REPORTS AND ENQUIRIES

Compulsory Accident Insurance in Switzerland from 1923 to 1927 [1]

The Swiss National Accident Insurance Fund has recently published a statistical report on the results of its work during the second quinquennial period, from 1923 to 1927 inclusive. This report is more extensive than that on the first period and contains a particularly interesting innovation, for it gives the frequency and severity rates per full-time worker, and that not only for all accidents, but also by industry and by cause. It points out that the stabilisation of the general situation during this second period has made the data lend themselves much better to detailed statistical treatment than those for the preceding period. Economic conditions too have been more favourable, and the method of compensation has become stabilised. In dealing with the figures for this period it was therefore possible to take the demands of international statistics into account.

As the legislative and financial basis of the Swiss insurance system was described in these pages on the occasion of the first report published by the National Fund [2], we may proceed at once to analyse the figures for 1923-1927.

The General Accident Risk

The following table gives the number of accidents in respect of which compensation was paid. [3]

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[1] This note has been prepared on the basis of an analysis communicated to the International Labour Office by Mr. F. Hool, of the Swiss National Accident Insurance Fund.

[2] Cf. *International Labour Review*, Vol. X, No. 5, Nov. 1924, pp. 837-853 : " Five Years of Compulsory Accident Insurance in Switzerland."

[3] Under Swiss law compensation equal to 80 per cent. of the insured person's earnings is payable as from the third day after the accident. Minor accidents that are cured within this period are not included in the figures of the table. For every 100 accidents leading to more than two days' disability in addition to the day of the accident there were 49 of these minor accidents covered by industrial accident insurance and 30 by non-industrial accident insurance.

NUMBER OF ACCIDENTS, 1923-1927

Year	Industrial accidents					Non-industrial accidents				
	Total	Permanent disability		Deaths		Total	Permanent disability		Deaths	
		Total	Per 1,000 accidents	Total	Per 1,000 accidents		Total	Per 1,000 accidents	Total	Per 1,000 accidents
1923	76,842	2,591	33	269	3.5	21,063	678	32	153	7.2
1924	82,489	2,882	35	312	3.7	22,282	735	33	141	6.3
1925	86,072	2,944	34	265	3.1	25,627	818	32	156	6.1
1926	89,341	2,881	32	287	3.2	27,133	811	30	191	7.0
1927	94,200	3,023	32	317	3.4	28,528	863	30	195	6.8

It will be seen that the number of accidents increased from year to year, but that the proportion of serious cases leading to permanent disability or death remained constant.

To estimate the accident risk the National Fund has selected the base advocated as an international measure, that is to say, the "full-time worker", corresponding to 300 working days. In calculating the number of full-time workers for each class of risk, it has used the figures of average wages and total wages of the insured persons when the time of exposure could not be calculated directly.

The Fund has calculated frequency rates and severity rates. For the latter it followed the international system, using the formula adopted in Sweden [1]:

$$K = \frac{1}{N}(S + 75\,I + 7{,}500\,T).$$

The report points out, however, that the coefficients 75 and 7,500 used in Sweden have not yet been adopted internationally, and that the coefficient 75 used to calculate the time lost by permanent disability is too high for Switzerland, owing to the conditions of compensation.

The general frequency and severity rates and the average cost of compensation are shown in the table below.

[1] K = severity rate = loss of working days per full-time worker ; N = number of full-time workers employed ; S = number of working days lost owing to temporary disability ; I = sum of percentages of permanent disability ; T = number of deaths. Cf. *International Labour Review*, Vol. VIII, No. 3, Sept. 1923, p. 439.

FREQUENCY AND SEVERITY OF ACCIDENTS AND AVERAGE COST OF COMPENSATION, 1923-1927

Year	Number of accidents per 100 full-time workers		Number of working days lost per full-time worker		Average cost of compensation per 1,000 francs of wages	
	Industrial accidents	Non-industrial accidents	Industrial accidents	Non-industrial accidents	Industrial accidents	Non-industrial accidents
1923	14.5	4.4	14.3	5.1	18.4	5.8
1924	14.4	4.0	15.3	5.0	19.1	5.6
1925	14.5	4.5	14.9	5.3	18.7	6.0
1926	15.1	4.6	15.3	6.0	18.9	6.3
1927	15.5	4.6	15.6	6.0	18.9	6.1

The covariation between the severity rate and the average cost rate shows that the latter is sufficient for the internal requirements of the National Fund.

Apart from a slight increase in both branches of insurance, the average risk remains fairly stable. As will be seen later, however, the different classes of risks and industries show wide divergences. In some the risk of accident is increasing, in others diminishing. Certain branches of industry have developed rapidly, others have suffered a setback, and these fluctuations affect the risk and therefore the results of insurance. Finally, there have been certain changes in the conditions of compensation for permanent disability, which should be mentioned here as a cause of the increase in the average risk.

The severity rates for the period in question were as follows :

WORKING DAYS LOST PER FULL-TIME WORKER PER YEAR ON ACCOUNT OF ACCIDENTS, 1923-1927

Extent of disability	Working days lost	
	Industrial accidents	Non-industrial accidents
Temporary disability	2.7	0 8
Permanent disability	8.7	2.5
Death	3.8	2.2
Total	15.2	5.5

The average duration of the disability per accident is relatively very long. It was steadily rising during the whole of the first period, then became stabilised, and now even tends to diminish, as will appear from the following table.

AVERAGE DURATION OF DISABILITY PER ACCIDENT, 1923-1927

Year	Industrial accidents	Non-industrial accidents
	Days	Days
1923	17.1	19.0
1924	17.2	18.8
1925	15.4	16.7
1926	15.0	15.8
1927	14.8	15.8

The improvement in the economic situation has no doubt contributed to bring about this improvement, but the National Fund also considers that the reduction is partly due to its stricter supervision. This raises the question of the influence of non-occupational factors on the frequency, and above all on the severity, of accidents.

The Influence of Non-Occupational Factors

Factors Foreign to the Risk

It is a well-known fact that insurance has a kind of paralysing effect on the will, energy, and resistance to pain. It is even in some measure a cause of fraud in all its forms, ranging from obviously unlawful action — serious abuses, malingering or exaggeration, self-inflicted injuries — to what might be called semi-fraud, or simply sharp practice, which, without being a serious offence in itself, is much the most so in its consequences. Malingering and serious abuses are comparatively rare, and the insuring institution has sufficient experience to track down or prevent this kind of fraud or to counteract it. On the other hand, mere sharp practice is widespread. In accident insurance there is a great temptation to prolong absence a little beyond what is justified, or even to try to obtain compensation for an insignificant injury which in no way affects the capacity to work.

The National Fund has tried to compile statistics showing the effect of some of these abuses. It is found, for instance, that the supplementary insurance for the amount of wages not covered by com-

pulsory insurance — the latter granting compensation of only 80 per cent. of the insured person's earnings — results in a fairly considerable prolongation of the absences. In the metal industry, for instance, the average period of absence in 1925-1926 was 12 days for the victims of industrial accidents who were in receipt of the statutory benefit only, 14 days for those who were covered by an additional insurance, and 13.3 and 15.8 days for the victims of non-industrial accidents. The difference was thus 15 to 20 per cent.

Furthermore, experience shows that work is resumed most often on a Monday. In 1925 this was so in 51.1 per cent. of the cases. [1] There is obviously no reason why a person should be more likely to be cured on a Monday. It is a matter of convenience to the injured person, and also a matter of habit. The average period of absence is in this way prolonged by about one day, which in 1927 involved an additional expenditure of 981,824 francs, or nearly a million.

Personal Risk Factors

Risk factors of quite a different kind are those described by the report as "causes of accident depending on the personality of the insured person". Among these causes, age is the most important.

During the first period (1918-1922) the National Fund found that accident frequency was evidently not a function of age, the rates being very nearly constant for the different age groups, except that the lower age groups had a slightly higher frequency. In order to ascertain the reason for this excess, the results of the insurance of apprentices during two years of the second period were closely examined. It was found that the relative frequency of accidents was greater among apprentices than among insured persons as a whole. In the metal industry the number of industrial accidents per full-time worker was 0.29 for apprentices and 0.16 for workers. The difference was slightly smaller for the general figures of non-industrial accident insurance. It should be observed that it is not a case of an especially high frequency for apprentices of slight accidents only.

The lack of technical training and of adaptation to surroundings obviously plays an important part in this connection. A study of the accidents in 1926 and 1927 showed that 14 per cent. of them happened to insured persons who had been employed by the undertaking

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[1] The average number of days of absence in the various groups of injured persons (excluding pension cases) calculated according to the day on which work was resumed was as follows:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
12.8	10.8	11.6	11.1	10.5	11.0

The Fund has tried to remedy this state of affairs. Its intervention has reduced the number of cases of resumption on Monday, but this reduction has unfortunately been counterbalanced by an almost equivalent increase in the cases of resumption on Tuesday.

for not more than a month, and 46 per cent. to persons employed for not more than a year. The newcomers in an undertaking therefore run greater risks, which diminish as they become familiar with the conditions of the undertaking and adapt themselves to their new surroundings.[1]

The direct relation between age and the severity of the accident, which has already been proved on various occasions by other statistics, is again confirmed by the results of the Swiss Insurance Fund during 1923-1927. The percentage of accidents resulting in permanent disability or death increases with age, and so does the average duration of temporary disability.

The report also mentions the influence of negligence and predisposition to accidents. Although a collective insurance system hardly lends itself to this kind of research, the National Fund was able to establish that during the period 1923-1927, 3,097 insured persons had 10 or more accidents each. These must no doubt be classified as workers with a marked predisposition to accidents. One-third of the group were unskilled workers and labourers ; the rest were distributed among the various occupations in proportions corresponding fairly closely to the degrees of risk in those occupations.

The National Fund has also found that for a person who suffers an accident in a given year the risk of accident during the following year is 50 per cent. higher than for insured persons on the average.

The influence of alcohol and of fatigue was not made the subject of special study. It is difficult to separate their effects from those of other factors. It is known that the abuse of alcoholic beverages tends to increase accidents, that it should be energetically combated, and that the consumption of alcohol at the workplace should even be prohibited.

Consequences of Accidents

Temporary Disability

The proportion of accidents resulting in temporary disability varies between about 965 and 962 per thousand. This group comprises all accidents resulting in disability lasting more than two days in addition to the day of the accident.

What is most important from the point of view of insurance is obviously the duration of the period of recovery to health. The following table shows the progress of recovery of 1,000 persons injured. It will be seen that for industrial accidents recovery is more rapid than for non-industrial accidents, the latter being as a rule more serious.

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[1] Reference should be made to the observation made by the National Fund that in mechanical woodworking undertakings 50 per cent. of the serious accidents due to machinery happened to insured persons who had been employed for not more than one year.

PROGRESS OF RECOVERY OF 1,000 PERSONS INJURED

Period that has elapsed since occurrence of accident (weeks)	Injuries not yet cured	
	Industrial accidents	Non-industrial accidents
Up to 1[1]	1,000	1,000
1	866	886
2	514	538
3	295	324
4	176	201
5	116	135
6	81	98
9	38	47
12	22	28
15	14	17
18	10	12
26	4	5

[1] 3-7 days.

The curves represented by these figures are similar to those obtained from the data for the first quinquennial period.

These statistics form a basis for estimating the probable period that an injured person under treatment will take to recover after any given period of disability.

AVERAGE EXPECTANCY OF RECOVERY

Period that has elapsed since occurrence of accident (weeks)	Probable number of weeks still necessary for recovery	
	Industrial accidents	Non-industrial accidents
Up to 1	2.59	2.80
1	2.38	2.55
2	2.67	2.88
3	3.28	3.45
4	4.16	4.25
5	5.05	5.09
6	6.01	5.82
9	8.44	7.81
13	11.22	9.65
26	18.67	16.74

The recovery of 100 victims of industrial accidents requires 259 weeks and that of 100 victims of non-industrial accidents 280 weeks.

As regards the effect of sex and age on the period of recovery, the new observations confirm the preceding, namely, that this period increases with age and is a little shorter for women than for men, the injuries suffered by women being in general less serious owing to differences in the nature of the work done by men and women.

A comparison of the average periods of recovery with the corresponding figures for the first quinquennial period shows a slight fall if the very slight and very serious cases are left out of account.

Similarly, the cost of medical aid and duration of treatment per accident are no longer steadily rising, as during the first period. While remaining abnormally high, the cost of medical aid has even fallen a little. There is a similar tendency in non-industrial accident insurance.

COST OF MEDICAL AID AND DURATION OF MEDICAL TREATMENT PER INDUSTRIAL ACCIDENT, 1923-1927

Year	Cost of medical aid per accident	Duration of medical treatment per accident	Cost of medical aid per day of medical treatment
	Frs.	Days	Frs.
1923	88.20	22.6	3.90
1924	88.70	22.6	3.90
1925	86.40	22.5	3.82
1926	83.70	22.4	3.73
1927	80.75	22.1	3.65

Permanent Disability

The considerable increase during the first period in the proportion of accidents resulting in permanent disability came to a stop, and there has even been a slight fall in the second period.

On the other hand, the average initial degree of disability rose steadily from 21.27 per cent. in 1923 to 24.41 per cent. in 1927 for industrial accidents, and from 22.22 per cent. to 25.66 per cent. for non-industrial accidents. The chief reason for this rise is that the National Fund, following the decisions of the courts, has adopted the practice of fixing high initial pensions but graduating them in advance so that they fall more rapidly. The higher average initial degree is to

some extent counterbalanced by the more rapid revision of pensions ; the increase in the average degree does not therefore mean a proportionate increase in the cost of invalidity insurance. As the National Fund points out, here is yet another proof that valid comparisons between countries cannot be made without reference to the method of fixing pensions.

The observations already made on the relation between age and permanent disability are confirmed by the new statistics. The risk of permanent disability increases with age, as appears from the following table.

DISTRIBUTION OF CASES OF PERMANENT DISABILITY BY AGE OF THE INJURED, 1923-1927

Age group (years)	Industrial accidents		Non-industrial accidents	
	Number	Per 100 accidents	Number	Per 100 accidents
Under 19	549	2.3	93	1.0
20-24	1,439	2.5	260	1.7
25-29	1,680	2.7	393	2.8
30-34	1,479	2.9	333	2.6
35-39	1,371	3.4	347	3.3
40-44	1,345	4.4	398	4.4
45-49	1,508	4.7	432	5.1
50-54	1,465	5.4	422	7.1
55-59	1,188	6.3	362	7.2
60-64	828	6.8	245	7.2
65 and over	950	7.3	300	7.2

In estimating the capital value of the pensions two factors have to be taken into account : the mortality of the disabled persons and the results of the revision of pensions in cases of partial recovery. The Fund, in drawing up its balance sheets, did not change the figures for the capitalised value of pensions, on the basis of which the amount of capital required to cover the cost of pensions is calculated, so as to make the results for the two periods comparable. It has tried, however, to determine the effects of the mortality of the disabled and of the revision of pensions, so that past experience can now serve as a basis for a fresh estimate of the capitalised value of the pensions. The following table shows the combined effect of mortality and revision.

RATE OF EXTINCTION OF PERMANENT DISABILITY PENSIONS

Number of years since award of pensions	Sum to which pensions of 10,000 francs initial value are reduced		
	Experience of the National Fund	Estimates of the National Fund	Initial estimates based on Austrian experience
0	10,000	10,000	10,000
¼	9,263	9,880	8,759
½	8,416	9,586	7,649
¾	7,690	9,071	6,479
1	7,347	8,761	5,799
1¼	6,783	8,186	5,279
1½	6,563	7,906	4,860
1¾	6,302	7,616	4,500
2	6,106	7,431	4,269
3	5,293	6,518	3,851
4	4,927	6,416	3,791
5	4,740	6,310	3,728
6	4,491	5,804	3,429
7	4,154	5,698	3,366
8	4,035	5,588	3,301
9	3,764	5,391	3,185

The differences between the three sets of figures are primarily due to the fact that the Swiss practice is to fix a high initial degree of disablement and review it subsequently. It can in fact be shown that during the whole of the first period of nine years the capitalised value of the pensions is mainly dependent on the effects of revision. Hence these capitalised values do not lend themselves to international comparison, since they depend on judicial practice and legal provisions, which differ widely from one country to another.

In order to determine whether there is a relation between mortality and degree of disability, the National Fund grouped its permanently disabled persons in three classes : slight disability (1 to 20 per cent.), medium disability (21 to 75 per cent.), and serious disability (76 to

100 per cent.), and calculated for each class the average rate of reduction of pensions by the mortality of disabled persons in that class.[1]

AVERAGE RATE OF REDUCTION OF PENSIONS BY DEATH, ACCORDING TO DEGREE OF PERMANENT DISABILITY

Period since award of pension (years)	Slight disability (1-20 per cent.)	Medium disability (21-75 per cent.)	Serious disability (76-100 per cent.)
Under 1	0.007	0.012	0.038
1	0.010	0.012	0.013
2	0.012	0.013	0.027
3	0.013	0.017	0.026
4	0.015	0.015	0.038
5	0.022	0.019	0.024
6	0.017	0.015	0.051
7	0.012	0.010	0.000
8	0.016	0.025	0.005

It will be seen that the group of seriously disabled persons has a very much higher rate of reduction by death than the other two groups, but that the differences between the latter are insignificant. The view that the mortality is a function of the degree of disability cannot therefore be supported absolutely.

Furthermore, a comparison between the mortality among the pensioners of the National Fund and the general mortality of the Swiss population from 1901 to 1910 and from 1920 to 1921 has again shown that on the average the mortality among disabled persons is no higher. It was lower than the general mortality by 19 per cent. in 1901-1910 and lower than the mortality for men by 6.5 per cent. in 1920-1921. It should be pointed out that the lower rates are particularly marked during the first three years, contrary to what is observed for disabled persons in general. It is therefore difficult to determine the capitalised value of the pensions in a satisfactory manner.

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[1] The average rate is calculated as follows. During the period between the dates t and $t + 1$, if the reduction by death of the total amount B_t of pensions at the beginning of the period is T_t, then the rate of reduction is

$$q_t = \frac{2T_t}{B_t + B_{t+1} + T_t}$$

On the other hand, if the reduction by revision of pensions of the amount B of pensions during the same period t to $t + 1$ is R_t, then the rate of reduction by revision is

$$r_t = \frac{2R_t}{B_t + B_{t+1} + R_t}$$

Deaths

During the period 1923-1927, as during the first period, the proportion of fatal industrial accidents was relatively constant, while that of fatal non-industrial accidents fell a little, though remaining much higher than that of industrial accidents.

The distribution of the cases of death by the age of the injured for the two quinquennial periods is given in the following table.

AGE DISTRIBUTION OF PERSONS KILLED BY ACCIDENTS

(Per cent. of all fatal cases)

Age group (years)	Industrial accidents		Non-industrial accidents	
	1918-1922	1923-1927	1918-1922	1923-1927
Up to 19	7.3	6.0	11.3	10.5
20-29	22.2	21.0	21.2	20.9
30-39	19.9	21.9	19.9	17.3
40-49	23.0	22.6	21.1	20.6
50-59	16.5	19.0	14.0	19.1
60 and over	11.1	9.5	12.5	11.6

The proportion in the youngest age group is very high in the case of non-industrial accidents, which naturally affects the composition of the various groups of survivors and therefore the cost of compensation. The injured persons who die leaving only ascendants form a much higher percentage of the total number of deaths in non-industrial accident insurance than in industrial accident insurance.

The following table gives the distribution by groups of beneficiaries of the expenditure on survivors' pensions in each of the two periods.

PERCENTAGE DISTRIBUTION, BY GROUPS OF BENEFICIARIES, OF THE COST OF SURVIVORS' PENSIONS

Class of beneficiaries	Industrial accidents		Non-industrial accidents	
	1918-1922	1923-1927	1918-1922	1923-1927
Widows	49.8	56.3	47.9	50.7
Orphans	23.4	22.7	23.6	20.2
Brothers, sisters, and ascendants	26.8	21.0	28.5	29.1

The proportion of widows' pensions to the total cost has risen, while that of pensions for ascendants and brothers and sisters has fallen.

To determine the capital value of the survivors' pensions, both the mortality of the survivors and the expectation of re-marriage of the widows must be taken into account.

This mortality has fallen considerably. Among the widows the number of deaths was 122, whereas the estimates based on the Swiss mortality table from 1901 to 1910 gave the figure of 154, so that the actual figure was 20 per cent. below the estimate. For the other survivors a similar result was found.

The actual frequency of the cases of re-marriage agreed better with the Dutch data that had been adopted as a basis of calculation for estimating pension costs. It was on the other hand much lower than the estimates made on the basis of observations relating to the Swiss population.

The average cost per fatal accident from 1923 to 1927 was 16,788 francs for industrial accidents and 13,527 francs for non-industrial accidents. The corresponding figures from 1918 to 1922 were respectively 15,082 and 13,857 francs. There was thus a considerable increase for industrial accidents, but a fall for non-industrial accidents.

The Distribution of the Risk by Cause and by Industry

An important purpose of statistics is to discover whether the facts agree with the assumptions, and whether the factors that are held to enter into the risk of accident actually play the part assigned to them. The statistics must show whether the composition of the risk classes as defined for the calculation of premiums is satisfactory, and whether, and to what extent, preventive measures and safety appliances affect the risk of accident.

To facilitate these enquiries the National Fund has from the first devoted the greatest attention to constituting homogenous risk classes. Its classification of accidents by the immediate objective cause, that is to say, by the events producing them, is most instructive. Not only does it give information on the risks in different branches of industry, but it also provides a useful basis for studying the methods and technical means of protecting the life of the worker.

For the second period the National Fund did not, as for the first, calculate the cost of compensation per accident for each industry and each cause, but it recorded the number of working days lost and calculated frequency and severity rates per thousand full-time workers, with a view to facilitating international comparison. These rates are therefore of special interest. The table on page 243 shows the distribution by causes of the number of working days lost owing to industrial accidents per thousand full-time workers in certain important industrial groups.

DISTRIBUTION BY CAUSE OF ACCIDENT OF WORKING DAYS LOST IN CERTAIN INDUSTRIAL GROUPS PER THOUSAND FULL-TIME WORKERS, 1923-1927

Cause of accident	Manufacture of cement, artificial stone, and bricks	Mechanical processes in metal working, including fitting	Mechanical engineering	Precision instrument making and small engineering workshops	Watchmaking and jewellery	Large mechanical woodworking undertakings	Printing	Textiles		Chemical industry	Extraction of minerals	Navvying work	Building undertakings	Forestry	Mechanical woodworking undertakings	Federal Railways	Moto-car undertakings	Carting undertakings	Shops and warehouses
								Spinning	Weaving, twisting										
Tools, handling objects	971	2,079	1,430	694	280	1,291	415	507	375	1,046	2,635	1,603	1,829	7,209	2,489	310	2,009	1,655	2,082
Lifting and moving loads by hand	3,474	2,211	1,257	409	50	2,226	449	664	249	1,301	8,560	4,910	6,018	7,000	3,599	1,133	2,347	10,696	6,690
Falls of persons	4,172	3,088	1,848	510	376	978	207	1,003	574	3,261	9,055	7,831	11,211	7,451	6,951	6,913	7,454	19,364	5,541
Collapse, fall, and rupture of objects	4,271	1,765	1,333	364	27	3,205	60	474	92	1,044	23,610	7,234	8,308	12,234	4,341	564	1,197	7,261	1,368
Wood felling	—	—	—	—	—	—	—	—	—	—	—	—	—	18,357	—	—	—	—	—
Machinery :	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—
Prime movers and working machinery other than those specified below	1,781	2,118	2,219	1,426	365	778	1,843	2,311	1,078	1,846	2,213	723	764	721	234	—	923	451	956
Polishing and grinding machinery	—	819	490	316	28	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Punching machinery, presses, drop hammers	—	1,073	501	1,465	973	—	332	—	—	—	—	—	—	—	—	—	—	—	—
Cutting and shearing machinery	—	256	111	74	8	—	244	—	—	—	—	—	—	—	—	—	—	—	—
Mechanical brick presses	1,484	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Crushing and mixing machinery	380	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Willowing, carding, combing machines	—	—	—	—	—	—	—	1,240	—	—	—	—	—	—	—	—	—	—	—
Calenders and rollers	—	—	—	—	—	—	—	342	5	—	—	—	—	—	—	—	—	—	—
Woodworking machinery :	355	559	386	107	9	—	109	158	89	—	—	—	—	—	—	—	3,140	5,720	467
Circular saws	—	—	—	—	—	6,037	—	—	—	—	—	—	—	—	7,774	—	—	—	—
Planing machines	—	—	—	—	—	1,459	—	—	—	—	—	—	—	—	3,139	—	—	—	—
Moulding, jointing, and mortising machinery	—	—	—	—	—	2,099	—	—	—	—	—	—	—	—	6,264	—	—	—	—
Other woodworking machinery	—	—	—	—	—	1,432	—	—	—	—	—	—	—	—	1,592	—	—	—	—
Transmissions and belts	1,858	—	—	—	—	189	19	612	141	527	—	—	—	—	217	—	—	—	—
Splinters, chips, etc.	573	1,265	802	454	122	201	4	28	32	143	3,781	1,176	1,154	1,235	284	110	401	547	244
Explosives and explosions	—	—	—	—	—	—	—	—	—	—	4,055	1,084	120	3	—	—	—	—	—
Transport :	1,196	1,910	880	75	133	551	16	202	264	198	2,343	1,034	1,077	3,365	1,404	—	—	—	—
Mechanical means of transport	4,026	—	—	—	—	—	—	—	—	379	3,230	1,085	1,141	205	—	—	—	—	—
Trucks	—	—	—	—	—	—	—	—	—	—	3,190	2,752	670	65	—	—	—	—	—
Shunting and coupling operations	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2,110	—	—	—
Hot, corrosive, poisonous, explosive, and inflammable substances	394	788	603	284	108	—	—	31	14	3,473	1,452	772	375	60	—	697	954	96	2,188
Poisons	—	—	—	—	—	—	—	—	—	1,790	—	—	—	—	—	—	—	—	—
Occupational diseases	—	98	58	333	17	—	461	12	16	652	117	428	397	86	—	17	25	198	111
Agriculture	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	5	5,432	148
Miscellaneous	1,072	1,161	646	64	61	1,207	212	88	82	211	1,912	920	790	670	1,176	947	1,264	864	1,576
Total	26,007	19,190	12,564	6,575	2,557	21,653	4,371	7,672	3,011	15,871	66,153	31,552	33,854	58,661	39,434	12,810	19,719	52,284	21,371

The severity of the accidents varies widely in different industries. Among the industries included in the table, the highest rates are found in the extraction of minerals, forestry, and carting ; the lowest rates in watchmaking and jewellery, weaving and twisting, printing, and precision instrument making and small engineering shops.

In each of the industrial groups the distribution of the general risk by causes is very unequal. Taking the total results for all the undertakings liable to insurance, the principal causes are found to be the following :

PRINCIPAL CAUSES
OF INDUSTRIAL ACCIDENTS IN ALL UNDERTAKINGS

Cause	Percentage of all accidents	Percentage of all working days lost
Prime movers and working machinery	11.8	19.3
Falls of persons	11.9	22.8
Collapse, fall, and breaking of objects	11.3	17.7
Lifting and moving loads by hand	24.1	12.8
Tools, handling objects	18.9	6.9
Mechanical means of transport	3.3	4.7
Total for these 6 causes of accidents	81.3	84.2

The accidents due to machinery range fourth from the point of view of number, and second from that of working days lost, which confirms the observation made elsewhere that accidents due to machinery are responsible for 20 per cent. of the cost of compensation.

This relatively low average may easily induce to error. It appears to offer an argument against the demands for the prevention of accidents. The general average, however, is reduced by the fact that many undertakings do not employ machinery, and the figures for different industrial groups are therefore more significant. In many industries the accidents due to machinery occupy the first place, as will appear from the table below.

EFFECT OF MACHINERY ON THE ACCIDENT RISK IN VARIOUS INDUSTRIAL GROUPS

Industrial group	Accidents due to machinery	
	Percentage of all accidents	Percentage of all working days lost
General groups in the premium schedule :		
Metal working	22.7	38.6
Manufacture and working of leather, rubber, paper ; printing industry	28.1	50.7
Mechanical woodworking	26.2	50.2
Special risk classes in the premium schedule :		
Manufacture of cardboard, etc.	46.3	77.8
Cotton spinning	32.4	62.7
Cabinet making	33.0	60.0
Carpentry in building and cabinet making	40.8	73.5

These figures clearly demonstrate the great importance of machinery as a cause of accidents, and the value of fitting it with effective safety devices.

Falls of persons are a second very important cause of accidents, for they occupy the first place in regard to the number of working days lost. As for machinery, there are large differences, though not quite so marked, between different industries. Factories were below the average, and building trades well above. The maximum was reached in transport undertakings, where falls of persons were responsible for 50 per cent. of the total number of working days lost.

All the other causes of accidents too vary in importance with the kind of industry. Some particular cause, which seems of quite minor importance in the total results, may be of first-rate importance in a given industry. This is true of mechanical means of transport, which caused a loss of only 4.7 per cent. of the total number of working days lost, but had a predominant effect in navvying work, and above all in construction of waterworks, where 22 per cent. of the total number of working days lost were due to them, the proportion due to trucks on narrow-gauge tracks being 75 per cent.

It will be seen that the field for the technical prevention of accidents is not limited to machinery, but comprises all the causes of acci-

dents mentioned. It is clear that in many cases useful action can very well be taken on the personal initiative of the head of the undertaking.

The significance of occupational diseases also varies with the kind of industry, but the consequent expenses do not have a determining influence on the results in any risk class [1].

As regards non-industrial accidents, this branch of insurance, too, has had to be organised collectively, so that the individual risks of each insured person cannot be determined. Risk groups have been formed, and the question to be examined is whether the risks considered predominant and characteristic in each group are actually so in practice. From this point of view it is not the direct causes of accidents that are of interest, but the work, the occupation, or the circumstances in which the accident took place. The table below gives the distribution of the accidents by the occupation in which they occurred.

DISTRIBUTION OF NON-INDUSTRIAL ACCIDENTS BY OCCUPATION, 1923-1927

Occupation causing the accident	Percentage of all accidents
Walking, excursions, journeys	29.5
Travelling to and from workplace	24.2
Various incidents occuring at home without being engaged in any definite work	12.6
Sport (excluding gymnastics and wrestling), fire brigade drill	5.1
Domestic work	13.0
Agriculture, gardening, cattle and poultry keeping	6.4
Forestry work ; occupational work	2.7
Brawling and drunkenness	1.0
Gymnastics and wrestling	4.6
Miscellaneous	0.9
Total	100.0

[1] It should be added that not all occupational diseases give a right to compensation. Compensation is paid only for cases due to substances in the list of poisons drawn up in accordance with section 68 of the Swiss Act and cases entitled to insurance by a special decision of the Administrative Council of the National Fund. For the period 1923-1926 compensation was paid in 5,969 cases in all ; the total cost involved, including medical aid, was 1,645,000 francs.

Severity and frequency rates have also been calculated. The differences are found to be very marked as regards the sex distribution of the accidents classified by cause. On the contrary, the differences between the various risk classes in each sex separately are only slight. It is also found that the increase in non-industrial accidents is general, and that all the causes of accidents contribute to this increase, but in particular means of transport, motor-car accidents becoming more and more frequent.

OTAL COST OF INSURANCE AND COST BY INDUSTRY

In comparing the accident risks and the cost of compensation, the compensation cost rates per wages insured have already been given. The National Fund has drawn up the accounts for the two quinquennial periods on the same actuarial bases, in order to make the results comparable.

The total amount of wages insured, the total cost of compensation during the two periods, and the cost per 1,000 francs of wages are shown in the following table.

WAGES INSURED AND COST OF COMPENSATION

Wages and cost	Industrial accidents		Non-industrial accidents	
	1918-1922	1923-1927	1918-1922	1923-1927
	Frs.	Frs.	Frs.	Frs.
Wages insured	7,803,000	9,281,000	7,803,000	9,281,000
Compensation :				
Total cost	145,160,000	178,406,000	41,134,000	54,783,000
Cost per 1,000 francs of wages	18.6	19.2	5.3	5.9

The average total cost was higher in the second period. As already explained, this rise was not due to an increase in the risk of accident, but to a change in the method of fixing pensions. The change in the distribution of the sums allocated to the various forms of compensation is characteristic.

PERCENTAGE DISTRIBUTION OF THE DIFFERENT KINDS OF COMPENSATION

Kind of compensation	Industrial accidents		Non-industrial accidents	
	1918-1922	1923-1927	1918-1922	1923-1927
	Frs.	Frs.	Frs.	Frs.
Medical treatment and drugs	20	20	18	20
Compensation for loss of wages	32	29	29	28
Permanent disability pensions	34	37	27	32
Survivors' pensions	14	14	26	20
Total	100	100	100	100

The expenditure on compensation for loss of wages is falling owing to the improvement in the economic situation and the constant efforts of the Fund to persuade insured persons to resume work as soon as possible. The cost of fatal cases in non-industrial accident insurance has fallen, but this is no doubt the effect of chance.

The total average cost of compensation can clearly not serve as a basis for fixing the scale of premiums. The only factors to be taken into account here are the results in the separate branches of industry. The very great majority of risk classes are sufficiently large for the results in each to serve for calculating the rate necessary to cover the expenses of medical treatment and drugs and the compensation for loss of wages. The rate needed to cover the risk of permanent disability and death, on the contrary, can be estimated only on a wider basis, the data furnished by any one risk class being insufficient.

A comparison of the results in the principal industrial groups gives valuable information, however, on the fluctuations of the average cost ; and since severity rates were not calculated for the period 1918-1922, the figures obtained provide an approximate measure of the fluctuations in the risk of accident. The following are some of the groups in which this risk has increased.

INDUSTRIAL GROUPS IN WHICH THE RISK OF ACCIDENT HAS INCREASED

Group in the premium schedule of the National Fund	Average cost of compensation per 1,000 francs of wages insured	
	1918-1922	1923-1927
	Frs.	Frs.
Extraction of minerals	54.78	72.60
Navvying work	34.11	38.19
Building undertakings	35.62	41.67
Forestry	54.12	65.53
Building trades	33.96	34.74
Federal Railways	12.50	15.51
Motor-car undertakings	23.10	26.12
Carting	46.14	54.92
Shops and warehouses	24.16	26.95

This increase in the risk is due to various causes. For instance, the composition of the groups "extraction of minerals" and "navvying work" was not the same in the two periods. In the former of these two groups the extraction of turf, which offers comparatively little risk, was much more important during the first period ; whereas the extraction of stone for road construction and paving, which has a high risk, developed during the second period. The increase in the group "navvying work" is due to the construction of large waterworks and tunnels during the second period. In the "building undertakings" and "building trades" groups there have been no changes in the kind of occupation ; but the work has gained in extension and intensity, and the risk has increased parallel with the development of activity. The principal cause of this increase must no doubt be sought in the ever shorter periods allowed for construction and the difficulty of finding skilled workers.

In forestry the risk has risen owing to more intensive wood felling during the second period. In addition, it still happens that the Fund is not informed of the execution of forestry work in remote places, and does not receive the premiums until the accidents have already happened. More effective supervision would improve the situation, but

the most important factor is improved organisation of the work from the point of view of safety.

The intensity of traffic explains some of the increase observed on the Federal Railways, an increase which fell, however, year by year during the second period.

The results in the group " motor-car undertakings " reflect the increasingly frequent and extensive use of motor lorries and tractors. The risks of motor-car transport are also the principal cause of the increase observed for shops and warehouses.

The following table shows, on the contrary, some industrial groups in which the average risk has fallen.

INDUSTRIAL GROUPS IN WHICH THE RISK OF ACCIDENT HAS FALLEN

Group in the premium schedule of the National Fund	Average cost of compensation per 1,000 francs of wages insured	
	1918-1922	1923-1927
	Frs.	Frs.
Manufacture of cement, artificial stone, and bricks	34.12	30.41
Precision instrument making and small engineering workshops	13.78	11.70
Large mechanical woodworking undertakings	31.02	28.37
Chemical industry	28.49	23.12
Mechanical woodworking undertakings	46.11	45.72

The improvement in the " manufacture of cement, artificial stone, and bricks " is due to the very advanced degree of rationalisation in this kind of industry.

The lowering of the risk in precision instrument making and small engineering workshops may be attributed partly to the use of protective goggles. Attempts to improve the conditions of working are also primarily responsible for the improvement in the chemical industry, where the accidents due to hot, poisonous, and explosive substances are diminishing in number. The figures in the mechanical woodworking groups are relatively very favourable. The fact that the average cost has fallen in spite of the speeding up of the work and the more and more intensive use of machinery suggests that the campaign for the prevention of accidents will produce very satisfactory results.

Reference has already frequently been made to the success of the efforts of the National Fund to reduce the cost of insurance, on the one hand by combating abuses, and on the other by spreading preventive measures. The report for 1923-1927 contains a special chapter on the financial results of accident prevention. It points out first of all that general statistics hardly lend themselves to conclusions as to the effects of prevention, in view of the complexity of the relations between preventive measures and intensity of work. The data for drawing such conclusions can be obtained only from special enquiries and statistics of production. In addition, it was not until 1927 that the Fund was able to supply undertakings with really adequate safety devices.

Even so, certain results can already be established. The energetic campaign against accidents to the eyes due to flying fragments has proved most effective. The number of accidents of this kind caused by emery wheels fell from 2,406 in 1919 to 320 in 1927; and their percentage of the total number of industrial accidents fell from 2.27 to 0.33. The effect of safety devices for woodworking machinery has also become apparent. The number of accidents due to circular saws increased, but their proportion to the total number of accidents due to woodworking machinery fell.

Similarly, the safety devices constructed by the National Fund for use with punching machines, presses, and drop hammers have probably helped to reduce the number of accidents due to machinery, as the cost of these fell from 16.7 francs per 1,000 francs of wages insured in 1923 to 9.9 per 1,000 in 1927.

Working Conditions in Shanghai Cotton Mills

The following information on working conditions in Shanghai cotton mills has been received from a correspondent in China.

Statistics

The first cotton mill in China was established in the eighties of the last century. The following figures show the enormous development there has been in the period of little more than forty years that has elapsed since then.