ACCIDENTS IN A NAVAL DOCKYARD

BY

C. P. COLLINS

From the Royal Naval Hospital, Chatham, Kent

(RECEIVED FOR PUBLICATION MAY 28, 1958)

The high incidence of accidents in H.M. Dockyard, Singapore, during 1954 led to a more detailed recording and analysis in 1955-56. The departmental accident rates per 1,000 workers were recorded, together with the circumstances of all injuries resulting in the loss of more than one shift (two per working day, lasting four and a half hours in the mornings and three and three-quarter hours in the afternoons).

In the successive quarters of 1955, the numbers of accidents of all degrees of severity dropped steadily, but by 1956 they had levelled out at figures ranging from one-sixth to one-quarter of the original numbers. In 1956 the numbers of minor accidents reported were 44% of those for 1955, while cases requiring hospital treatment had fallen to 53.5%. This was balanced to some extent by an increase of trivial cases treated without loss of time by first aid in the workshops, but the total numbers still showed a reduction in the accident rate per 1,000 workers of 26.2%.

Recording every possible form of accident for the year 1955, a rate of 2.38 accidents per 100 employee-months was obtained which differs markedly from rates published for industrial workers in Britain.

The ethnic groups employed all showed a similar decrease in accident rates, but the reduction was noticeably greater among the Malays than the Chinese or Indians.

Analysis by category of causation showed that the lower incidence was largely due to improvement in the categories of handling stores, using hand tools and power-driven machinery, but attention to the causes of eye injuries occasioned a reduction of only 5.2%.

Analysis of time lost showed that the improvement in 1956 was due mainly to two groups. The number of persons experiencing accidents resulting in the loss of two shifts dropped to one-quarter of those found in 1955, while those losing seven shifts, who would in Britain require notification under the Factories Act, 1937, showed a reduction of exactly one-third.

Accident rates were highest in Chinese and Indians between 26 and 35 years of age, but in Malays in the subsequent decade.

In the Island of Singapore there is established one of H.M. dockyards of a size capable of dealing with any class of ship. Some 10,000 persons belonging to several different ethnic groups are employed in the dockyard, but of these a number are listed as "non-industrial", or are employed on work that is unlikely to bring them into contact with industrial hazards. The remainder, 7,122 males, an average figure over the years 1955-56, were on the books of the eight departments principally concerned with industrial work. This number was made up of 2,298 Chinese, 3,680 Indians, 1,133 Malays, and 11 Eurasians.

About 250 women were also employed, but no accidents were reported among them during 1955-56.

At the end of 1954, the number of accidents in

the dockyard was considered greater than was justifiable. The recording of accidents was also inaccurate and the degree of severity was not noted. A new routine was therefore instituted, so that race, age, department, and cause for each accident and whether it was necessary to send the patient to hospital for further treatment or investigation were recorded.

Accidents fell into three degrees of severity:

(1) The very trivial, in which the employee was treated on the spot from the first aid box.

(2) Those cases seen by the foreman and sent for treatment to the dockyard dressing stations. There were two of these stations, centrally sited and no man had to walk more than half a mile. Cases reporting at the dressing stations with injuries

incurred on duty were accepted as accidents for the purpose of this study.

(3) Cases seen in the dressing stations by the senior surgery assistant or the hospital assistants and considered to need further examination or treatment in the R.N. Asian hospital, to which they were sent. These were subsequently listed as hospital (H) cases.

It is possible that some variation in degree of severity may have existed in cases transferred to the dressing stations or hospital. Some foremen or hospital assistants may have tended to send men with minor injuries for treatment elsewhere while others dealt with them locally and returned them to duty. No marked variation in the degree of injury of cases reporting was, however, attributable to this cause.

Beginning in 1955, at the end of each month, a nominal roll of all H cases was sent to the respective departments to aid them in pinpointing areas where most accidents were occurring. At the end of each quarter a general analysis of accidents was issued under the various categories of causation, and placing the departments in descending order of the rates of accidents occurring per 1,000 workers.

An immediate reaction was observed. The heads of most departments discussed the list of accidents with their foremen and inspectors and demanded immediate action. It became a point of honour not to head the list with the highest rate, and until the accuracy of the numbers given had been proved in detail over the first few months, attempts to combat or deny the figures were made by several departments. When it was at length realized that this was no attempt to pillory any particular section, but merely to assist in the reduction of man hours lost through unnecessary accidents, cooperation became general.

The effect of greater watchfulness in supervision

and possibly the increase in awareness generated among the workers was shown by a remarkable drop in the number of accidents, which continued throughout 1955. The total for the fourth quarter of 1955 was the lowest experienced, and was actually less than in any quarter of 1956. By 1956, however, the quarterly number of accidents was apparently stabilized at a figure approximately one-fourth of that of the first quarter of 1955. The numbers of accidents occurring are shown in Table 1.

Over the two years a considerable increase occurred in the number of cases treated in the departments. While these were of too minor a degree to be included in the official figures, undoubtedly some of the simpler cases formerly attending the dressing stations were treated from the first aid box in the departments.

In 1955, 1,794 accidents were reported, but in the following year the total had dropped to 805, or 44.0% of the former figure. Cases sent to hospital showed a reduction to 53.5%. The individual ethnic groups showed similar reductions in number of accidents.

Fig. 1 gives the quarterly accident rates (expressed as annual rates) and annual rates, in ethnic groups, for the two years studied. In the first quarter, the Malays had far the highest record, with the Chinese next and the Indians lowest. But by the second quarter, the rates were already approximating, and in the third, Malay and Indian were almost identical. Thereafter the Malay showed a lower rate than either Chinese or Indian.

The rapid fall in accident rates during 1955 is most striking. By 1956, the number of accidents did not vary greatly from quarter to quarter.

The possibility that the rates for the three ethnic groups were affected by differences in exposure to accident or in distances from the sick bay was examined. The Chinese had a relative excess in

TABLE 1

ANNUAL AND QUARTERLY NUMBERS OF ACCIDENTS AT H.M. DOCKYARD, SINGAPORE, IN 1955 AND 1956 IN MALE INDUSTRIAL WORKERS CLASSIFIED BY ETHNIC GROUPS

Year	Ethnic Group	Average Population in Year	Quarterly No. of Accidents				Annual Total No. of Accidents	Accident Rate per 1,000 Workers per Annum
			1st	2nd	3rd	4th		
1955	Chinese	2,330	307	145	133	47	632	260.5
	Indian	3,718	372	220	153	75	820	211.4
	Malays	1,141	194	76	47	20	337	294.5
	Eurasians	11	1	1	1	2	5	(—)
	All workers	7,200	874	442	334	144	1,794	249.2
	H cases*	—	181	160	83	62	486	67.5
1956	Chinese	2,266	78	69	57	68	272	120.0
	Indian	3,641	88	106	138	109	441	121.1
	Malays	1,125	26	13	27	24	90	80.0
	Eurasians	11	—	—	—	2	2	(—)
	All workers	7,043	192	188	222	203	805	114.3
	H cases*	—	65	68	59	68	260	36.9

*H cases are those sent to the R.N. Asian hospital for further treatment.

FIG. 1.—Quarterly accident rates (expressed as annual rates) in ethnic groups.

the departments of the constructor and engineer, the Indians in that of the civil engineer, and the Malays in the Armament Supply Depot. It is unlikely that the last two would have had any marked effect on the total number of accidents, but the concentration of 1,031 Chinese in the skilled artisan grade of the first two departments, whose accident rates were amongst the highest found, might be expected to increase the rate for this ethnic group. The distances of the various departments from the dressing stations were approximately the same and no difference in accident rates between the ethnic groups could be attributed to this factor.

Cases treated in their own departments numbered 265 in 1955 and 682 in 1956. If these were included with those reporting to the dressing stations, accidents in 1955 and 1956 would number respectively 2,059 and 1,487, giving annual rates of 286.0 and 211.1. Though by no means so marked, this still represents a substantial reduction. The reduction in the number of cases sent to hospital from 486 in 1955 to 260 in 1956 is striking.

The accident rate per 100 employee-months can be calculated from Table 1. This index was chosen as the most convenient by Sutherland, Harris, and Smithers (1950) who reported 14.5 accidents per 100 employee-months in an assembly factory and 49.4 in a light engineering factory. In the Singapore dockyard equivalent rates for the Chinese in 1956 were 1.00, for the Indians 1.01, and for the Malays 0.67. The differences between these and Sutherland's

figures are enormous and difficult to explain. Sutherland recorded every accident however trivial, and it is possible that first aid in the British factories was obtainable at a shorter distance, more easily, and possibly in a more welcoming environment. Vernon (1936) reported nearly two minor accidents a year per man employed at the Stanton Ironworks between 1927 and 1932, and at three other large works, the character of which was not stated, in one year 9,000 workers suffered 563 reportable accidents and 41,160 accidents requiring first aid. These figures approach an average of five accidents a man each year or 41.7 accidents per 100 employee-months. Even if the very minor accidents at Singapore are included, the accident rates for 1955 and 1956 for all industrial workers become only 2.38 and 1.76 respectively per 100 employee-months. Nor is this due to a weighting of the rates by a majority of the workers being engaged in less dangerous jobs. The work of a dockyard embraces most forms of industrial activity and the largest departments are those of construction (repair and alterations to ships) and of engineering.

The highest rate for 1956 was produced by the department of victualling stores, which, with 79 male workers, gave a rate of 253.2 per 1,000 workers. If the 30 trivial cases treated in the department itself are added, the rate rises to 633.6 per 1,000 workers, equivalent to 5.28 accidents per 100 employee-months. In 1955 this department, with 75 accidents recorded in the dressing station and 12 treated in the department, gave a total rate of 1,035.7 per 1,000 male employees or 8.63 accidents per 100 employee-months. The highest departmental accident rate in the Singapore dockyard was thus much below the rates recorded by Sutherland for British factories. This difference may be associated with a greater tendency to report accidents in Britain.

Categories of Causation

Table 2 gives the numbers of accidents occurring in 1955 and 1956, separated into 11 categories of causation. For each category the rate per 1,000 workers is shown, and the percentage reduction between the two years.

The accidents in the categories of handling stores, using hand tools, using power-driven machinery, burns and scalds, and electrical accidents were all reduced by approximately 70 to 80%, eye injuries were lessened by only 5.2%, struck by falling objects by 11.1%, and persons falling by 25.3%. The reduction in accidents which occurred in 1956 was due mainly to the improvement in the first three of these categories. Furthermore, the last three categories together were only reduced by 71 accidents and in 1956 they constituted 52.3% of all accidents.

TABLE 2

NUMBERS OF ACCIDENTS AND RATE PER 1,000 WORKERS IN 11 CATEGORIES OF CAUSATION IN SINGAPORE DOCKYARD IN 1955 AND 1956

Year	No. Employed		Category of Causation											Total
			Handling Stores	Persons Falling	Struck by Falling Objects	Stepping on or Striking Objects	Using Hand Tools	Using Power-driven Machinery	Burns and Scalds	Welding	Transport	Electrical	Eye Injury on Duty	
1955	7,200	No. of accidents Rate per 1,000 workers	307	140	143	170	320	258	94	43	75	35	209	1,794
			42.6	19.4	19.9	23.6	44.4	35.8	13.1	6.0	10.4	4.9	29.0	249.2
1956	7,043	No. of accidents Rate per 1,000 workers	70	102	125	79	88	58	31	22	30	6	194	805
			9.9	14.5	17.7	11.2	12.5	8.2	4.4	3.1	4.3	.9	27.5	114.3
The accident rate for 1956 expressed as a percentage of that for 1955			23.2	74.7	88.9	47.5	28.2	22.9	33.6	51.7	41.3	18.4	94.8	44.9

These are evidently the groups which require closer supervision and an increase of safety instruction among the workers. The National Safety Council of U.S. (1952) reported that, in the United States, 22% of all industrial accidents were caused during handling stores, 17% by falls, and 16% by machinery. Taylor (1954) gives 27%, 14%, and 16% respectively in these categories. In the Singapore dockyard the corresponding percentages were 17.1, 7.8, and 14.4 in 1955 and 8.7, 12.6, and 7.2 in 1956. The Singapore 1955 percentages of accidents caused by handling stores and machinery were of the same order as those given by the National Safety Council of U.S. and Taylor; in 1956, however, there was a considerable reduction in the percentage of accidents due to handling stores and machinery, with a relative increase in those due to falls.

The accident rates in 1956 varied considerably between the various departments of the dockyard. In several instances unexpected results were found. In four departments (construction, engineering, civil engineering, and naval stores) the number of eye accidents increased in 1956; accidents from falling and being struck by falling objects also

increased in two departments. Although the total number of accidents in all departments was greatly reduced, these results indicate danger points for further accident prevention.

Loss of Working Times in Cases Sent to Hospital

In H.M. Dockyard, Singapore, the working day is divided into two shifts, 7 a.m. to 11.30 a.m. and 12.45 to 4.15 p.m. The severity of an accident was measured roughly by the number of shifts lost before the employee returned to work.

The total number of accident cases referred to hospital in the two years 1955 and 1956 was 746 and none of these patients returned to duty with the loss of less than two shifts. Table 3, for cases referred to hospital, gives the numbers of workers losing two, three, or more shifts as a result of their injury. Those absent from work for seven or more shifts, who in Britain would require notification under the Factories Act of 1937 as experiencing accidents where more than three working days were lost, are included in one group.

TABLE 3

NO. OF SHIFTS LOST IN ACCIDENT CASES REFERRED TO HOSPITAL AND INTERNATIONAL FREQUENCY RATE AT SINGAPORE DOCKYARD 1955 AND 1956

Year	No. of Workers Referred to Hospital after Accident: Shifts Lost						Total	International Frequency Rate, i.e., No. of Accidents Causing Loss of Working Time per 100,000 Man-hours Worked
	2	3	4	5	6	7+		
1955	264	41	17	25	43	96	486	3.2
1956	67	33	25	27	44	64	260	1.7
H accidents in 1956 as a percentage of those in 1955	25.4	80.5	147.1	108.0	102.3	66.6	53.5	

TABLE 4

NO. OF ACCIDENT CASES REFERRED TO HOSPITAL FROM H.M. DOCKYARD, SINGAPORE, IN 1955 AND 1956, LIABLE TO NOTIFICATION UNDER FACTORIES ACT, 1937, AND PERCENTAGE IN EACH CATEGORY OF CAUSATION COMPARED WITH UNITED KINGDOM PERCENTAGE

Causation Category of Accident	No. of Accident Cases Referred to Hospital			% of Total	% of Total United Kingdom Reportable Accidents in Each Category (H.M. Chief Inspector, 1955)
	1955	1956	Total		
Handling goods or stores	15	2	17	10.6	27.3
Persons falling	7	9	16	10.0	13.9
Struck by falling bodies	13	11	24	15.0	8.4
Stepping on or striking objects	3	5	8	5.0	8.2
Using hand tools	16	8	24	15.8	8.0
Using power-driven machinery	14	10	24	15.0	15.8
Transport	2	2	4	2.5	5.7
Burns and scalds	3	1	4	2.5	12.7
Welding	1	—	1	.6	
Electrical	1	—	1	.6	
Eye injuries	21	16	37	23.1	
Total:	96	64	160	100.7	100.0

With the exception of the accidents involving the loss of seven shifts or more, which were reduced by one-third, the greatest saving in time lost was for the accidents in which two shifts were lost. These fell in 1956 to a quarter of the number recorded in 1955.

There were 96 accidents resulting in the loss of seven shifts or more in 1955 and 64 in 1956. The rates of accidents which would have been notifiable under the Factories Act per 1,000 workers were 13.3 in 1955 and 9.1 in 1956. H.M. Chief Inspector of Factories (1955) gives a corresponding rate for the United Kingdom of about 24, which is considerably higher. The numbers and percentages of accident cases occurring in the various causation categories in Britain and in Singapore Dockyard are compared in Table 4 for the accidents resulting in more than three days' absence from work.

It will be seen that the percentages due to handling stores or goods are much lower in Singapore than those under equivalent categories in the United Kingdom, but those under "struck by falling objects", using hand tools, and eye injuries are greater. Vernon (1936) quotes the 1928 and 1932 reports of the Chief Inspector of Factories to show that eye injuries incurred in industry averaged 4.3% and 4.2% respectively of all reportable accidents, and also that the highest percentage in any one year was 8.3%. The percentage of eye injuries over two years in Singapore amounted to nearly three times the highest percentage recorded in the United Kingdom, but of course, percentage distribution in any one category may fluctuate with changes in other categories.

Accidents as Affected by Age and Ethnic Group

Workers in H.M. Dockyard, Singapore, are of all ages from 16 to a maximum of 65. As in other parts of this study, the term "accident" includes all cases referred to the dockyard dressing stations or to hospital. The annual average number of

accidents occurring during 1955 and 1956 was calculated, and the rates for three ethnic groups in 10-year age groups are shown in Fig. 2 and Table 5.

In Table 6, the annual average numbers of accidents are subdivided by ethnic group and category of causation.

Among Chinese and Indians the accident rate increases to a peak in the second age group and falls steadily away thereafter; in the Malays the peak occurs in the 36 to 45 age group. In the veterans of 56 years and more the rate is notably low for Chinese and Malays. These rates, based on an average of two years with very different accident records, are of course misleading in themselves but portray accurately the relation between the age groups.

FIG. 2.—Accident rates for the three ethnic groups in 10-year age groups.

TABLE 5

ANNUAL AVERAGE NO. OF ACCIDENTS IN MALE INDUSTRIAL WORKERS IN H.M. DOCKYARD, SINGAPORE, IN 1955 AND 1956 AND RATES PER 1,000 WORKERS IN AGE AND ETHNIC GROUPS

Ethnic Group		Age Group					All Ages
		16-25	26-35	36-45	46-55	56+	
Chinese	Average no. in group	695	603	431	368	200	2,297
	Average no. of accidents per annum	42.5	199.5	135.0	57.5	9.5	444.0
	Annual rate per 1,000 workers	61.2	330.8	313.3	156.2	47.5	193.3
Indian	Average no. in group	620	1,175	1,242	517	125	3,679
	Average no. of accidents per annum	64.5	282.5	212.0	74.0	10.0	643.0
	Annual rate per 1,000 workers	104.0	240.0	170.0	143.1	80.0	174.8
Malay	Average no. in group	358	377	213	139	45	1,132
	Average no. of accidents per annum	21.0	112.5	61.5	17.5	1.5	214.0
	Annual rate per 1,000 workers	58.7	271.9	288.7	125.9	33.3	189.0

TABLE 6

ANNUAL AVERAGE NUMBER OF ACCIDENTS IN MALE INDUSTRIAL WORKERS OF H.M. DOCKYARD, SINGAPORE IN 1955 AND 1956 AND RATES PER 1,000 WORKERS IN ETHNIC GROUPS AND CATEGORIES OF CAUSATION

Ethnic Group	Annual Average No. in Group		Handling Stores	Persons Falling	Struck by Falling Objects	Stepping on, or Striking Objects	Using Hand Tools	Using Power-driven Machinery	Burns and Scalds	Welding	Transport	Electrical	Eye Injuries	All Accidents
Chinese	2,297	Average no. of accidents per annum	74.0	33.5	46.0	38.5	62.5	57.5	24.5	11.5	18.0	11.5	66.5	444.0
		Per cent of all accidents	16.9	7.6	10.5	8.8	14.2	13.1	5.6	2.6	4.1	1.5	15.1	100.0
		Annual rate per 1,000 workers	32.2	14.6	20.0	16.8	27.2	25.0	10.7	5.0	7.8	2.7	29.0	193.3
Indian	3,679	Average no. of accidents per annum	61.5	69.5	76.0	71.5	115.0	63.5	31.5	18.0	20.5	12.5	103.5	643.0
		Per cent of all accidents	9.6	10.8	11.8	11.1	17.9	9.9	4.9	2.8	3.2	1.9	16.1	100.0
		Annual rate per 1,000 workers	16.7	18.9	20.7	19.4	31.3	17.3	8.6	4.9	5.6	3.4	28.1	174.8
Malay	1,132	Average no. of accidents per annum	52.5	17.5	10.5	14.0	26.5	37.0	6.5	3.0	13.5	1.5	31.5	214.0
		Per cent of all accidents	24.5	8.2	4.9	6.5	12.4	17.3	3.0	1.4	6.3	0.7	14.9	99.9
		Annual rate per 1,000 workers	46.4	15.5	9.3	12.4	23.4	32.7	5.7	2.6	11.9	1.3	27.8	189.0

They differ from the findings of Hewes (1921) who, dealing with 2,891 male employees of a Connecticut silk mill, showed that the frequency of accidents was greater under 20 years of age but dwindled steadily thereafter. This was also the experience of Schmitt (1926), but Brundage (1927) showed a comparatively steady frequency rate up to the age of 50 and then a fall.

McFarland (1957) quoted the records of an industrial physician of Ohio, that "50% of industrial accidents occurred in people under the age of 25, and that the rate for the 20-24 year group was more than twice that of the 40-44 age group".

Sutherland *et al.* (1950) show in both groups of factories the highest rates in the youngest age groups decreasing exponentially to a minimum over 55 years of age of between one-third and one-quarter the rates of those under 20.

Kossoris (1948), however, agrees in showing that among 18,000 factory workers the frequency of non-disabling injuries showed a steady decline from the 25 to 27 age group onwards. King and Speakman's suggestion (1953) that the high rate in the younger age groups is largely due to inexperience does not agree with the findings here that those most affected were not the youngest; nor does the very low labour turnover in the dockyard support this suggestion. The other concepts of "general immaturity" and "less responsibility" remain for consideration but must apparently be counterbalanced by carelessness or over-confidence in the middle age groups.

Days and Times of Occurrence of Accidents

In 1956 the accident rates had become stable, and further information was recorded, including the day of the week and the time of the day at which accidents occurred.

TABLE 7
NOS. OF ACCIDENTS OCCURRING ON DIFFERENT DAYS
OF THE WEEK AT SINGAPORE DOCKYARD, 1956

Day of Occurrence	No. of Accidents	% of Total
Monday	203	25.2
Tuesday	196	24.3
Wednesday	94	11.7
Thursday	84	10.4
Friday	156	19.4
Saturday	61	7.6
Sunday	11	1.4
Total	805	100.0

Table 7 shows the distribution of accidents by day of the week. The accidents included in Table 7 were those in which the employee was sent to a dockyard dressing station or to hospital. During the six weekdays, all employees were present, but on Sundays, as an average, only about 5% were working. On Saturdays one shift was worked in place of the usual two. The accident frequency was highest on Monday and fell to its lowest level at mid-week. This agrees with Factory B of Sutherland *et al.* (1950) for the first three days of the week (476, 466, and 424 accidents) but not for the next two days (481 and 393). Sutherland's Factory A was different on all counts.

Vernon (1918) showed that, with a 12-hour working day, accidents were most frequent on Mondays, sinking to a minimum on Fridays, with an increase once more on Saturdays, and related this to some extent to the consumption of alcohol. This factor would apply very little in Singapore.

The time of day when an accident was sustained was only recorded for cases referred to hospital and the results are shown in Table 8.

The number of accidents rose to a peak between 8 and 10 a.m. and to a lesser ridge between 2 and 3 p.m. Ignoring the few accidents on a Sunday, in the six mornings of four and a half hours each (27 hours) 182 accidents were reported, while in the five afternoons (17½ hours) only 78 occurred. Thus 70% of these accidents took place in the morning at a rate of 6.7 accidents per hour, and 30% in the afternoons at a rate of 4.5 accidents per hour.

Imbert (1904) stated that more accidents occur during the last two hours of the morning and in the afternoon spells of work, but most records of a committee of the British Association (Sargant

Florence, 1916) show that accidents increase during the morning to reach a maximum in the last hour or hour but one. In the afternoon the peak period for accidents was around 3 p.m.

Vernon, Bedford, and Warner (1931) also showed that miners attained maximum accident frequency in the last hour of full work at low temperature, but when the temperature was high, accidents reached the peak in the last hour but one. In the Singapore dockyard, where temperatures are high, the second peak of accident frequency was reached in the penultimate hour of afternoon work.

The two factories investigated by Sutherland (1950) differed in their hours of work but the peak periods for accidents were in both instances between 8 and 9 a.m. and 3 and 4 p.m. Sutherland also found that the rate of reporting accidents was from 30 to 40% lower in the afternoon than in the morning.

Conclusions

Accidents occurring to male industrial workers of H.M. Dockyard, Singapore, during the years 1955-56 have been analysed as to age and ethnic group and category of causation. Average numbers employed were 7,200 (1955) and 7,043 (1956).

Cases requiring further investigation or treatment at the R.N. Asian Hospital are shown separately.

The number of accidents reported were 1,794 (1955) and 805 (1956). Expressed as accidents per 100 employee-months this is 1.00 for Chinese, 1.01 for Indians, and 0.67 for Malays.

The rates per 1,000 workers for 1956 for accidents requiring notification under the Factories Act, 1937, is shown as 9.1: the international accident frequency rate is 1.7.

The rates for accidents are highest for Chinese and Indians in the 26 to 35 years of age group, falling to the lowest at 56 years and over. The Malays differ only in having the accident peak in the 36 to 45 age group.

The majority of the accidents occurred on Mondays, falling steadily for the next three days, with a slight secondary peak on Fridays; by far the greatest number occur between 0800 and 1000 every day. During the mornings accidents occur at the rate of 6.7 an hour and in the afternoon at 4.5 an hour (total accidents for the year represented as occurring

TABLE 8
NO. OF ACCIDENTS IN WHICH THE EMPLOYEE WAS REFERRED TO HOSPITAL RELATED TO TIME OF
OCCURRENCE AT SINGAPORE DOCKYARD, 1956

	Periods of Working Day							Total No. of Accidents
	0700—	0800—	0900—	1000—	1245—	1400—	1500—1615	
No. of accidents	26	70	63	23	19	43	16	260
No. of accidents per hour	26	70	63	15	15	43	13	—

in one working week).

The types and sites of injuries are tabulated.

I am indebted to Surgeon Vice-Admiral Sir Cyril May, K.B.E., M.C., Medical Director-General of the Navy, for permission to publish this article.

I am also most grateful to Mr. H. H. Dickson, acting senior surgery assistant at H.M. Dockyard, Singapore, for the great assistance he has given in the recording and listing of these accidents.

REFERENCES

- Brundage, D. K. (1927). *Publ. Hlth Rep. (Wash.)*, 42, 529.
 Chief Inspector of Factories (1956). Annual Report for the Year 1955. H.M.S.O., London.
- Florence, P. Sargent (1916). Report of the 85th Meeting of the British Association for the Advancement of Science, Manchester, 1915 (published 1916), p. 283.
- Hewes, A. (1921). *J. industr. Hyg.*, 3, 187.
- Imbert, A. (1904). *Rev. Scientifique, Paris*, 5 ser., 1, 711.
- King, H. F., and Speakman, D. (1953). *Brit. J. industr. Med.*, 10, 51.
- Kossoris, M. D. (1948). *Monthly Labor Review*, Vol. 67, p. 16. Bureau of Labor Statistics, U.S. Dept. of Labor.
- McFarland, R. A. (1957). *Amer. J. med. Sci.*, 234, 1.
- National Safety Council of U.S. (1952). *Accident Facts*, p. 30.
- Schmitt, J. (1926). *Reichsbahn*, p. 558.
- Sutherland, I., Harris C. G., and Smithers, A. (1950). *Brit. J. Industr. Med.*, 7, 140.
- Taylor, A. (1954). *Trans. Ass. industr. med. Offrs*, 3, 296.
- Vernon, H. M. (1918). Memo. No. 21 of Health of Munition Workers Committee.
- (1936). *Accidents and Their Prevention*. University Press, Cambridge.
- , Bedford, T., and Warner, C. G. (1931). *Rep. industr. Hlth Res. Bd (Lond.)*, No. 62.

THE APRIL (1959) ISSUE

The April (1959) issue contains the following papers:—

Health Problems of Epoxy Resins and Amine-curing Agents. By L. B. Bourne, F. J. M. Milner, and K. B. Alberman.

Medical Examinations for Public Safety. By P. A. B. Raffle.

Measuring Dust Exposure with the Thermal Precipitator in Collieries and Foundries. By S. A. Roach.

Pulmonary Fibrosis in an Aluminium Worker. By John Mitchell.

Two Cases of Hydrazine Hydrate Dermatitis without Systemic Intoxication. By Darrell M. Evans.

The Chemotherapy of Poisoning by Organophosphate Anticholinesterases. By D. R. Davies and A. L. Green.

A Follow-up Study of Men Exposed to Cadmium Oxide Fume. By J. A. Bonnell, G. Kazantzis, and E. King.

The Value of Mobilization of Lead by Calcium Ethylene-diamine-tetra-acetate in the Diagnosis of Lead Poisoning.
 By J. Teisinger and J. Srbová.

The Mechanical Properties of the Lung in Pneumoconiosis of Coal-miners. By G. L. Leathart.

Further Studies of the Neutralization of Silica Toxicity *In Vitro*. By J. Marks.

Miscellanea:

The Employment of Diabetics. By John F. Copplestone.

Book Reviews.

A number of copies are still available and may be obtained from the Publishing Manager, British Medical Association, Tavistock Square, W.C.1, price 17s. 6d.