	4.21	3.22	3.52	3.77	3.73	4.35	5.29	6.09	5.60	4.44	4.61
13–15	7.76	3.99	2.91	3.36	3.63	3.68	4.47	5.92	7.49	7.45	6.22	5.01
16–20	7.71	3.37	2.27	2.79	3.16	3.38	4.42	6.32	9.07	9.90	8.93	5.25
21–25	3.36	1.25	0.78	1.02	1.25	1.42	2.01	3.08	5.01	6.01	5.84	2.56
26–30	2.71	0.85	0.53	0.73	0.97	1.18	1.72	2.85	5.00	6.57	6.89	2.40
31–40	1.72	0.45	0.31	0.45	0.61	0.87	1.36	2.36	4.55	6.58	7.47	2.05
41–50	0.54	0.13	0.09	0.15	0.24	0.37	0.61	1.09	2.28	3.64	4.47	1.00
51+	0.41	0.08	0.08	0.14	0.29	0.60	0.93	1.58	3.79	6.88	8.78	1.67
All males	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

AUS 6 (continued)
Medicare-enrolled persons by number of services, age and sex for services 1 July 1995 to 30 June 1996 (percentages)

Number of services	Age range											
	0–4	5–9	10–14	15–19	20–24	25–34	35–44	45–54	55–64	65–74	75+	Total
Female												
0	7.34	14.23	18.16	11.35	7.34	8.48	9.31	7.74	7.07	8.28	12.62	9.75
1	7.50	12.92	15.36	10.27	5.69	5.33	6.67	5.74	4.38	3.14	2.13	6.83
2	7.97	11.77	12.95	9.43	5.82	5.07	5.79	5.01	4.05	3.09	2.19	6.28
3	8.00	10.28	10.38	8.24	5.88	5.28	5.96	4.99	4.08	3.10	2.21	5.99
4	7.73	8.63	8.22	7.11	5.79	5.25	5.76	5.00	4.12	3.22	2.38	5.62
5	7.29	7.19	6.58	6.24	5.50	5.04	5.39	4.86	4.18	3.22	2.42	5.21
6	6.63	5.95	5.22	5.45	5.24	4.74	5.05	4.69	4.10	3.30	2.47	4.79
7	5.95	4.92	4.21	4.77	4.91	4.49	4.68	4.50	4.04	3.31	2.53	4.42
8	5.29	4.03	3.33	4.21	4.57	4.20	4.32	4.23	3.94	3.27	2.56	4.05
9	4.67	3.28	2.70	3.63	4.15	3.92	3.95	4.02	3.71	3.22	2.56	3.70
10	4.07	2.73	2.19	3.22	3.86	3.61	3.60	3.76	3.55	3.16	2.53	3.38
11–12	6.71	4.10	3.23	5.29	6.85	6.46	6.32	6.74	6.62	6.04	5.11	5.95
13–15	7.05	3.98	2.96	5.86	8.15	7.95	7.52	8.22	8.59	8.20	7.44	7.16
16–20	6.73	3.27	2.42	6.15	9.58	9.69	8.65	9.94	10.88	11.25	10.91	8.48
21–25	2.81	1.22	0.87	2.95	5.09	5.52	4.61	5.38	6.30	7.04	7.19	4.66
26–30	2.18	0.83	0.62	2.58	4.85	5.68	4.50	5.35	6.58	7.79	8.50	4.70
31–40	1.35	0.44	0.38	1.94	3.90	5.07	3.93	4.68	6.17	7.92	9.20	4.25
41–50	0.40	0.12	0.12	0.73	1.54	2.12	1.79	2.20	3.14	4.33	5.34	2.02
51+	0.30	0.08	0.10	0.57	1.29	2.07	2.22	2.94	4.51	7.12	9.73	2.75
All females	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
All persons												
0	6.94	14.09	18.21	15.15	14.05	15.19	14.45	11.52	9.20	10.51	15.41	13.27
1	7.07	12.73	15.19	12.48	9.74	9.47	9.62	8.24	5.61	3.82	2.78	8.94
2	7.62	11.72	12.90	10.72	8.44	7.84	7.72	6.60	4.78	3.46	2.58	7.67
3	7.74	10.24	10.41	9.00	7.41	6.84	6.82	5.81	4.43	3.27	2.39	6.75
4	7.50	8.69	8.31	7.49	6.57	6.06	6.11	5.38	4.34	3.31	2.50	6.03
5	7.10	7.23	6.64	6.37	5.82	5.42	5.52	5.07	4.31	3.25	2.45	5.41
6	6.52	5.98	5.31	5.38	5.18	4.80	4.97	4.78	4.23	3.32	2.46	4.85
7	5.90	4.96	4.27	4.55	4.59	4.28	4.46	4.48	4.08	3.28	2.49	4.35
8	5.29	4.06	3.39	3.86	4.09	3.80	3.98	4.08	3.92	3.24	2.51	3.88
9	4.71	3.32	2.72	3.25	3.55	3.40	3.53	3.76	3.67	3.16	2.48	3.46
10	4.17	2.76	2.21	2.80	3.15	3.01	3.13	3.46	3.45	3.07	2.44	3.10
11–12	6.88	4.17	3.22	4.38	5.29	5.09	5.33	6.00	6.35	5.83	4.86	5.28
13–15	7.41	3.98	2.94	4.58	5.86	5.81	6.00	7.05	8.03	7.84	6.98	6.09
16–20	7.24	3.32	2.34	4.43	6.33	6.53	6.53	8.10	9.96	10.60	10.17	6.87
21–25	3.09	1.24	0.83	1.97	3.15	3.47	3.31	4.21	5.64	6.55	6.68	3.62
26–30	2.45	0.84	0.58	1.63	2.88	3.43	3.11	4.08	5.78	7.21	7.90	3.56
31–40	1.54	0.45	0.34	1.18	2.24	2.97	2.65	3.50	5.35	7.28	8.55	3.16
41–50	0.47	0.12	0.11	0.43	0.88	1.25	1.20	1.64	2.71	4.00	5.01	1.52
51+	0.36	0.08	0.09	0.35	0.79	1.34	1.57	2.25	4.15	7.00	9.37	2.21
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Source: Health Insurance Commission: *Annual Report 1996–97*.

AUS 7
Medical services processed under Medicare, selected years

Type of service	Percentage of Medicare claims			
	1984/85	1986/87	1988/89	1990/91
GP attendances	57.3	55.5	55.9	57.8
Specialists attendances	9.9	9.8	9.5	10.2
Obstetrics	0.5	0.5	0.5	0.4
Anaesthetics	1.1	1.0	1.0	1.0
Pathology	19.6	21.1	22.0	17.8
Diagnostic imaging	4.5	5.0	5.0	5.7
Operations	2.8	3.2	2.6	3.1
Optometry	1.3	1.5	1.5	1.8
Other	3.0	2.4	2.0	2.2
Total	**100.0**	**100.0**	**100.0**	**100.0**
Total number of services (000s)	**113 103**	**128 844**	**143 357**	**146 875**

Source: Department of Health, Housing and Community Services.

AUS 8
Number and amount of benefits according to types of services, 1996/97

Type of service	Number of services	Percentage	Amount of benefits $ (millions)	Percentage	Average benefit per service $
All unreferred attendances:	102 529 070	51.57	2 339.712	37.99	22.82
– *general practitioner/VRGP*	*89 619 607*	*45.08*	*2 065.237*	*33.54*	*23.04*
– *other*	*12 909 463*	*6.49*	*274.475*	*4.46*	*21.26*
Specialist attendances	18 186 324	9.15	897.738	14.58	49.36
Obstetrics	1 627 637	0.82	56.817	0.92	34.91
Anaesthetics	1 742 676	0.88	125.705	2.04	72.13
All pathology:	50 276 890	25.29	857.769	13.93	17.06
– *pathology collection items*	*16 882 061*	*8.49*	*174.494*	*2.83*	*10.34*
– *pathology other*	*33 394 829*	*16.80*	*683.275*	*11.10*	*20.46*
Diagnostic imaging	10 438 171	5.25	880.107	14.29	84.32
Operations	5 422 087	2.73	582.087	9.45	107.35
Assistance at operations	239 676	0.12	24.157	0.39	100.79
Optometry	3 666 327	1.84	146.229	2.37	39.88
Radio and nuclear therapy	451 140	0.23	32.327	0.52	71.66
Miscellaneous	4 220 466	2.12	215.306	3.50	51.01
Total	**198 800 464**	**100.00**	**6 157.954**	**100.00**	**30.98**

Source: Health Insurance Commission: *Annual Report 1996–97*.

2. Canada

I. Canada: Demography

CAN 1
Population structure (thousands)

Age group	1980	1990	1995
0–9	3 610	3 874	4 018
10–14	1 974	1 890	1 990
15–19	2 429	1 936	1 934
20–24	2 444	2 146	1 999
25–29	2 217	2 606	2 233
30–34	2 028	2 549	2 674
35–39	1 608	2 291	2 585
40–44	1 333	2 063	2 305
45–49	1 270	1 600	2 062
50–54	1 242	1 301	1 592
55–59	1 177	1 239	1 283
60–64	954	1 177	1 201
65+	2 309	954	3 526
Total	**24 593**	**27 791**	**29 402**

II. Canada: Health care infrastructure

CAN 2
Employment in health and social services (thousands)

Employees[1]	Years			
	1985	1990	1994	1997
Health and social services	933.5	1 128.0	1 187.1	1 127.6
Institutional and non-institutional health	755.1	864.7	891.6	880.6
Hospitals	505.6	568.3	542.4	519.8
Other institutional health and social services	172.2	202.9	224.7	222.0
Non-institutional social services	77.3	93.4	124.5	138.6
Other health and social services	178.4	263.4	295.5	327.0
Non-institutional health services	12.5	31.8	51.5	76.6
Offices of physicians, surgeons and dentists	91.6	127.2	129.7	133.8
Offices of other health practitioners	13.9	23.8	35.1	39.3
Offices of social services practitioners	0.6	0.8	2.5	3.4
Medical and other health laboratories	15.0	22.5	21.8	19.8
Health and social services associations	44.9	57.3	54.8	53.9

[1] Excludes owners or partners of unincorporated businesses and professional practices, self-employed persons, unpaid family workers, persons working outside Canada, military personnel and casual workers.

CAN 3
Approved beds in institutions per 1,000 population, by type of care, 1991–1992[1]

Province	All[2] institutions	Hospitals	Residential care facilities
Newfoundland	12.8	5.3	7.5
Prince Edward Island	22.3	5.7	16.6
Nova Scotia	16.2	6.1	10.1
New Brunswick	17.8	6.9	10.9
Quebec	13.7	7.8	5.9
Ontario	14.9	5.2	9.8
Manitoba	17.5	5.8	11.6
Saskatchewan	19.6	7.7	11.9
Alberta	16.2	5.2	11
British Columbia	14.3	6	8.3
Yukon	10.6	4.5	6.1
Northwest Territories	11.1	5.8	5.3

[1] Includes beds approved for the facility by the provincial authorities at the end of the reporting year. Only facilities that were in operation for the entire fiscal year and that reported beds in the Annual Hospital and Residential Care Survey are included.
[2] Only facilities with four or more beds are included. (Population is based on estimates as of October 1, 1991.)

III. Canada: Health care utilization and cost

CAN 4
Average length of stay in hospital, by selected diagnostic group, 1992–1993

Group	Days
All diagnostic groups	**11.2**
Infectious and parasitic diseases	8.5
Neoplasm	12.8
Endocrine, nutritional, metabolic and immunity diseases	12
Diseases of blood and blood-forming organs	8.3
Mental disorders	32.6
Diseases of the nervous system and sense organs	22.9
Diseases of the circulatory system	15.8
Diseases of the respiratory system	7.5
Diseases of the digestive system	6.3
Complications of pregnancy, childbirth and the puerperium	3.5
Diseases of the skin and subcutaneous tissue	9.3
Diseases of the musculoskeletal system	10.6
Congenital anomalies	10.2
Certain conditions originating in the perinatal period	11.3
Injury and poisoning	9.8

CAN 5
Average payment per medical care service, by category of service[1] (dollars)

Category	Periods	
	1988–89	1991–92
Average payment	23.03	27.49
Major surgery	297.95	277.96
Obstetrical services	175.68	183.24
Surgical assistance	125.33	123.58
Anaesthesia	111.29	114.67
Consultations	66.31	64.52
Radiology services	40.34	53.17
Psychotherapy, counselling	45.5	43.43
Special calls	42.8	42.68
Major assessments	38.51	37.4
Minor surgery	34.36	32.38
Diagnostic, therapeutic services	22.83	21.33
Other assessments	19.39	20.3
Hospital care days	14.49	15.57
Special services	6.62	8.24
Laboratory services	8.38	6.67
Miscellaneous services	15.74	54.22
Not specified	22.48	–

[1] This data set was prepared by Health Canada using criteria designed to ensure an optimum degree of compatibility of data. Owing to large inter-provincial differences in payment schedule nomenclatures and frequent changes in nomenclatures, some inconsistencies may remain.

CAN 6
Total health expenditures by age and sex in million $

Age	1980			1985			1990			1994		
	Males	Females	All	Males	Females	All	Males	Females	All	Males	Females	All
Total	**9 996**	**12 402**	**22 398**	**17 895**	**22 143**	**40 038**	**27 194**	**33 848**	**61 042**	**32 272**	**40 190**	**72 463**
0–14	1 267	1 139	2 406	2 139	1 922	4 060	3 129	2 850	5 980	3 603	3 289	6 893
15–44	3 156	4 269	7 425	5 607	7 445	13 051	8 412	11 166	19 578	10 022	12 938	22 960
45–64	2 474	2 485	4 959	4 306	4 344	8 649	6 137	6 304	12 441	7 125	7 468	14 594
65+	3 099	4 509	7 608	5 845	8 433	14 277	9 516	13 527	23 042	11 522	16 494	28 016

Total health expenditures by age and sex by percentage distribution

Age	1980			1985			1990			1994		
	Males	Females	All	Males	Females	All	Males	Females	All	Males	Females	All
Total	**44.6**	**55.4**	**100**	**44.7**	**55.3**	**100**	**44.5**	**55.5**	**100**	**44.5**	**55.5**	**100**
0–14	5.7	5.1	10.7	5.3	4.8	10.1	5.1	4.7	9.8	5	4.5	9.5
15–44	14.1	19.1	33.2	14.0	18.6	32.6	13.8	18.3	32.1	13.8	17.9	31.7
45–64	11.0	11.1	22.1	10.8	10.8	21.6	10.1	10.3	20.4	9.8	10.3	20.1
65+	13.8	20.1	34.0	14.6	21.1	35.7	15.6	22.2	37.7	15.9	22.8	38.7

Total health expenditures by age and sex ($ per capita)

Age	1980			1985			1990			1994		
	Males	Females	All	Males	Females	All	Males	Females	All	Males	Females	All
Total	**816**	**1 005**	**911**	**1 388**	**1 697**	**1 543**	**1 973**	**2 416**	**2 196**	**2 228**	**2 722**	**2 478**
0–14	442	419	431	756	715	736	1 060	1 014	1 038	1 181	1 129	1 156
15–44	516	718	616	859	1 175	1 015	1 224	1 662	1 441	1 437	1 893	1 663
45–64	1 083	1 053	1 068	1 779	1 745	1 762	2 316	2 361	2 339	2 380	2 483	2 432
65+	3 120	3 429	3 296	5 234	5 484	5 379	7 286	7 469	7 393	7 879	8 206	8 068

Source: Health Canada.

CAN 7
Provincial government health expenditures by category of expenditure and age, 1994

Category	$ per capita					Percentage distribution				
	Total	0–14	15–44	45–64	65+	Total	0–14	15–44	45–64	65+
Total	**1 642**	**514**	**914**	**1 446**	**6 818**	**100**	**100**	**100**	**100**	**100**
Hospitals	794	163	331	717	3 857	48.4	31.7	36.2	49.6	56.6
Other institutions	166	22	54	74	1 015	10.1	4.4	5.9	5.1	14.9
Physicians	343	201	282	410	716	20.9	39.1	30.9	28.3	10.5
Other professionals	23	17	16	24	61	1.4	3.4	1.8	1.7	0.9
Drugs	93	10	23	62	572	5.7	1.9	2.5	4.3	8.4
Capital	–	–	–	–	–	–	–	–	–	–
Other expenditures	222	100	208	159	597	13.5	19.5	22.7	11	8.8

Source: Health Canada.

3. France

I. France: Demography

FRA 1
Population structure

	1970	1975	1980	1985	1990	1994	1995	1996
Population (thousands)	50 528	52 600	53 712	55 062	56 303	57 804	58 027	58 256
Percentage distribution:								
0–19 years	33.2	32.1	30.6	29.2	27.8	26.4	26.1	26.0
20–59 years	48.8	49.5	52.4	52.8	53.2	53.8	53.9	53.9
over 60	18	18.4	17	18.1	19	19.8	20.0	20.1
over 75	4.66	5.05	5.73	6.27	6.78	6.13	6.09	6.36

Source: Institut national de la statistique et des études économiques (INSEE, Paris).

II. France: Health care infrastructure

FRA 2
Health care personnel, all sectors and status

Occupation	1980	1985	1990	1994	1995	Rate per 100 000 population
Doctors	108 054[1]	125 000	148 089	160 235	169 553	290.7
Generalists	65 255		77 329	80 354	86 107	
Specialists	38 818		70 761	79 881	83 446	
Dentists	31 872	34 744	37 931	39 284	39 714	68.1
Midwives	8 479	9 149	10 705	11 957	12 218	83.1[2]
Pharmacists	37 820	43 965	51 367	53 085	53 810	92.3
Nurses	192 913	226 198	242 953	272 722	281 764	483.1
Other medical personnel[3]	102 812	109 187	111 229	115 154	118 506	203.2

Source: Ministère du Travail et des Affaires sociales.

[1] Data provided were inconsistent.
[2] Rate per 100 000 women age 15–49.
[3] Incl. psychiatric nurses, physiotherapists, chiropodists, speech therapists, orthopaedists.

FRA 3
Number of beds available for full hospital care in public and private hospital establishments, and availability rate per 1,000 head of population, 1995[1]

Category	Number of beds			Beds per 1 000 population		
	Public	Private	Both	Public	Private	Both
General and specialized medicine	99 413	26 974	126 387	1.71	0.46	2.18
General and specialized surgery	52 654	60 419	113 073	0.91	1.04	1.95
Gynecology/obstetrics	15 840	10 841	26 681	0.27	0.19	0.46
Subtotal short stays	**167 907**	**98 234**	**266 141**	**2.89**	**1.69**	**4.59**
Psychiatry	52 215	23 700	75 915	0.9	0.41	1.31
Drug addiction and alcoholism	1 081	1 097	2 178	0.02	0.02	0.04
Follow-up and rehabilitation	39 149	53 548	92 697	0.67	0.92	1.6
Long-term care	73 118	6 450	79 568	1.26	0.11	1.37
Total hospitals	**333 470**	**183 029**	**516 499**	**5.75**	**3.15**	**8.9**

Source: Ministère du Travail et des Affaires sociales.

[1] 1995 data is at 31 December 1995; the same data may sometimes be found as 1996 data, at 1 January 1996.

III. France: Health care utilization and cost

FRA 4
Number of admissions in public and private hospital establishments and rate per 1,000 head of population, 1995[1]

Category	Admissions			Admissions per 1 000 population		
	Public	Private	Both	Public	Private	Both
General and specialized medicine	4 037 749	1 053 184	5 090 933	69.59	18.15	87.74
General and specialized surgery	2 297 573	3 137 346	5 434 919	39.6	54.07	93.67
Gynaecology/obstetrics	779 124	516 180	1 295 304	13.43	8.9	22.33
Subtotal short stays	**7 114 446**	**4 706 710**	**11 821 156**	**122.62**	**81.12**	**203.74**
Psychiatry	389 232	159 793	549 025	6.71	2.75	9.46
Drug addiction and alcoholism	14 115	8 571	22 686	0.24	0.15	0.39
Follow-up and rehabilitation	350 738	452 333	803 071	6.05	7.8	13.84
Long-term care	50 617	4 030	54 647	0.87	0.07	0.94
Total hospitals	**7 919 148**	**5 331 437**	**13 250 585**	**136.49**	**91.89**	**228.38**

Source: Ministère du Travail et des Affaires sociales.

[1] 1995 data is at 31 December 1995; the same data may sometimes be found as 1996 data, at 1 January 1996.

FRA 5

Hospital days (days of full hospital care), and average length of stay (number of hospital days/number of admissions) in public and private hospital establishments, 1995[1]

Category	Hospital days			Average length of stay		
	Public	Private	Both	Public	Private	Both
General and specialized medicine	27 478 100	8 585 046	36 063 146	6.8	8.2	7.1
General and specialized surgery	12 285 328	18 469 043	30 754 371	5.3	5.9	5.7
Gynecology/obstetrics	3 755 835	3 280 615	7 036 450	4.8	6.4	5.4
Subtotal short stays	**43 519 263**	**30 334 704**	**73 853 967**	**6.1**	**6.4**	**6.2**
Psychiatry	14 518 134	7 678 014	22 196 148	37.3	48	40.4
Drug addiction and alcoholism	282 260	338 416	620 676	20	39.5	27.4
Follow-up and rehabilitation	11 333 877	16 271 422	27 605 299	32.3	36	34.4
Long-term care	25 676 544	2 251 117	27 927 661	507.3	558.6	511.1
Total hospitals	**95 330 078**	**56 873 673**	**152 203 751**	**12**	**10.7**	**11.5**

Source: Ministère du Travail et des Affaires sociales.

[1] 1995 data is at 31 December 1995; the same data may sometimes be found as 1996 data, at 1 January 1996.

4. Ghana

I. Ghana: Demography

GHA 1
Population structure (thousands)

Age group	1980	1990	1995
0–9	3 526	5 005	5 560
10–14	1 329	1 804	2 219
15–19	1 149	1 564	1 777
20–24	961	1 298	1 534
25–29	794	1 112	1 268
30–34	657	923	1 084
35–39	540	758	897
40–44	449	622	732
45–49	371	505	597
50–54	302	412	479
55–59	242	330	384
60–64	185	256	299
65+	302	428	508
Total	**10 808**	**15 018**	**17 338**

II. Ghana: Health care infrastructure

GHA 2
Personnel: Medical and paramedical personnel in government service

Category	1993
Medical officers	588
Medical assistants	343
Dentists	34
Dental assistants	78
Pharmacists	107
Dispensary technicians	839
Midwives	1 712
Nurses[1]	4 286
Nurses[2]	7 677
Physiotherapists	73
Radiologists[3]	199
Dental technologists	8
Medical laboratory technologists[4]	330
Nutritionists/dietitians	225
Bacteriologists	–
Public health engineers	14
Epidemiologists[5]	2 722
Scientific officers[6]	33
Total	**19 268**

Note: Excludes medical and paramedical staff working in quasi-government institutions.

[1] State-registered nurses.
[2] Enrolled/community health nurses, ward and clinics assistants.
[3] Includes radiographers and medical x-ray technicians.
[4] Includes laboratory technicians and assistants.
[5] Environmental health officers/technologists and health education officers.
[6] Includes biologists, biochemists, zoologists, agronomists and related scientists.

5. Japan

I. Japan: Demography

JPN 1
Total population: Age structure

Age	1960	1970	1980	1990	1995
0–9	17 506	17 119	18 579	14 104	12 706
10–14	10 920	7 953	8 934	8 627	7 537
15–19	9 390	9 138	8 265	9 988	8 617
20–24	8 361	10 693	7 907	8 800	9 965
25–29	8 274	9 119	9 132	8 086	8778
30–34	7 519	8 414	10 701	7 874	8 065
35–39	6 028	8 246	9 171	9 115	7 845
40–44	5 041	7 370	8 341	10 613	9 064
45–49	4 833	5 901	8 061	9 008	10 516
50–54	4 204	4 826	7 128	8 108	8 876
55–59	3 680	4 441	5 568	7 713	7 921
60–64	2 943	3 740	4 461	6 693	7 427
65+	5 397	7 371	10 560	14 809	17 752

Source: ILO.

II. Japan: Health care infrastructure

JPN 2
Medical care facilities and beds per 10,000 population

	1970	1975	1980	1985	1990	1995
Medical care facilities						
Hospitals	0.77	0.74	0.77	0.79	0.82	0.77
General clinics	6.65	6.53	6.63	6.52	6.54	6.93
Dental clinics	2.88	2.91	3.32	3.76	4.22	4.65
Beds						
Hospital beds	102.44	103.99	112.71	123.55	135.65	132.99
General clinics	24.07	23.59	24.59	23.42	22.04	20.65
Dental clinics	0.04	0.03	0.02	0.02	0.02	0.02
Total beds/10 000 pop.	**126.55**	**127.61**	**137.32**	**146.99**	**157.71**	**153.66**

JPN 3
Health care personnel per 10,000 population

Category	1970	1975	1980	1985	1990	1994
Doctors	11.47	11.83	13.35	15.73	17.13	18.44
Dentists	3.65	3.89	4.58	5.49	5.99	6.48
Pharmacists	7.65	8.43	9.91	11.18	12.19	14.15
Nurses (incl. assistant nurses)	26.36	32.3	41.62	52.6	60.29	68.94
Public health nurses	1.35	1.43	1.53	1.81	2.05	2.32
Midwives	2.71	2.39	2.21	1.98	1.85	1.84
Total health care pers./10 000 pop.	**53.21**	**60.28**	**73.2**	**89.23**	**99.5**	**112.17**

Source: National Federation of Health Insurance Societies: *Health insurance and health insurance societies in Japan*, 1997.

III. Japan: Health care utilization and cost[1]

JPN 4
Number of medical-care cases per 100 persons insured, 1994

	Total	In-patient	Out-patient	Dental care	Pharmacies
Average	73.88	2.88	60.84	10.17	10.11
Insured persons	55.35	1.68	43.69	9.98	7.10
Retired persons	103.18	2.7	87.23	13.26	13.83
Of which: 55–59	90.66	1.95	74.73	13.98	10.46
60–64	99.3	2.4	83.26	13.64	13.10
65–69	113.24	2.9	97.15	13.19	15.70
Elderly persons	130.93	7.65	113.98	9.29	19.91

[1] Utilization and cost data are only for self-employed persons.

JPN 5
Number of medical-care cases per 100 persons insured, by age, 1994

Age	Total	In-patient	Out-patient	Dental care	Pharmacies
0–4 years	71.27	1.46	63.82	5.99	12.82
5–9	62.28	0.54	44.12	17.62	9.81
10–14	42.03	0.35	30.75	10.94	5.73
15–19	30.01	0.45	23.06	6.5	3.07
20–24	29.85	0.94	20.56	8.35	3.65
25–29	36.31	1.34	26.7	8.27	4.43
30–34	40.46	1.17	30.19	8.8	4.9
35–39	40.8	1.45	30.04	9.31	4.44
40–44	43.49	1.78	32	9.71	4.73
45–49	47.49	1.76	35.83	9.89	5.82
50–54	58.6	2.11	45.64	10.85	6.78
55–59	75.31	2.51	60.49	12.31	8.63
60–64	92.6	2.9	76.5	13.21	11.91
65–69	108.7	3.52	93.21	11.97	15.52
70 and over	128.82	7.32	113.25	8.25	19.63

Source: Ministry of Health and Welfare, Tokyo: National Health Insurance: *Report on Research of Medical Care Benefits*, 1994.

JPN 6
Cost of medical care per insured person, 1994 (yen)

	Total cost per insured	Sub-total	In-patient	Out-patient	Dental care	Pharmacies
Average	22 214	21 360	10 221	9 570	1 569	854
Insured persons	12 979	12 505	5 427	5 663	1 415	474
Retired persons	27 364	26 203	10 731	13 270	2 202	1 161
Of which: 55–59	21 817	21 079	7 406	11 582	2 090	739
60–64	25 378	24 328	9 646	12 473	2 209	1 050
65–69	30 439	29 043	11 849	14 887	2 307	1 396
Elderly persons	55 525	53 351	28 635	22 874	1 842	2 174

JPN 7
Cost of medical care per insured person by age, 1994 (yen)

Age	Total cost per insured	Sub-total	In-patient	Out-patient	Dental care	Pharmacies
0–4 years	8 613	8 118	3 093	4 466	558	495
5–9	6 059	5 658	1 138	3 039	1 482	400
10–14	3 971	3 790	842	2 084	863	181
15–19	3 835	3 685	1 067	1 924	693	151
20–24	5 777	5 625	2 271	2 182	1 173	152
25–29	7 135	6 917	2 985	2 762	1 170	218
30–34	8 543	8 274	3 549	3 526	1 199	269
35–39	9 411	9 100	3 926	3 768	1 407	311
40–44	11 719	11 428	5 421	4 517	1 490	291
45–49	12 533	12 112	5 579	4 971	1 562	421
50–54	15 824	15 294	6 947	6 644	1 703	531
55–59	21 133	20 386	9 122	9 169	2 095	748
60–64	26 193	25 169	10 885	12 097	2 188	1 024
65–69	32 797	31 434	13 749	15 572	2 113	1 364
70 and over	53 582	51 476	27 766	22 057	1 652	2 107

Source: Ministry of Health and Welfare, Tokyo: National Health Insurance: *Report on Research of Medical Care Benefits*, 1994.

JPN 8
Cost of medical care per case, 1994 (yen)

	Total	In-patient	Out-patient	Dental care	Pharmacies
Average	28 910	355 098	15 730	15 433	8 443
Insured persons	22 594	323 519	12 962	14 176	6 673
Retired persons	25 396	398 031	15 214	16 614	8 400
Of which: 55–59	23 249	379 885	15 498	14 950	7 063
60–64	24 499	401 087	14 982	16 196	8 013
65–69	25 647	408 781	15 324	17 489	8 891
Elderly persons	40 749	374 234	20 068	19 818	10 920

JPN 9
Cost of medical care per case by age, 1994 (yen)

Age	Total cost per insured	In-patient	Out-patient	Dental care	Pharmacies
0–4 years	11 390	211 971	6 998	9 317	3 861
5–9	9 086	212 312	6 887	8 410	4 082
10–14	9 017	243 470	6 779	7 895	3 165
15–19	12 278	236 153	8 346	10 668	4 914
20–24	18 842	241 670	10 611	14 035	4 156
25–29	19 048	222 758	10 344	14 143	4 923
30–34	20 449	241 603	11 680	13 617	5 500
35–39	22 305	271 020	12 544	15 100	7 011
40–44	26 279	304 148	14 118	15 347	6 162
45–49	25 506	316 888	13 873	15 787	7 235
50–54	26 097	329 320	14 555	15 699	7 829
55–59	27 069	363 316	15 158	17 014	8 660
60–64	27 180	375 484	15 813	16 567	8 596
65–69	28 917	390 228	16 706	17 656	8 787
70 and over	39 959	379 241	19 476	20 035	10 732

Source: Ministry of Health and Welfare, Tokyo: National Health Insurance: *Report on Research of Medical Care Benefits*, 1994.

JPN 10
Percentage trends in expenditures for medical care services

Services	1970	1975	1980	1985	1990	1995	Increase 1970–90
Total expenditures	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**0.0**
Doctor consultations and home care	10.5	19.0	14.5	16.8	17.1	16.0	5.5
Medical technology	75.3	62.1	67.0	60.5	60.2	61.0	−14.3
Medication, injections	56.8	43.6	44.0	34.2	33.8	34.3	−22.5
Diagnostic imaging, laboratory examinations	12.0	11.1	14.7	16.1	16.7	16.5	4.4
Procedures, surgery, etc.	6.5	7.4	8.3	10.1	9.8	10.3	3.8
Hospitalization	14.2	18.7	18.2	22.2	22.0	23.1	8.9

Note: Only the general (medical) expenditures provided by government-managed health insurance are covered. Hospitalization includes nursing services and 'hotel' services.

Source: Ministry of Health and Welfare, Tokyo: Survey of National Medical Care Insurance Services and National Medical Care Expenditures.

6. Mexico

I. Mexico: Demography

MEX 1
Population structure (thousands)

Age group	1980	1990	1995
0–9	21 519	21 519	21 972
10–14	8 976	10 570	10 385
15–19	7 338	10 134	10 285
20–24	6 028	8 207	9 664
25–29	4 852	6 636	7 893
30–34	3 873	5 596	6 453
35–39	3 210	4 573	5 471
40–44	2 623	3 660	4 467
45–49	2 211	3 015	3 558
50–54	1 811	2 431	2 908
55–59	1 506	2 005	2 316
60–64	1 059	1 587	1 874
65+	2 563	3 294	3 901
Total	**67 570**	**83 226**	**91145**

II. Mexico: Health care infrastructure

MEX 2
Personnel

	Years	
	1980	1993
People per physician	1 149	615
People per hospital bed	–	1 704

MEX 3
Medical human resources – Instituto Mexicano del Seguro Social (IMSS)

Category	Years		
	1986	1990	1995
Medical personnel	32 262	39 772	47 420
Generalists	10 206	12 226	13 266
Specialties	8 816	11 227	14 075
Assistant-physicians	10 650	12 997	15 828
Treatment and diagnostic auxiliaries	2 588	3 322	4 251
Non-medical personnel	131 431	132 859	151 146
Treatment and diagnostic auxiliaries	9 042	11 589	13 945
Paramedical	71 216	83 720	95 426
Administrative personnel	15 587	20 084	22 121
Nutritionists	7 393	8 061	8 813
Pharmacists	1 965	2 449	2 793
Management	23 336	3 033	4 646
Laundry	1 413	1 409	1 486
Maintenance and supports	53	15	53
Scholarship-holder	1	5	7
Transport staff (drivers)	1 425	2 494	1 856
Others	7 020	9 047	7 464
Total general	**170 713**	**181 678**	**206 030**

MEX 4
Number of medical units (IMSS)

Type	Years		
	1986	1990	1995
Direct service	1 472	1 604	1 748
1st level (family medicine)	1 230	1 345	1 482
2nd level (general medicine)	217	220	225
3rd level (specialized medicine)	25	39	41
Substitute service	38	–	–
Total general	**1 510**	**1 604**	**1 748**

III. Mexico: Health care utilization and cost

MEX 5
Number of cases of medical services

Category	Years	
	1990	1994
External consultation	78 694 007	90 746 287
Clinical laboratories	15 171 462	18 123 788
Anatomy pathology	899 376	1 109 568
Radiodiagnostic	6 439 941	7 608 055
Electrography	755 586	1 062 710
Physiotherapy	880 608	1 105 811
Radiotherapy	127 272	177 162

MEX 6
Number of cases of hospitalization

Type	Years	
	1990	1995
Admissions	1 799 373	1 925 884
Discharges	1 797 570	1 907 275
Total number of hospital days	7 930 601	8 904 285
Childbirth expected	710 562	704 751
Surgeries	1 080 736	1 293 319

Source: IMSS: Memoria Institucional (enero – diciembre 1995), *Memoria Estadisca 1995.*

7. Morocco

I. Morocco: Demography

MOR 1
Population by age and region, 1987

Age	Population (000s)
Urban	**10 544**
Under 15	3 796
15–60	6 202
Over 60	546
Rural	**12 832**
Under 10	4 093
Over 10	8 739
Total	**23 376**

MOR 2
Population by region (historical development)

Population (000s)	1982	1984	1987
Total	**20 419**	**21 465**	**23 376**
Urban	42.8%	43.6%	45.1%
Rural	57.2%	56.4%	54.9%

Source: Ministère de la Santé publique: *Étude du système de financement des secteurs de santé*, 1990.

II. Morocco: Health care infrastructure and utilization

MOR 3
Public hospitals, facilities and utilization, 1987

Beds (000s)	23.330	Beds per 1 000 population	1.00
		Occupancy rate[1]	0.57
Admissions (000s)	471.200	Admissions per 1000 population	20.16
Hospital days (000s)	4 853.807	Average length of stay[1]	10.3

Medical personnel	Number	Personnel per 10 000 population	Beds per personnel
Doctors	2 087	0.893	11.2
Auxiliaries	9 866	4.221	2.4
Administrators	5 194	2.222	4.5

[1] Length of stay = days/admissions; occupancy rate = hospital days/365 beds.

MOR 4
Other public health care establishments (Centres de Santé et Dispensaires Publics) facilities and utilization, 1987

Centres		Density (population per establishment)
Total number	1 633	14.315
Urban (CSDU)	452	23.327
Rural (CSDR)	1 181	10.865
Number of consultations	6 491 483	-

Personnel	Numbers	Personnel per establishment
Doctors	775	0.47
Urban	482	1.07
Rural	293	0.25
Auxiliaries	9 033	5.53
Urban	4 915	10.87
Rural	4 118	3.49
Administrators	924	0.57
Urban	651	1.44
Rural	273	0.23

MOR 5
Medical personnel of public sectors, 1987

Personnel	Hospitals	Health centres	Total	Personnel per 10 000 population
Doctors	2 087	775	2 862	1.22
Auxiliaries	9 866	9 033	18 899	8.08
Administrators	5 194	924	6 118	2.62
Total			**27 879**	**11.93**

8. Sri Lanka

I. *Sri Lanka: Demography*

SRI 1
Total population: age structure (thousands)

Age groups	Year					
	1950	1960	1970	1980	1990	1995 (estimate)
Total	**7678**	**9889**	**12514**	**14819**	**17057**	**15108**
0–9	2249	2989	3669	3540	3749	2344
10–14	873	1170	1575	1687	1826	1644
15–19	786	967	1211	1604	1642	1519
20–24	719	820	1050	1507	1603	1405
25–29	602	725	882	1271	1473	1303
30–34	502	664	792	1121	1354	1145
35–39	423	559	776	837	1128	1131
40–44	349	468	559	697	998	932
45–49	292	391	527	609	744	917
50–54	239	318	411	541	625	664
55–59	186	259	329	421	549	551
60–64	154	201	288	341	478	1555[1]
65+	303	358	455	643	889	

[1] For the age group of 60+.

Sources: ILO: Bureau of Statistics (STAT) Working paper, *Estimates and projections 1950–2010*, No. 96-1; ILO: *Yearbook of Labour Statistics*, 1996.

SRI 2
Mortality rates per thousand

Year	Crude death rate	Maternal mortality rate	Infant mortality rate	Neonatal mortality rate
1945	22.0	16.5	140.0	75.5
1950	12.6	5.6	82.3	49.2
1960	8.6	3.0	57.0	34.2
1970	7.5	1.5	47.5	29.7
1980	6.2	0.6	34.4	22.7
1985	6.2	0.5	24.2	16.2
1990	5.7	–	19.3	–
1995	5.8	0.4	17.7	12.9

Source: WHO: Implementation of the Strategy for Health for All, Third evaluation, 1997.

SRI 3
Life expectancy at birth

Year	Male	Female
1920–22	32.7	30.7
1946	43.9	41.6
1953	58.8	57.5
1963	61.9	61.4
1967	64.8	66.9
1971	64.2	67.1
1981	67.8	71.7
1991	69.5	74.2

II. Sri Lanka: Health care infrastructure

SRI 4
Human resources

Occupation	Numbers, by year			
	1980	1985	1990	1995
Medical officer	2 055	2 809	2 440	4 628
Dental surgeon	218	301	317	404
Registered medical officer/ assistant medical officer	1 018	957	1 074	1 274
Nursing officer	6 336	8 284	11 537	13 466
Midwives	3 350	3 255	4 959	6 460
Pharmacists	386	420	472	639
Medical laboratory technicians	350	540	538	611
Radiographers	161	210	233	328
Physiotherapists	131	149	161	181
Occupational therapists	14	30	50	52
Public health inspectors	913	946	886	963
Dispenser	653	630	688	556
School dental therapists	434	455	482	545
Total	**16 019**	**18 986**	**23 837**	**30 107**

Source: WHO: Implementation of the Strategy for Health for All, Third evaluation, 1997.

SRI 5
Health facilities and hospital beds,[1] 1981–1995

Facilities	Number of institutions			Number of beds			
	1985	1990	1995	1980	1985	1990	1995
Teaching hospitals	14[2]	11	14	10 716[2]	12 446[2]	9 545	11 572
Provincial hospitals		7	6			4 636	5 187
Base hospitals	20	21	24	5 396	5 848	5 273	6 330
District hospitals	109	122	145	12 180	11 265	10 769	12 377
Peripheral unit	117	119	110	4 326	5 007	4 248	4 401
Rural hospital	118	120	121	2 442	2 790	2 645	3 033
Central dispensary and maternity homes	88	82.0	78	1 127	1 005	663	639
Central dispensary	338	342	367	–	–	–	–
Other	13	18	16	972	1 398	4 300	4 126
Total	**817**	**842**	**881**	**37 159**	**39 759**	**42 079**	**47 665**

Notes: [1] Excluding beds at institutions in NE.
[2] Sum of teaching hospitals and provincial hospitals.

Source: WHO: Implementation of the Strategy for Health for All, Third evaluation, 1997.

III. Sri Lanka: Health care utilization

SRI 6
Inpatient and outpatient attendance in government health institutions, 1960–1995

Year	Inpatient		Outpatient[1]	
	000s	Rate per 1 000 pop.	000s	Rate per 1 000 pop.
1960	1 392	140.7	28 852	2 915.5
1965	1 642	150.4	31 258	2 866.9
1970	2 054	164.1	34 895	2 788.0
1975	2 146	159.0	27 654	2 049.1
1980	2 334	158.3	31 892	2 162.6
1985	2 494	157.4	29 570	1 867.1
1990[2]	2 533	174.6	28 401	2 000.5
1991[2]	2 629	178.6	28 575	1 940.9
1992	3 023	173.7	36 827	2 115.9
1993	3 174	180.1	36 656	2 080.5
1994	3 204	179.3	35 276	1 974.6
1995[3]	2 953	179.3	32 084	1 947.7

Notes: [1] Clinic attendance.
[2] Northern and Eastern provinces.
[3] Jaffna, Killonochchi, Mullaitivu and Amparai districts.

Source: WHO: Implementation of the Strategy for Health for All, Third evaluation, 1997.

9. Thailand

I. Thailand: Demography

THA 1
Demographic structure by age (thousands)

Age	1980	1990	1995
0–9	12 581	11 542	10 654
10–14	6 112	6 158	5 580
15–19	5 288	6 147	6 047
20–24	4 574	6 018	6 024
25–29	3 750	5 184	5 888
30–34	2 884	4 463	5 057
35–39	2 364	3 638	4 338
40–44	2 180	2 774	3 519
45–49	1 825	2 248	2 664
50–54	1 501	2 035	2 133
55–59	1 132	1 652	1 901
60–64	878	1 306	1 513
65+	1 649	2 414	2 922
Total	**46 718**	**55 580**	**58 242**

II. Thailand: Health care infrastructure

THA 2
Medical personnel

Population	Year	
	1980	1993
Per physician	6 803	4 416
Per nurse	2 280	1 067
Per hospital bed	651	765

THA 3
Number of medical personnel by category

Category	Year			
	1991	1992	1993	1994
Whole Kingdom	**124762**	**131767**	**145964**	**145964**
Physician	12803	13398	14098	14098
Dentist	2408	2669	2984	2984
Dental hygienist	1221	1328	1607	1607
Pharmacist	4333	4609	5575	5575
Nurse	40685	43856	51058	51058
Technical nurse	23289	25424	29880	29880
Auxiliary nurse	14266	13790	13165	13165
Midwife	10582	10456	10342	10342
Health worker	15175	16237	17255	17255

THA 4
Number of hospitals and medical establishments with beds and health institutions

Type of administration	Year			
	1991	1992	1993	1994
Number of hospitals and medical establishments with beds				
General services	983	1019	1028	1127
Government	788	809	822	874
Ministry of Public Health	718	740	754	803
State enterprise	11	12	12	12
Municipality	8	8	8	8
Specialized services	81	78	77	88
Others	70	69	68	71
Private	257	268	263	322
Health institutions, no admissions				
Health centres	7911	8178	8202	8513
Community health centres	419	555	540	531
Health centres (Bureau of Health)	58	59	59	60
Clinics (private)	13415	15711	11395	11936

THA 5
Number of beds in hospitals and medical establishments

Type of administration	Year			
	1991	1992	1993	1994
General services	79 156	83 016	87 089	95 540
Government	77 672	79 952	81 342	83 613
Ministry of Public Health	62 250	64 180	65 558	68 550
Others	15 122	15 472	15 484	14 763
State enterprise	2 178	2 229	2 229	2 229
Municipality	2 125	2 167	2 232	2 177
Private	11 354	13 051	14 919	19 828
Specialized services	14 696	14 840	14 077	15 207
Others	15 422	15 772	15 784	15 063
Private	523	457	444	716
Total	**280 498**	**291 136**	**299 158**	**317 686**

III. Thailand: Health care utilization

THA 6
Medical service utilization rates

Type of administration	Year			
	1994		1995	
	Public	Private	Public	Private
Outpatient (visit per person per year)	1.07	1.25	1.23	1.41
Inpatient (visit or person per year)	0.040	0.037	0.024	0.026
Average number of days/visits	4.32	3.52	4.59	4.00

10. United Kingdom

I. United Kingdom: Demography

UK 1
Resident population (estimated mid-year) by age

Ages	Year					
	Past				Projected	
	1971	1981	1991	1996	2001	2011
0–4	4 553	3 455	3 886	3 763	3 602	3 411
5–9	4 684	3 677	3 674	3 905	3 773	3 478
10–14	4 232	4 470	3 501	3 690	3 914	3 618
15–19	3 862	4 735	3 739	3 522	3 727	3 817
20–29	7 968	8 113	9 298	8 380	7 470	7 899
30–44	9 797	10 956	12 221	12 935	13 747	12 170
45–59	10 202	9 540	9 500	10 582	11 228	12 660
60–64	3 222	2 935	2 888	2 772	2 859	3 821
65–74	4 764	5 195	5 067	5 058	4 893	5 451
75–84	2 160	2 675	3 136	3 125	3 243	3 305
85+	485	602	896	1 067	1 163	1 296
Total UK	**55 929**	**56 353**	**57 806**	**58 799**	**59 619**	**60 926**
Total England	**46 412**	**46 821**	**48 209**	**49 089**	**49 871**	**51 162**

Source: Office for National Statistics: *Annual Abstract of Statistics*, 1998.

UK 2
Health service workforce, and 1994 rate per 100,000 population

Workforce	Year				
	1984	1989	1991	1994	
				Number	Rate
Total directly employed staff (including also works professional and maintenance staff, ancillary staff, and others)	**821 308**	**796 561**	**800 238**	**762 957**	**1 566.4**
Medical and dental staff, total	42 384	46 256	48 567	52 153	107.1
Hospital medical staff	36 814	40 993	43 372	47 339	
Hospital dental staff	1 219	1 222	1 240	1 356	
Community medical staff	2 923	2 802	2 819	2 426	
Community dental staff	1 428	1 240	1 136	1 030	
Nursing and midwifery, total	397 488	405 281	396 136	353 128	725
Nursing	374 695	382 255	373 097	332 681	
Midwifery	22 794	23 026	23 039	20 804	
General and senior managers	–	4 609	14 500	22 954	47.1
Professional and technical	72 656	81 168	86 876	92 769	190.4
Professions allied to medicine	30 903	36 681	37 958	40 475	83.1
Professional and technical	32 235	32 406	35 389	37 901	77.8
Scientific and professional	9 518	12 081	13 529	14 392	29.5
Administrative and clerical	110 304	116 842	127 367	134 610	276.4
Ambulance staff	17 129	18 862	17 627	17 950	36.8
FHSA practitioners	48 072	49 399	49 841	51 242	105.2
Medical practitioners	25 788	27 749	27 888	28 735	59
Dental practitioners	14 066	15 351	15 451	15 885	32.6
Ophthalmic practitioners	5 826	6 298	6 502	6 622	13.6

Note: Data are for England unless otherwise indicated.

Source: Department of Health: *Health and Personal Social Services Statistics for England*, 1996

UK 3
Hospital beds and patient activity (thousands)

	Year 1984	1989–90	1990–91	1993–94	1994–95
All specialities					
Inpatients					
Average daily available beds	335	270	255	219	212
Cases treated	6 867	7 477	7 524	7 988	8 065
Throughput	20.5	27.7	29.5	36.4	38.1
Day cases	903	1 163	1 261	2 106	2 474
Outpatient attendances					
New patients	8 508	8 519	8 502	9 683	10 363
Total attendances	37 043	36 305	36 112	38 202	39 306
General and acute					
Inpatients					
Average daily available beds	194	170	163	147	145
Cases treated	5 246	5 677	5 685	6 127	6 210
Throughput	27	33.4	34.9	42	42.9
Day cases	872	1 152	1 251	2 080	2 439
Outpatient attendances					
New patients	7 577	7 621	7 593	8 832	9 513
Total attendances	31 702	31 612	31 400	33 821	34 932
Maternity					
Inpatients					
Average daily available beds	17	15	14	13	12
Cases treated	833	918	948	970	974
Throughput	48.4	62.4	66.9	78	81.4
Day cases	18	9	9	23	32
Outpatient attendances					
New patients	731	689	695	600	588
Total attendances	3 533	3 017	2 982	2 443	2 307
Geriatrics					
Inpatients					
Average daily available beds	56	49	46	37	37
Cases treated	344	447	468	554	548
Throughput	6.2	9.2	10.2	15	14.9
Day cases	1	3	3	5	6
Outpatient attendances					
New patients	51	60	72	83	94
Total attendances	322	390	427	459	480
Total (including psychiatric, mental illness, learning disabilities)					
Inpatients					
Average daily available beds	848	675	635	536	516
Cases treated	13 794	15 059	15 171	16 217	16 373
Throughput					
Day cases	1 819	2330.2	2526.2	4219.8	4957.8
Outpatient attendances					
New patients	17 269	17 309	17 290	19 698	21 082
Total attendances	76 216	74 678	74 381	78 801	81 159

UK 3 (continued)
Hospital beds and patient activity: rates per thousand population

	Year				
	1984	1989–90	1990–91	1993–94	1994–95
All specialities					
Inpatients					
Average daily available beds	7.1	5.7	5.3	4.5	4.3
Cases treated	146	156	157	165	166
Day cases	19.2	24.3	26.3	43.4	50.8
Outpatient attendances					
New patients	181	178	177	200	213
Total attendances	788	759	752	787	807
General and acute					
Inpatients					
Average daily available beds	4.1	3.6	3.4	3	3
Cases treated	112	119	118	126	127
Day cases	18.6	24.1	26.1	43	50.1
Outpatient attendances (excluding accident and emergency cases)					
New patients	161	159	158	182	195
Total attendances	674	661	654	697	717
Accident and emergency					
Day cases	217	234	233	234	245

Note: Data are for England unless otherwise indicated.

Source: Department of Health: *Health and Personal Social Services Statistics for England*, 1996.

UK 4
Finished consultant episodes (ordinary admissions plus day cases) by age group and sex, 1992–93 to 1994–95 (thousands)

Ages	1992–93			1993–94			1994–95		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0–4	657	524	1 181	663	533	1 198	643	515	1 168
5–14	283	209	492	286	214	501	293	222	520
15–44	974	2 473	3 447	1 008	2 514	3 523	1 051	2 553	3 630
45–64	901	892	1 794	976	959	1 935	1 045	1 027	2 092
65–74	658	566	1 224	725	622	1 347	773	662	1 449
75–84	496	605	1 102	521	632	1 153	537	643	1 191
85+	131	292	423	146	322	469	157	336	497
Unknown	5	7	12	3	5	8	2	2	4
Total	**4 105**	**5 566**	**9 675**	**4 328**	**5 802**	**10 134**	**4 501**	**5 959**	**10 550**

Note: Data are for England unless otherwise indicated.

Source: Department of Health: *Health and Personal Social Services Statistics for England*, 1996.

UK 5

Finished consultant episodes (ordinary admissions plus day cases) for selected diagnostic groups by age group and sex, year ending 31.3.95 (thousands)

	Age groups							
	0–4	5–14	15–44	45–64	65–74	75–84	85+	Total
All causes								
All	1 160	514	3 634	2 099	1 452	1 191	496	10 550
Males	639	290	1 054	1 047	774	536	157	4 499
Females	511	219	2 555	1 031	665	644	336	5 964
Neoplasms								
All	12	21	160	297	229	145	39	904
Males	6	11	54	133	130	80	18	433
Females	6	9	105	161	97	64	21	462
Mental disorders								
All	4	17	140	56	33	44	25	318
Males	2	10	79	28	14	16	7	155
Females	1	7	61	28	19	27	18	161
Nervous system and sense organs								
All	50	63	96	109	100	109	41	568
Males	29	34	44	52	45	39	11	254
Females	20	29	51	57	54	69	30	309
Circulatory system								
All	2	2	89	282	253	213	87	928
Males	1	1	44	183	148	98	27	503
Females	1	1	45	97	103	114	60	420
Respiratory system								
All	137	82	134	91	87	82	41	654
Males	84	42	63	49	49	44	17	347
Females	51	40	70	41	38	38	24	302
Digestive system								
All	48	63	332	282	173	128	50	1 076
Males	29	33	160	153	92	57	15	540
Females	19	29	170	126	79	70	34	527
Genito-urinary system								
All	26	27	348	243	121	75	22	864
Males	19	21	61	83	75	47	10	317
Females	6	6	283	157	45	28	11	536
Pregnancy								
Females	0	1	1 150	2	0	0	0	1 153
Injury and poisoning								
All	52	80	273	102	63	78	55	703
Males	29	50	180	56	25	22	10	373
Females	22	29	91	45	37	56	44	325
Other reasons								
All	429	25	278	131	96	78	37	1 075
Males	215	15	85	64	54	38	12	483
Females	211	10	191	65	39	38	25	580

Note: Data are for England unless otherwise indicated.

Source: Department of Health: *Health and Personal Social Services Statistics for England*, 1996.

GLOSSARY

Access to care The extent to which care is available for a patient in case of need.

Account A record of all financial transactions of a particular type. For example, the office rent account is a record of all payments made for the office rent.

Accounting framework A reporting system which enables the budget to be monitored and produces necessary financial reports, such as an income and expenditure report and a balance sheet.

Accruals accounting Registers transactions when an invoice is received, or when payment becomes due.

Actuarial equilibrium This is usually defined in the Law of a social security scheme. It can take several forms while essentially it should stipulate the minimum level, and sometimes the maximum level, of the reserve that has to be maintained over a definite period of time. This definition should be straightforward for collectively or individually fully funded schemes whereas for a scheme operated on a pay-as-you-go (PAYG) approach, the level of the minimum contingency reserve has to be set on the basis of risk assessment techniques. Under partial funding systems, such as those based on the scaled premium method of financing, the definition should encompass information on the minimum level of the reserve expressed as a multiple of the next annual benefit expenditure, i.e. a funding ratio, and the period over which this actuarial equilibrium has to be achieved or maintained. Alternatively, a series of targeted funding ratios applicable over consecutive periods of time can be prescribed with the aim of reaching a specified final level of funding.

Acute Describes a disease or symptom of rapid onset and brief duration, which can be cured by medical treatment (see also *chronic*).

Administrative costs Costs related to the operations of the health care system, including such items as risk management, utilization review, premium collection, claims processing, quality assurance and underwriting fees.

Adverse selection In the health care context, usually refers to efforts of third-party payers to enroll or insure only persons with low risks. Also refers to the tendency applicants for health insurance with impaired health status, or who are prone to above-average utilization of benefits, to be enrolled in a higher proportion.

Age This usually refers to the average age of a cohort of insured persons or beneficiaries as of valuation date. It is defined as the "age at last birthday", i.e. year of valuation minus year of birth. *For example: if the valuation date is as of 31.12.1997 and the pensioner was born on 15.7.1927, then the pensioner's age as of valuation date would be of 70 (1997–1927).* Often, the requirement to collect data by age allows for the collection of data by five-year age groups in the event that single-age data is unavailable.

Allocation of resources The distribution of available resources (capital and manpower) among various categories of care (e.g. general practitioner care, hospital care, laboratory services, pharmaceuticals, etc.).

Alternative medicine A general term for an extensive list of medical systems which differ from allopathic (western) medicine, including acupuncture, ayurvedic, tribal-traditional medicine, herbal or phototherapeutic, homeopathic and other treatments. Alternative medicine is not identical to *holistic medicine.*

Ambulatory care Health care services provided on an outpatient basis. Services that fall under this category are: ambulatory care centres in hospitals, hospital outpatient departments, physicians' offices and home health care.

Annual budget Statement covering the first year of the medium or long-term plan, involving costing the planned activities for the year and authorizing amounts for approved expenditure. The budget also provides the basis for performance monitoring during the year.

Asset Expenditure for which the benefit is not enjoyed entirely within the accounting period, but remains to be enjoyed after the accounting period has ended.

Balance sheet Statement showing the financial position at a particular point in time (e.g. at the end of the financial year), listing all assets and liabilities outstanding at that time. It is derived from the income and expenditure account, incorporating information on accruals, depreciation and stock balances.

Bargaining Process for fixing the prices and/or volume as well as structure of health care goods and services in negotiations between providers/suppliers and *third-party payers.*

Beneficiary Individual who is eligible to use services or receive reimbursement of costs according to an insurance contract.

Benefits in kind All health goods and services delivered to patients by providers that are provided or paid in whole or in part by health insurance.

Budget profile A breakdown of the annual budget into monthly or quarterly figures, to assist the monitoring of actual expenditure against the budget throughout the year.

Budgeting See *payment of providers.*

Capital expenditure account Account recording capital expenditure incurred from the beginning of the financial year. Each major item of expenditure is shown separately, and is analysed by type, e.g. purchase of property, office equipment, etc.

Capitation Payment system whereby managed-care plans pay health care providers a fixed amount per insured person to provide care to a group of patients for a defined period. Under this system, providers are not paid for services that exceed the allotted amount of costs. In the United Kingdom, for example, covered persons register with a

GP, selected from a list of registered and participating GPs, who receive a fixed fee from the National Health Service per month for each listed person that registers with him or her. See also *payment of providers.*

Case management A process whereby all health-related matters of a case are managed by a designated health professional. Case managers coordinate designated components of health care, such as referrals to consultants or specialists, hospitalization and ancillary services. The purpose of case management is to match the intensity of services with the patient's needs, to ensure continuity of care, to overcome system rigidities and reduce the misutilization of resources.

Cash accounting Registers transactions when cash is actually paid or received (compare with *accruals accounting*).

Cash benefits All cash payments which are made by the insurer to a covered person in case of certain contingencies. These generally include sickness, maternity and funeral allowances.

Cash limit An amount which cannot be exceeded. In some organizations, once the budget is approved, it becomes a cash limit. Any increases in expenditure which were not accounted for in the budget (e.g. higher-than-expected pay awards) must then be found from other savings or reserves.

Catastrophic insurance A 'top-up' insurance (or re-insurance) to cover individual cases with severe or prolonged illnesses generating very high costs. See also *co-payments.*

Catchment ratio The ratio of the total amount of earnings subject to the payment of contributions, i.e. total insurable earnings, to the total amount of earnings theoretically received by insured persons in their employment.

Categories of health care services Various types of health care services or goods grouped according to providing institutions. A customary grouping is: general practitioner care, specialist care, dental care, pharmaceuticals, supporting laboratory services, hospital care and miscellaneous.

Chronic Describes a disease of long duration, for which treatment normally can relieve symptoms but not cure the underlying condition (compare with *acute*).

Circumvention fees See *co-payments.*

Co-insurance (1) A situation where two underwriters assume a risk jointly. This usually means the patient has dual coverage, although one insurance may be the primary insurer and the other may be a secondary insurer. Sometimes, a primary insurer covers the insured and the secondary covers the insured's spouse. (2) A cost-sharing requirement under a health insurance policy stipulating that the insured will pay a portion or percentage of the costs of covered services. One example of co-insurance (or co-payment) is the 'ticket moderator' applied in the social security health insurance systems of Belgium and France. Under this system, patients pay 25% of medical fees (and amounts above any approved fees) for a broad range of services. However, in those systems, 100% of costs are reimbursed to patients for some services. See also *co-payments.*

Collective equivalence See *principle of equivalence.*

Commitment accounting Registers transactions when the organization is committed to them, e.g. when an order is placed.

Community rating A method for determining insurance rates on the basis of the average cost of providing health services in a specific geographic area. This method ignores the individual's medical history or the likelihood of the individual to use the services.

Contingency reserve Funds which are set aside by an insurer in order to be able to meet unforeseen benefit expenditure, e.g. caused by an epidemic or catastrophe.

Contributions Monies paid by or on behalf of insured persons to a health insurer to purchase the coverage of a defined range of services (the benefit package). Contributions may be flat-rate premiums or progressive rates. Social security health insurance schemes generally charge progressive contributions, defined as a percentage of the insured person's *insurable income*. Social security contributions are, in general, independent of the age, sex and the number of covered family members.

Contribution ceiling The maximum amount of salary per month or per year which is subject to social security contributions.

Contribution collection ratio The relative total amount of contributions actually collected by the scheme in a given financial year as stipulated in financial statements to the expected total amount of contributions as declared in the periodical statements of employers to the social security scheme which normally also reflect the liability of the scheme towards insured persons.

Coordination of benefits (COB) The process of attributing the portion of the cost of care payable by each insurer when a beneficiary is covered by more than one health insurance scheme. Many third-party payers develop their own COB procedures, and report under this heading the amount saved by transfer of costs to other insurers.

Co-payments Also referred to as *cost-sharing*. All payments which patients have to make for consumed health care goods and services, in addition to payments by a third-party payer. Co-payments generally only cover a part of the cost of services incurred by the patient. Some social security health insurance schemes apply co-payments that are differentiated on the basis of income. Co-payments may take various forms, as illustrated by the following classification scheme:[1]

(1) *Fixed fees or charges*. The patient pays a fixed, flat-rate fee for every service or a defined range of services.

(1.1) *Circumvention fee*. A type of fixed fee which is due if a patient directly contacts a provider on a higher level of care than the designated entry level of the delivery system (for example, contacting a specialist first, without being referred by a general practitioner).

(2) *Deductible*. A part of a bill or a part of the total cost incurred over a defined period by a covered person which has to be paid by the covered person. Insurance benefits then cover all of or a percentage of the rest of the cost. Some variations of this principle are:

(2.1) *Maximum liability level*. All expenses of covered person beyond a certain level are borne by a third-party payer

(2.2) *Catastrophic insurance*. The third-party payer only bears expenses beyond a very high ceiling.

(3) *Maximum coverage limits*. The reverse of catastrophic insurance i.e. the patient bears all expenses above a certain limit

(3.1) *Co-insurance*. Patients pay a fixed percentage of the cost of all or a defined range of services. An example is the 'ticket moderator' applied in the social security health insurance systems of Belgium and France. Under this system, patients pay 25% of medical fees (and amounts above the approved fees) for a broad range of services; however, 100% of costs are reimbursed to patients for some services.

(3.2) *Exclusion of benefits.* The cost for a defined range of services is not borne by the third-party payer, but by the patient in full.

(3.3) *Indemnity payments.* The third-party payer reimburses a certain amount per purchased good or service, regardless of the actual cost to the patient (e.g. a fixed rate for board and lodging per hospital day).

Coverage ratio (registration ratio, insured ratio) The ratio of the number of insured persons actually insured/registered/covered by the scheme to the potential number of persons that should be covered which often refers to the number of employed persons in the population or some of its sub-groups.

Cost-based reimbursement See *payment of providers.*

Cost-benefit analysis A form of economic analysis in which all costs and benefits are expressed in common monetary terms.[2]

Cost containment Measures to reduce the increase of health care expenditure, often taken to counter rapid increases in expenditure in some or all categories of services (a phenomenon often referred to as *cost explosion*).

Cost control Determination of the proper capacity to deliver services and the most efficient ways to produce services at any level of capacity.[3]

Cost sharing An arrangement whereby the consumer of health care pays a share of the cost as an out-of-pocket expense to receive care. Cost sharing may take the form of a fee payable by the patient at the point of service, when initiating an episode of care, or after the care has been delivered.

Cost shifting The practice of charging one group of patients (or any individual belonging to a certain group) a higher price for services, to make up for the underpayment for providing the same service to other groups of patients. Commonly, private patients pay higher prices than those covered by a publicly financed scheme (especially where the public scheme fixes maximum prices for services).

Coverage (1) The part of the expenses for a defined range of services for covered persons that is borne by the insurer. (2) The part of a given population that is eligible to receive benefits from a certain health care scheme or insurance.

Credit balance The balance that exists on a particular account when the sum of credits is greater than the sum of the debits.

Cross-subsidization This occurs when one social security sub-system or scheme, one provider, or one department of a provider institution (e.g. one hospital ward) is subsidized by revenues collected by or for another subsystem, scheme, provider or unit.

Current assets Assets that have a relatively short life (usually less than one year) and are for use by the organization, e.g. drugs and medical appliances.

Debit balance The balance that exists on a particular account when the sum of debits is greater than the sum of the credits.

Deductible An amount fixed by the insurance plan (per person, per period, per case or per type of service) that must be paid by the insured person before the insurance pays benefits. See also *co-payments*.

Demand for health services The volume and structure of health care services or goods the public is willing or able to purchase at various price levels for the respective goods and services.

Demand-suppressing function of the market price A uniform market price for a good or service suppresses a part of the potential demand, since some persons are not able or willing to purchase the good or service at the prevailing market price.

Depreciation A measure of the wearing out, consumption or other loss of value of a fixed asset that arises from using the asset, the passage of time or obsolescence. For example, if a vehicle is bought and expected to be replaced after five years, its cost to the organization will be recognized as spread over five years, and the depreciation applied each year will be one-fifth of the value of the vehicle. In the income and expenditure account, the depreciation charge represents the fair proportion of the consumption of the fixed asset that is linked to that accounting period. On the balance sheet, the fixed asset should be valued at its original purchase cost, less accumulated depreciation to date.

Diagnosis-related-groups (DRGs) A system used by Medicare and other insurance schemes in the United States to classify illnesses according to diagnosis and treatment. Each DRG carries a specific weight, and the authorized fee depends on that weight. The fees are determined in advance for each DRG, and are paid on a per-case basis. In the United States, hospitals are required to specify on the invoice the DRGs for which they charge fees. See also *payment of providers*.

Density factor This factor reflects the ratio of the average period of contributions actually paid during a financial year to the potential full period of contributions over the same financial year.

Dircct/indirect pattern of delivery of services Some insurers have their own health service facilities (e.g. outpatient clinics or even hospitals), which supply services to insured persons – this constitutes a *direct pattern of delivery*. In other cases, services might be provided by external providers under contract with the insurer, or expenses for services purchased from providers might be reimbursed to the patient – which reflects an *indirect pattern of delivery*.

Discharge planning Identifying the patient's needs and providing those medical needs outside the hospital, in order to expedite the release of patients from hospital (i.e. from inpatient care).

Double-entry bookkeeping A recording system which registers the dual aspect of every transaction, i.e. the fact that there is a payment and a receipt, a transfer from one account to another. For each transaction, there are always two entries, one debit and one credit. For example, if a building is rented for office premises, each payment of the rent, paid by cheque, would be recorded as debit to the bank column of the cash account and a credit to the rent account. This system enables entries to be checked, as at any time the total debits and total credits recorded should agree. The *balance* of a particular account is the difference between the sum of the debits on that account and the sum of the credits; it is a *debit balance* if the sum of the debits is greater than that of thc credits and a *credit balance* if the credits exceed the debits. If the balances of all accounts are written down, with the debit balances in one column and the credit balances in another, the totals of the two columns should agree.

Double blind test A clinical study of the impact of a medicine, in which neither the participants nor the doctors know who is receiving the experimental drug and who is receiving the placebo or standard comparison treatment. This method is believed to achieve the greatest accuracy in observed results.

Economies of scale The amount of money saved in the mass or specialized production of a given good or service, as opposed to a more singular production method. Economies of scale may occur in the health care sector, for example, if hospitals specialize in certain treatments.

Effectiveness of care The extent to which a type of health service or care achieves its objective, i.e. improving the health status of patients.[4]

Efficiency of care The extent to which an activity produces the greatest product at a given cost, or a specified level of production at the lowest cost.[5]

Elasticity of demand/supply The ratio of the percentage change of the quantity consumed or produced of a given good or service to a given percentage change in the price of the respective good or service.

Eligibility conditions A process to determine if an individual meets the qualifications or conditions for benefits from the insurance scheme.

Equality of care The degree to which different persons receive the same quantity and quality of care in a case of identical need.

Equity of care This exists when the degree is considered to be fair for when persons or communities in fact or potentially benefit from the health care system in exchange for their contribution to the financing of the system.

Epidemiology The branch of medical science that studies the incidence, distribution and control of disease in a population.

Exception report An accounting of significant variances, which directs management's attention to the most relevant areas of income or expenditure to be examined.

Exclusion of benefits Clauses in an insurance contract that deny or limit coverage of specific risks or types of services, or subject them to qualifying conditions. See also *co-payments.*

Exclusive provider organization (EPO) A managed care organization that is similar to the *preferred provider organization (PPO),* in that patients may choose to receive care from among those providers within the network. If a patient wishes to receive care from a provider outside the established network, the cost of that treatment is not reimbursed by the scheme.

Exclusivity clause A clause between the provider (e.g. doctor or hospital) and the insurer which prohibits the provider from contracting with more than one managed care organization (e.g. HMO, PPO, etc.).

Experience rating A system where the insurance company evaluates the risk of individuals or groups by examining their health history.

Fee-for-service A method of payment by patients to providers based on a specific charge for each service rendered. The paying patient then claims reimbursement from the insurer. Under this system, the responsibility for payment to the provider remains with the patient. See also *payment of providers.*

Fee schedule A comprehensive listing of fees used by a paying agent (e.g. a health insurance scheme or government) to reimburse physicians and other providers who charge on a fee-for-service basis.

Financial equalization A system of transfer payments sometimes used by social security systems to equalize certain risks between independent individual statutory health insurance funds, e.g. an over-proportionate number of persons with costly illnesses (end-stage renal disease, haemophilia, etc.) or an over-proportionate number of elderly protected persons. Financial equalization is a form of institutionalized *cross subsidization.*

Financial plan Medium- or longer-term support tool for the scheme, covering a three- to five-year period. It supports the aims and objectives of the scheme, and ensures that its financial status is secure. A financial plan requires actuarial projections for the scheme to be drawn up, assessing the likely amount of medical benefit expenditure and expected contributions.

Fixed assets Assets which are held for use by the organization and which are of some economic benefit to the organization, e.g. premises, equipment, vehicles, etc.

Fixed fees or charges See co-payments.

Free choice of provider When patients can choose the provider/supplier of care they prefer, without restriction.

Free-rider-problem In health care, exists when persons can benefit from a health care system without contributing to the system.

Frequency The number of cases of treatment or (defined) units of care per insured or protected person in a given category of services within a defined period of time. Here, the terms ‘case’ and ‘unit’ require precise definitions.

Fund accounting A system of fund accounting will report on individual funds, using cash, accrual or commitment accounting (or a combination thereof).

Gate-keeper A primary care physician responsible for overseeing and coordinating all the medical needs of a patient. The gatekeeper must authorize any referral of the patient to a specialist or hospital. Except in cases of emergency, the authorization must be given prior to care. See also *triage system.*

Health care delivery system The way in which health care is actually delivered in a given country or region (i.e. the answer to the question: Who produces which goods or services for whom and how much?). The delivery system defines how the *health care infrastructure* is equipped, how work and responsibilities within the infrastructure are shared, and thus how medicine is practised in a given country or region.

Health care infrastructure The set and structure of all physical health care facilities (health centres, hospitals, pharmacies, dispensaries, medical schools, etc.) and operating manpower (doctors, nurses, midwives and other health care workers).

Health event record A voluntary record of names, addresses and symptoms of people who believe they may have been affected by an emergency incident.

Health maintenance organization (HMO) An institution, often owned by a group of providers or physicians, which provides comprehensive medical care to its enrollees or subscribers on a prepaid basis. The HMO assumes the risk for the cost of care within the contract period, in return for prepaid fees and restrictions on the subscribers' free choice of provider. There are four HMO model types. (1) The *staff model HMO* employs health care practitioners directly. These providers are then employees of the HMO, and work exclusively with HMO subscribers. (2) The *group model HMO* contracts with one or more group practice(s) to provide health care services, and each group primarily treats the HMO's members. (3) The *network model HMO* contracts with one or more group practices to provide health care services, and some or all of the groups provide care to a large number of patients who are not members of the HMO. (4) The *independent practice association (IPA) model HMO* contracts with physicians in private practice, or with associations of physicians who in turn contract with their member physicians to provide health care services to HMO members. Most physicians in IPA systems have private practices, and in many cases have a significant number of patients who are not HMO members. In addition, there is a fifth type known as a *mixed model HMO*, in which two or more of the basic models are combined. These HMOs sometimes offer their members various options (at differing prices) for one type of HMO service or another.

Health status indicators Generally, variables with numerical values that try to measure or indicate the health status of a given population in whole or in part, such as infant mortality, life expectancy at birth, number of cases of certain illnesses per capita during a defined period of time (*morbidity*), proportion of the labour force which is on average absent from work due to sickness (*sickness rate*), etc.

Holistic (wholistic) medicine Various systems of health protection and restoration, both traditional and modern, that are reputedly based on the body's natural healing powers, the influence of the external environment, and the way various tissues affect each other.

Income and expenditure account A statement of the results of financial operations carried out during the accounting period, e.g. the surplus or deficit for that period.

Incremental budgeting A budgeting method that assumes the existing pattern of income for the next year, taking into account only changes in cost from activities in the previous year.

Indemnity payments See *co-payments.*

Individual equivalence See *principle of equivalence.*

Individual practice association (IPA) See *HMO* and *pre-paid schemes.*

Infrastructure indicators Measurements of the availability of health facilities in a given country or region, such as number of physicians per capita (physician density), inpatient medical care beds per capita, etc.

In-patient services Diagnostic, analytical or therapeutical services which are provided by a hospital to a patient that remains in the facility overnight. The services are usually divided into accommodation (room and board), medical and surgical services, and ancillary or technical services.

Insurable earnings and Average monthly insurable earnings
– Insurable earnings are those received as a result of employment services rendered to an employer which are subject to the payment of contributions to the social security

scheme. Insurable earnings often include the base salary and additional compensation components awarded to an insured person while they exclude income received above the ceiling on insurable earnings.

– Average monthly insurable earnings are equal to the average annual insurable earnings divided by the average number of months of contributions payments recorded. They hence refer to the earnings of a normal month which are subject to contributions.

Insured persons (Registered persons, actually covered persons) and Active insured persons (active/current contributors; contributing population) and Inactive insured persons (latently insured persons) Insured persons refer to the group of persons who have been reported as insured/registered/actually covered under the social security scheme at some time, excluding those who have definitely left the scheme, e.g. deaths, and those who are already in receipt of long-term benefits.

Active insured persons are individuals on whose behalf at least one contribution payment has been paid to the scheme during a given financial year.

Inactive insured persons are all registered persons who did not pay contributions (or on behalf of whom no contributions have been paid) during the 12 months preceding the valuation date, i.e. insured persons minus active insured persons.

Investment policy An Investment Committee should normally be responsible for the design and monitoring of a statement of the investment policies and objectives of the scheme for both the short and the long term with a legal basis. In particular, it should list the permitted asset categories and the specific asset holdings, if necessary, that are permitted along all the prescribed constraints, including the minimum quality of assets and limits on the proportion of assets that may be invested in specific investment vehicles or assets. Such constraints should be determined in light of the level of risk that is allowed to be afforded by the scheme. Also, performance objectives should be stated at least for the short term – this may be expressed in terms of another indicator – along with the prescribed methods of measurement that should be used for monitoring the investment performance of the scheme.

Investment portfolio The details on the assets owned by the social security scheme, usually by category of investments.

Kind (type) of care Either preventive (primary and secondary prevention), curative, rehabilitative or promotive health care services.

Ledger The physical record of all accounts, which may be subdivided into sections. Ledgers may be maintained manually using loose-leaf files, or they may be in the form of computer files.

Level of care Term to denote the intensity of care: primary (generally preventive or curative), secondary (generally curative or rehabilitative specialist care) and tertiary (generally curative care).

Liabilities Amounts due but not yet paid at the date when the trial balance is compiled.

List of drugs A list of pharmaceuticals which a given third-party payer provides or pays for (positive list or list of approved drugs), or which the third-party payer does not provide or pay for (negative list). A positive list often includes fixed prices. Another type of list is the comparative price list, which compares the performance and prices of similar drugs.

Managed care A general term for organizing doctors, hospitals and other providers into groups in order to enhance the quality and cost-effectiveness of health care. Managed care organizations include HMOs, PPOs, POSs, and EPOs.

Management accounts Series of reports which support the monitoring and evaluation of the scheme, and enables a more detailed understanding of the financial status of the scheme.

Maximum liability level See *co-payments*.

Maximum coverage limits See *co-payments*.

Medically necessary Services that are required under a specific plan to preserve and maintain the health status of a member. These standards are usually defined according to the prevailing practice in the specific area.

Moral hazard The possibility of consumers or providers exploiting a benefit system unduly to the detriment or disadvantage of other consumers, providers or the financing community as a whole, without having to bear the financial consequences of their behaviour in part or in full.

National average wage The national average wage reflects the average amount of earnings received by workers of all sectors in the economy.

National health care system The functioning of health care in a given country or region, determined by the way health care resources have been and are developed and organized, as well as how services are delivered, financed, managed and supervised.[6]

National health insurance (NHI) A nationwide health insurance or system of individual insurance schemes which generally cover the majority of the population in a compulsory fashion.

National health service (NHS) A tax-financed nationwide health delivery system that provides health care services to the entire population. Facilities are generally owned by the State, and health manpower is in government employment (e.g. in the United Kingdom) or paid on a salary or capitation basis.

Need for health care services The structure and volume of health care services and goods a person or a population needs, according to the current medical and epidemiological knowledge. This is generally higher than actual demand.

Open enrolment (1) A period during which eligible subscribers may elect to enroll in or transfer between available programmes providing health care coverage. (2) A prepaid scheme which anyone can join without any restriction, and by which no potential member can be rejected on grounds of health status, age, sex, etc.

Outlier In *utilization reviews*, a term denoting that which falls outside the norm. For example, a provider who uses too few or too many services (usually identified by two standard deviations from the mean) is called an 'outlier'.

Outpatient services Medical and other services provided by a hospital or other facility (e.g. mental health clinic, rural health clinic, mobile clinic or X-ray unit) to patients who do not need hospitalization.

Over-billing When a provider charges more for services than the amount paid to him or reimbursed to the patient by a third-party payer.

Pay-as-you-go (PAYG) or assessment premium systems of financing A system of insurance financing under which total expenditure (benefit expenditure plus administrative expenditure) in a given period is met by income (contributions and other sources) from the same period. Pay-as-you-go financed insurance schemes do not accumulate reserves, except contingency reserves.

Payment of providers The payment of providers of care for services provided to protected persons can take several different forms. (1) *Salary*. Providers are employed by the scheme as salaried employees. (2) *Capitation*. Providers are paid a comprehensive fee per insured person to whom they provide services in case of need during a defined period of time. In the United Kingdom, for example, covered persons register on the list of a certain GP, who receives a fixed fee per month from the National Health Service for each registered person. (3) *Fee-for-service*. Providers are paid for every single item of service. The items and their prices are usually listed in a *fee schedule*. (4) *Diagnosis-related groups (DRGs)*. A comprehensive fee per case is paid to the provider for the treatment of a patient with a given diagnosed illness. The system is currently used in the United States to pay hospitals for the treatment of Medicare patients. (5) *Cost-based reimbursement*. Providers are reimbursed on the basis of the cost they incur for each case of treatment. (6) *Per diem fee*. Providers (generally hospitals) are paid a constant fee per hospital day for covered persons. Per diem fees may be constant throughout the period of hospitalization of a patient, or they might decrease over the period. Certain expensive procedures (generally surgeries) might be exempted from the overall fee, and reimbursed separately. (7) *Budgeting*. A scheme or group of schemes agree with providers on a fixed (usually annual) budget for the provision of services for a defined number of covered persons. This method is used in some countries for the payment of hospitals.

Per-diem fee See *payment of providers*.

Point-of-service plan (POS) Also known as an open-ended HMO, the POS encourages – but does not require – members to choose a primary care physician. The primary care physician acts as a *gatekeeper* for referrals. Subscribers who choose not to select a primary care physician are charged higher *deductibles* and *co-payments*.

Pre-existing condition A medical condition (or status) that already existed before the onset of a certain medical event (or before the start date of insurance coverage), whether or not diagnosed by a doctor.

Preferred provider organization (PPO) An arrangement between purchasers of care (e.g. insurance companies or employers) and providers of care for tariff protection of a defined group of patients, in return for preference of those providers by these patients. Usually, the patients have a double financial incentive to adhere to the arrangement – the providers charge lower fees, and the insurer offers preferential conditions, e.g. a lower *deductible* or *co-payment*. See also *pre-paid schemes*.

Prepaid group practice See *pre-paid schemes*.

Premium Usually a flat-rate contribution differentiated by age (at time of entry into the scheme) and sex of insured persons, charged by commercial health insurance schemes. Premiums are usually calculated using the present value of the expected average cost which an insured person is likely to incur during the period of membership in the scheme.

Pre-paid schemes (or systems, or plans) All delivery systems that provide health care to enrollees in case of need in exchange for predetermined ('prepaid') contributions that are independent of the amount of services the individual actually consumes. Examples include (1) *health maintenance organizations* (HMOs); (2) *preferred provider organizations* (PPOs), in which subscribers consent to utilize only certain designated providers; (3) *prepaid group practices*, in which a group of physicians in a group practice (generally GP and specialist) deliver services in case of need, in exchange for fixed predetermined contributions; and (4) *individual practice associations* (IPAs), in which a group of GPs and specialists provide health care services in their own individual practices in exchange for a fixed contribution paid to the group.

Pricing of health care goods The mechanism by which the prices paid by patients or third-party payers for health care services and goods to providers are fixed.

Principle of equivalence (1) The present value of all contributions of an insured person during the insurance period should be equal to the present value of all expected expenses incurred by the person, as well as the person's share of administrative costs (*principle of individual equivalence*). (2) The present value of the expected income of the scheme should equal the present value of expected expenses (benefit and administrative expenditure) over a defined period of time. In short-term benefit branches of social security, such as health insurance systems, this period is usually no longer than one year (*principle of collective equivalence*).

Prospective payment system (PPS) All systems for the payment of providers where fees or budgets are fixed in advance, usually before the beginning of a new fiscal year.

Protected (covered) persons All persons who are eligible for benefits of a given health care scheme, usually insured persons and their dependants (non-working spouses, dependent parents, and children under a certain age).

Provider A person or institution which physically delivers health care goods and services, often referred to as a *supplier*.

Provider-induced demand Providers of health care are to a certain extent in a position to create or determine the demand for their own services.

Quality assessment Methods to determine the quality of health services or goods.

Quality assurance (QA) Methods to guarantee a certain level of quality of care in a defined medical setting. Such activities include peer review and utilization review to identify and remedy deficiencies in quality. The method must include a mechanism for assessing effectiveness, e.g. measuring care against pre-established standards. In the United States, the QA function is often performed by professional standards review organizations (PSROs).

Redistributive effects of social security systems Social security benefits have a certain monetary value for the recipient, and they can thus be regarded as income. A social security system may redistribute income *horizontally* between insured or protected persons in one socio-economic group (persons with the same per capita contribution) – e.g. between healthy and sick persons. Redistribution may also occur *vertically* between different socio-economic groups. Due to often uniform contribution rates in social security health insurance schemes, one group of insured persons might subsidize another group (vertical income transfers), which can thereby consume more benefits than the equivalent of their contributions (e.g. young insured persons subsidize older persons, single insured persons might subsidize insured persons with families, or persons with high incomes may subsidize persons with low incomes). Vertical income redistribution is a form of *cross-subsidization* between different groups of insured or protected persons.

Relative value scale (RVS) or **relative value resource based scale (RVRBS)** A method for determining a dollar value payable for each medical procedure, by attaching relative values to medical and surgical procedures and using a conversion factor to translate the relative values into a scale of comparable values.

Risk The possibility of or exposure to loss or negative consequence. In insurance, this term signifies the possibility of loss associated with a given population.

Risk factor Something that increases the chance of developing a disease, or the resulting financial loss.

Risk pooling (pooling of risks) Aggregating money to be used for a defined purpose. In health insurance, this signifies enlarging the covered population and aggregating the resources related to the larger population, in order to reduce the average risk.

Screening out Methods for discouraging high-risk persons from joining a scheme or continuing membership. See also *adverse selection.*

Self-insurance The practice of an employer or other organization to assume the responsibility for health care losses of its employees, rather than to purchase insurance. Self-insurance may take the form of an established internal fund which operates in a manner similar to an insurance scheme (defining eligibility, processing claims, and paying benefits to covered persons).

Stop loss The quantitative level up to which an insurer is liable for costs, beyond which risk is passed on to a re-insurer. Stop-loss clauses usually cover either overly large single claims, or excessively high aggregate claims of any one member within a defined period.

Technological imperative The notion that every technological progress in medical science, regardless of costs, will find its application in common medical practice.

Tertiary care Speciality or sub-speciality care, usually requiring the facilities of a university-affiliated or teaching hospital with extensive diagnostic and treatment capabilities.

Theory of public choice A theory attempting to rationalize the decision-making processes in which in the interaction of voters, politicians and bureaucrats results in the selection of public policy options.

Third-party administrator (TPA) A company or a broker that performs all or part of the administrative tasks of the insurance, under contract from the insurer but without assuming any underwriting function. Typical TPA activities would be to collect premiums, process and pay claims, locate stop-loss insurance, as well as to conduct provider contracts or negotiations. The TPA may also analyse the claims data to identify patterns of utilisation, or examine the effectiveness and competitiveness of the health insurance.

Third-party payer Generally an institution that pays some or all expenses for health care incurred by a defined group of covered persons. In the case of an NHS, the State is the third-party payer, and the defined group of covered persons is the entire population.

Triage system A mechanism which directs patients to the appropriate level of care, often also referred to as a *gate-keeper* system.

Trial balance The list of balances on each account, i.e. the differences between the credit balance and debit balance for each account.

Variance The difference between the budget and actual expenditure; can be either positive or negative.

Virement Transfer of savings in one department or cost heading to another department or cost heading.

User charge A form of co-payment, usually a fixed fee payable directly to the provider at the point of delivery.

Unit cost The cost of a unit of service or good in a given category of services. The unit must be defined (e.g. a hospital day).

Usual, customary and reasonable (UCR) A *usual fee* is one which the provider usually charges his private patients for his services. A *customary fee* is one that is within a range of usual fees charged by providers of similar training and qualifications within the same area. A *reasonable fee* is one that meets the previous two criteria, or that is considered justified by a review committee, bearing in mind the special circumstances of a particular case.

Utilization reviews (URs) or **Utilization management (UM)** A *utilization review* is a systematic means for reviewing and controlling patients' use of medical services, as well as the quality and appropriateness of care provided. UR usually involves prospective, concurrent and retrospective activities, as well as data collection and analysis linked especially to authorizing payment for specialist referrals, emergency or elective hospitalization, and other costly services.

Waiting period The period an insured or covered person has to wait before he or she qualifies for benefits (often used in the context of sickness allowances, where a patient may have to wait a number of days before the sick pay commences).

Zero-based budgeting A budgeting method that starts each year from zero or no activity in each category, and which therefore requires each activity to be justified and costed again each year.

Notes

[1] This classification of co-payments is drawn from Ontario Council of Health, *User charges for health services* (Toronto, 1979).

[2] WHO, *Economic support for national health for all strategies*, Geneva: WHO, 1987, 119.

[3] Zubkoff, *Health: A victim or cause of inflation* (New York, 1976), 26.

[4] WHO, op cit., 119.

[5] Ibid.

[6] WHO, *National health systems and their reorientation towards health for all* (Geneva, WHO, 1984), 13.

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