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STUDIES IN OCCUPATIONAL MORBIDITY: PART III

BY

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The two previous papers in this series (Russell, Whitwell, and Ryle, 1947 ; Sutherland and Whitwell, 1948) contained analyses of sickness and accidents among factory employees which were of sufficient gravity to cause absence from work of at least one day. The records for two industrial organizations, with a total of about 5,000 employees in 1946, were studied. Such records probably yield a reasonably complete picture of illness among the workers. But they are very far from being a complete record of accidents. The majority of accidents occurring in a factory are relatively trivial, and the employee is able to return to work immediately after first-aid treatment, or at latest the following morning. None of these minor accidents figure in the records analysed previously. Yet a study of them is well worth while. It is often providential whether an accident is slight or serious, and so the circumstances surrounding the trivial accident can shed some light on the causes and prevention of the graver one.

Data

Arrangements were made with the same two factories which cooperated in 1946 for the recording of each accident occurring at work which was reported to the factory surgery or first-aid posts. The details were entered at the factory upon a specially designed form, and the completed records were sent to this Institute at frequent intervals. An analysis of the findings and a brief report were made monthly to the safety engineers. The collection of data was started in June, 1947, and the present study reviews the main findings for the six months from July to December, 1947. During this period the average number of employees (excluding staff) in each factory was as follows.

Factory	Males	Females	Total
A	3,290	214	3,504
B	664	117	781
	3,954	331	4,285

Incidence of Accidents

During the six months 5,292 accidents were reported from the two factories ; this represents an average rate of 20·6 accidents per 100 employees in the course of one working month. Table 1 presents

TABLE 1

NUMBER OF REPORTED ACCIDENTS PER 100 EMPLOYEE-MONTHS

	Males	Females
Factory A		
Production	17·0	12·5
Non-production	11·4	3·9
All departments	14·5	8·9
Factory B		
All departments	49·4	49·1

rates for the two factories separately by sex, and in factory A by the type of work. In factory B the accident rate among males was 49·4%, more than three times as great as that in factory A. The rate in factory B was equally high among females (49·1%), and this rate was more than five times the corresponding figure for the other factory. This very substantial disparity in the frequency of accidents is accounted for by the different work undertaken in the two organizations. Factory A is concerned with the assembly of finished products, whereas factory B is primarily engaged in light engineering manufacture from raw materials.

Table 1 also shows that in factory A the rates were lower among females than among males and lower in the non-production shops than among production workers. These differences are not surprising. Women are generally given rather lighter work than men in a factory, and such work would be expected to carry less risk of accident.

Accident Rates in Different Departments

A comparison of accident rates in different departments shows very clearly where the accidents are occurring, and the considerable extent to which the incidence is affected by the particular work

involved. Table 2 presents the rates in a selection of departments in the two factories. In factory A the accident rate among males ranges from 6·1 to 39·8 per 100 employees per month. In factory B the disparity between the highest and lowest rates is even greater: the range is from 3·4 to 125·6.

TABLE 2

NUMBER OF REPORTED ACCIDENTS PER 100 EMPLOYEE-MONTHS IN CERTAIN DEPARTMENTS

	Department No.	Average No. of Employees	Accident Rate
Factory A			
Males	3	134	39·8
	22	126	36·5
	30	52	31·8
	2	28	30·3
	29	130	24·9
	9	52	7·7
	25	40	7·2
	14	60	6·6
	23	131	6·1
Females	29	115	12·7
	23	41	1·6
Factory B			
Males	24	41	125·6
	23	33	101·5
	51	47	85·9
	10	33	22·6
	26	25	3·4
Females	24	15	115·7
	6	47	24·3

Department No. 2 in factory A consists of apprentices, who are nearly all aged under 20, and are very closely supervised. As part of this supervision the management insists upon the reporting of the slightest injury. Despite this tendency to swell the number of accidents reported, the rate of 30·3% among the apprentices compares favourably with that of 34·7% for all males aged under 20, and is a tribute to the efficacy of the supervision. (Wise training policies for apprentices will make a valuable contribution to safety in factories in the years to come.) Department 24 in factory B, with the highest rate for both sexes, is the press shop. The departments with low accident rates comprise occupations such as inspection (factory B, department 26) and dispatch (factory A, department 9).

Age

There is a definite trend in accident rate in each sex with the age of the employee, as is shown by Table 3. In each factory, despite the wide differences in average accident rate, the pattern is the same. The maximum rate is among those aged 15-19; the rate decreases at first rapidly and then more slowly with increasing age. For each of the four groups of employees identified in the table the rate among those aged under 20 is about twice the average for all ages.

This trend with age is quite different from that of sickness incidence rates, which were found in the earlier studies to be at a minimum in the age-group 25-34 and to rise steeply with increasing age, the rate at ages 55 and over being double the rate at ages 25-34. Fig. 1 illustrates the contrast between the incidence of sickness and of accidents in factory A.

This pattern in the accident rate is probably due not to a single factor, but to a variety. Any or all of the following influences may contribute: (*a*) Experience of the work; (*b*) the gradual hardening of the skin on the hands, which should protect workers to some extent from cuts and bruises; (*c*) the development of a sense of responsibility; (*d*) the fuller reporting of accidents by the younger employees. These are not listed in any particular order; it would be hard to assess the relative importance of these or other suggested influences.

Day of Accident

Table 4 shows the distribution of accidents according to the day of the week on which they occurred. In factory A Tuesday and Thursday

TABLE 3

NUMBER OF REPORTED ACCIDENTS PER 100 EMPLOYEE-MONTHS IN VARIOUS AGE-GROUPS

	Age in Years						All Ages
	15–19	20–24	25–34	35–44	45–54	55 and over	
Factory A							
Males ..	34·7	16·4	16·4	14·9	11·3	9·5	14·5
Females ..	19·2	13·5	9·5	4·1	6·7	3·8	8·9
Factory B							
Males ..	99·4	81·2	52·3	45·0	45·1	30·3	49·4
Females ..	94·4	57·2	51·2	24·2	37·9	16·7	49·1

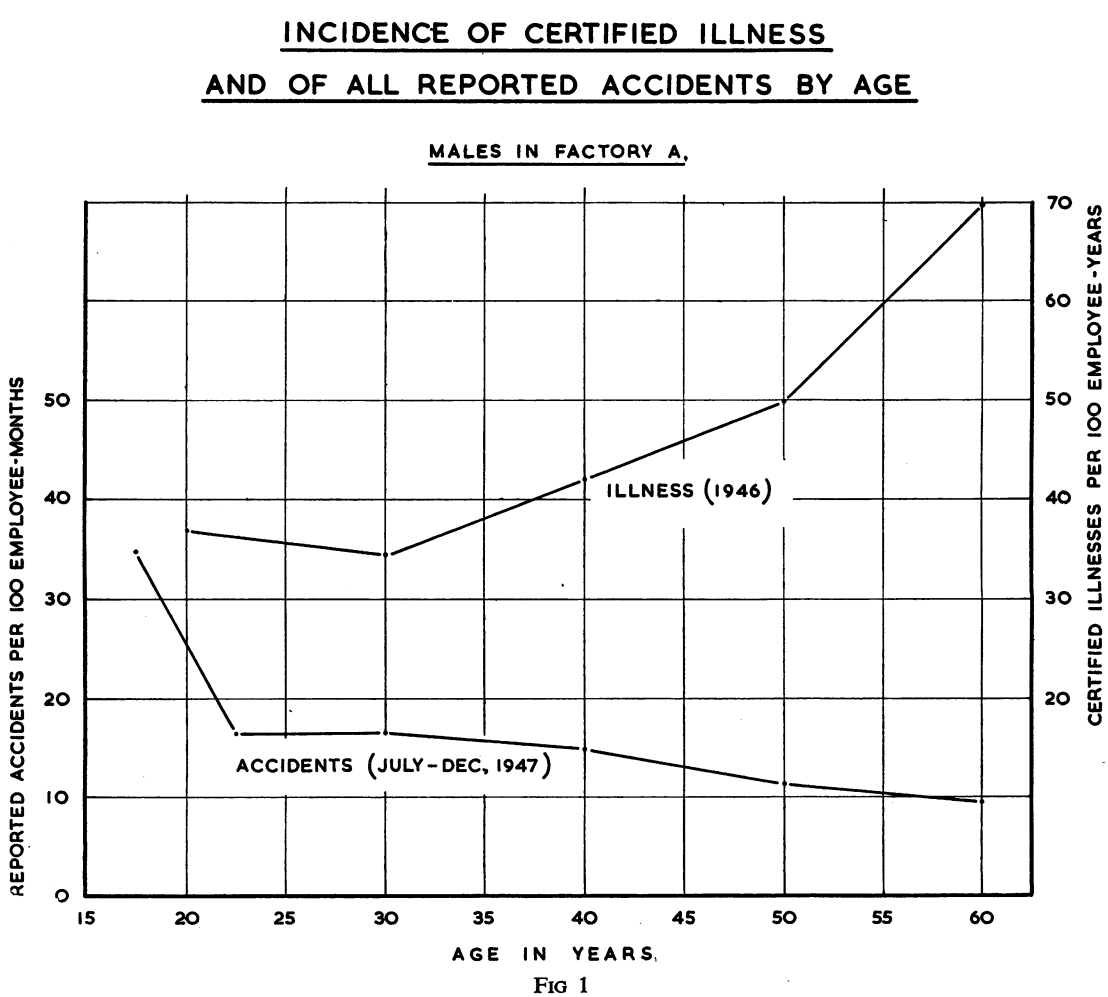

FIG 1

were heavy days for accidents, while Wednesday was light. In contrast, factory B showed inconsiderable variations between different days.

TABLE 4

NUMBER OF REPORTED ACCIDENTS ON DIFFERENT DAYS OF THE WEEK

Day of Occurrence	Factory A	Factory B
Monday	499	476
Tuesday	692	466
Wednesday	441	424
Thursday	614	481
Friday	567	393
Saturday	145	70
Sunday	5	2
Not stated	15	2
All accidents	2,978	2,314

Time of Accident

The time of day when the accident occurred could not be recorded. However, the number of hours between the start of work and the reporting of the accident was obtainable, and it was hoped that this might give a rough indication of the effect of fatigue on the liability to accident. The figures are presented in Table 5. They are complicated by the variations in working hours between different sections of each factory, and between different days of the week, but not sufficiently to obscure or to render invalid the contrast between morning and afternoon. It is clear that there is a much higher rate of reporting of accidents in the morning than in the afternoon. Taking into account the lengths of the normal working periods, the afternoon rate of reporting accidents is 30% lower in factory A and 39% lower in factory B than the corresponding rate

TABLE 5

NUMBER OF ACCIDENTS ANALYSED ACCORDING TO TIME OF REPORTING ON DAY OF OCCURRENCE

Factory A		Factory B	
Time	No. of Accidents	Time	No. of Accidents
7.15–8	188	8–9	354
8–9	378	9–10	304
9–10	331	10–11	313
10–11	356	11–12	283
11–12	323	12–1	266
1–2	180	2–3	250
2–3	247	3–4	253
3–4	282	4–5	199
4–5	219	5–6	41
After 5 (overtime)	236	After 6 (overtime)	5
Not reported same day ..	209	Not reported same day ..	45
Not stated	29	Not stated	1
Total	2,978	Total	2,314

during the morning. This indicates that accidents occur more frequently during the morning than during the afternoon. It may well be that with a working day of nine hours the necessity for adaptation to the work at the beginning of the day causes more accidents than fatigue at the end.

Although at both factories every effort is made to encourage workers to report accidents on the day of occurrence, some are reported later. In factory A the percentage of the recorded accidents for which the reporting was delayed was 7·0; in factory B it was only 1·9.

Details of Injuries

It was stated in the introductory paragraphs of this study that accidents causing absence from work on one complete day or more formed a very small proportion of the total accidents. The evidence for this statement is presented in Table 6. Accidents causing at least one complete day's absence from work numbered only 16 (0·5% of the total) in factory A, and 24 (1·0% of the total) in factory B. There was no fatal accident in either factory during the period.

TABLE 6

ACCIDENTS ANALYSED ACCORDING TO INCAPACITY CAUSED

Type of Accident	Factory A	Factory B
Fatal	0	0
Lost-time (one complete working day or more) ..	16	24
Minor (less than one working day)..	2,962	2,290
Total	2,978	2,314

In Table 7 are listed the commonest types of injury. The totals of injuries in Table 7 exceed the totals of accidents given in earlier tables because some accidents caused more than one injury. By far the most common injury was the cut finger, which accounted for approximately 35% of all injuries. Then followed bruised fingers, foreign body in the eye and foreign body in the finger, each type of injury accounting for 8 to 10% of all injuries. Cut hands accounted for about 5% and all the other groups were smaller still.

There were some interesting differences between the factories. For example, in factory A there were more instances of foreign bodies in the finger than of bruised fingers, whereas in factory B bruised fingers outnumbered foreign bodies in the finger by nearly 3 to 1. Again, cuts appear to have been proportionately rather commoner in factory B, with the marked exception of cut heads. Burns and scalds were also relatively more common in factory B, but this is because the work requires far more handling of hot materials than the work in factory A.

Sepsis

It has already been mentioned that 7% of the recorded accidents in factory A were not reported on the day of occurrence, compared with only 2% in factory B. The effect of the delay is apparent from the numbers of injuries which were presented septic to the surgery. Table 8 contains the data. In factory A 79 injuries were septic on arrival at the surgery, and this represents 38% of all the accidents reported after the day of occurrence. In factory B 11 injuries were presented septic, that is, 24% of all accidents not reported on the same day. It is

TABLE 7

COMMONEST TYPES OF INJURY IN REPORTED ACCIDENTS

Nature of Injury	Factory A			Factory B	
	Part Injured	No. of Injuries	Percentage of Total	No. of Injuries	Percentage of Total
Cut	Finger	1,072	34·8	856	36·8
Bruise	Finger	263	8·5	297	12·8
Foreign body	Eye	290	9·4	174	7·5
Foreign body	Finger	352	11·4	107	4·6
Cut	Hand	148	4·8	146	6·3
Cut	Arm	73	2·4	104	4·5
Burn, scald	Finger	34	1·1	122	5·2
Bruise	Arm	71	2·3	64	2·8
Bruise	Hand	70	2·3	64	2·8
Burn, scald	Arm	31	1·0	96	4·1
Bruise	Leg	88	2·9	35	1·5
Cut	Head	88	2·9	16	0·7
All others		504	16·3	244	10·5
Total		3,084	100·1	2,325	100·1

apparent that the habit of prompt reporting in factory B has a substantial effect on the incidence of sepsis in that factory; whereas over 2·6% of accidents in factory A were presented septic, the figure for factory B was under 0·5%.

TABLE 8

ANALYSIS OF DELAY IN REPORTING ACCIDENTS AND WOUND SEPSIS

	Factory A	Factory B
Number of accidents not reported on day of occurrence	209	45
Number septic when reported	79	11
Percentage septic when reported	37·8	24·4
Percentage of all accidents septic when reported	2·65	0·48

Summary and Conclusions

1. An analysis has been made of all accidents reported to the surgeries of two factories from July to December, 1947. The average population of the factories was 4,285 (excluding staff).

2. The number of accidents reported was 5,292. In factory A the number per 100 employee-months was 14·5 for males and 8·9 for females. In factory B the rates were 49·4 and 49·1 respectively. The difference is undoubtedly due to the different types of work undertaken.

3. In each factory there was a definite pattern in the rates according to age, differing markedly from the age-pattern of sickness rates. They were high for the youngest workers and dropped, at first rapidly and then more slowly, with increasing age.

4. The rate of reporting accidents was greater during morning than afternoon hours, suggesting that with a 9-hour day (approximately) the necessity for adaptation to work at the beginning of the day causes more accidents than fatigue at the end.

5. The types of injury are analysed.

6. In factory A 7% of the recorded accidents were reported later than the day of occurrence, and 2·6% were septic when reported. In factory B the corresponding figures were only 2% and 0·5%.

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Notes