BOILS AND INFECTED HANDS: AN EPIDEMIOLOGICAL INVESTIGATION

BY

G. P. B. WHITWELL and IAN SUTHERLAND

From the Institute of Social Medicine, Oxford

(RECEIVED FOR PUBLICATION, FEBRUARY 3, 1948)

Introduction

The literature on boils and infections of the hand is naturally confined in the main to the treatment of the individual. It has taken many years for the septic hand to receive the recognition due to its importance, not only in its power to disable but also in the length of time it renders a person incapable of work. But its importance extends beyond the individual. There are group reasons why these lesions should receive still further attention. Minor skin sepsis can be a cause of staphylococcal food poisoning. The infectivity of pemphigus neonatorum and breast abscess and its relation to the carriage of staphylococci in nursing staff has been studied by Knott and Blaikley (1944), while Wright (1944) has shown that in a group of nurses studied the most frequent causes of sick absence were whitlows and boils, which exceeded the rate for respiratory or any other illness. Outside hospitals relatively little is known of the background against which these conditions develop.

Scope of Present Study

In this investigation medical records from three large factories were used. For factory A the statistics indicate the incidence of boils and septic hands during the period April, 1943, to March, 1947,

and the information was compiled from factory surgery records, these being supplemented for the final fourteen months by the medical certificates forwarded by those who were incapacitated. In factories B and C the data relate solely to the prevalence of septic hands in the period April, 1946, to March, 1947, and the particulars were supplied by the safety engineers and compiled from the surgery records. All three factories have medical departments. These are readily available not merely for the treatment of accidents, but also for general medical consultation and treatment. The employee may attend during working hours, but loses no pay; he generally does not have far to go to reach the surgery nor long to wait on arrival. The inducements for a workman to seek treatment or report his sepsis at the factory are therefore great; for this reason it is believed that the data give a fair index of the amount of sepsis in the populations, especially for the period in factory A when outside medical certificates were used in addition to factory records.

Interpretation of Factory Records

The cases were seen by state registered nurses and some by the factory medical officer. While it is felt that the best criterion of a septic hand is the presence of pus, the condition was so rarely mentioned in recording as to be

TABLE 1
SEPTIC HANDS IN THREE FACTORIES DURING THE YEAR APRIL, 1946, TO MARCH, 1947

Factory	Average population (excluding staff)	Cases of septic hands reported per 1,000 workers	Percentage of cases which lost time	Average absence due to lost-time sepsis, in working hours
A	3,391	93	7.3	75.9
B	2,018	135	9.2	109.2
C	2,862	234	5.4	116.1

TABLE 2

SEASONAL INCIDENCE OF SEPTIC HANDS IN THREE FACTORIES (PER 1,000 AVERAGE POPULATION) APRIL, 1946, TO MARCH, 1947

Quarter	Factory		
	A	B	C
April-June, 1946 ..	22.8	31.2	66.7
July-Sept., 1946 ..	21.8	34.6	55.5
Oct.-Dec., 1946..	28.9	40.4	66.1
Jan.-Mar., 1947 ..	18.9	28.2	45.9

These rates are adjusted for the differing lengths of the quarters.

of little informative value. The following terms were therefore accepted: "whitlow," "septic" or "infected" finger or hand, and "inflamed cut." Vague terms like "inflamed finger," which might imply a chilblain, were rejected. In the interpretation of furunculosis the following were accepted: "boil," "carbuncle," and "stye." All else was rejected.

It should be remembered in interpreting the severity (as judged by lost time) of these conditions, that the facilities for early treatment afforded by the medical departments in these factories probably modify considerably the amount of sick absence which would otherwise occur. In addition, early attention to cuts and abrasions is strongly encouraged as a preventive measure against sepsis. This picture of sepsis is therefore a picture obtained from factories with reasonable medical facilities. It is not comparable to the conditions in factories with first aid boxes or to those obtaining in the home or elsewhere.

Incidence of Septic Hands in the Three Factories

Table 1 presents certain figures relating to septic hands reported in the three factories during the year April, 1946, to March, 1947. The figures are instructive in giving an indication of the prevalence and severity of the septic hands encountered at a factory surgery. It will be noticed that factory A had the lowest incidence, 93 per 1,000 employees. In factory C, the incidence was $2\frac{1}{2}$ times as great. Factories B and C, unlike A, have large machine shops, and it is possible that this may contribute to these wide differences. The percentage of cases reported which were sufficiently severe to occasion loss of time varied from 5.4 per cent. in factory C to 9.2 per cent. in factory B. The final column of the table shows the average number of working hours lost by those employees who were absent with sepsis. There is little difference between factories B and C, but factory A had a noticeably shorter average duration.

Despite the wide differences in incidence level, two of the three factories show a similar seasonal trend in incidence throughout the year. Table 2 gives the quarterly figures. Of the three factories, which are geographically remote from one another, A and B returned a higher rate during the fourth quarter of 1946 than in the preceding or succeeding quarters. In each factory the lowest rate occurred in the first quarter of 1947. Until data for the other years have been examined it is not possible to be sure whether this finding reflects a regular seasonal pattern, or represents an autumnal rise peculiar to 1946. It will be noted that factory C, unlike the other two, had a peak incidence in April to June, 1946.

Secular Trend in Boils and Septic Hands in Factory A

The incidence of boils and septic hands in factory A is shown quarterly from April, 1943, to March, 1947, in the Figure. There is much fluctuation between one quarter and the next, and this may be in part due to a regular seasonal pattern. On the whole both types of sepsis increased during the period; the rise in incidence of boils is especially marked in the final year. The secular trend and seasonal pattern will be investigated separately.

Table 3 indicates the annual incidence of boils and septic hands. Boils show a clear increase throughout the four years and had a particularly high incidence in 1946-47. In that year 66.8 cases were reported per million man-hours worked, a rate which is more than double the figure recorded three years before. Apart from a low incidence in

Quarterly incidence of boils and septic hands in factory A: April, 1943, to March, 1947. Both sexes.

TABLE 3

INCIDENCE OF BOILS AND OF SEPTIC HANDS PER MILLION MAN-HOURS IN FACTORY A: APRIL, 1943, TO MARCH, 1947

Year	Males				Females				Both sexes		
	Av. pop.	Boils	Septic hands	Total	Av. pop.	Boils	Septic hands	Total	Boils	Septic hands	Total
Apr., 1943-Mar., 1944	3,076	31.0	36.6	67.6	892	18.2	41.3	59.5	28.2	37.6	65.8
Apr., 1944-Mar., 1945	2,973	37.3	30.9	68.2	770	30.9	42.3	73.2	36.0	33.3	69.3
Apr., 1945-Mar., 1946	2,632	39.0	42.8	81.8	401	39.5	55.1	94.6	39.1	44.5	83.6
Apr., 1946-Mar., 1947	3,137	66.4	45.3	111.7	254	72.4	88.9	161.3	66.8	48.6	115.4

1944-45, the rate for septic hands also increased during the four years, but not so markedly as did the rate for boils. Whereas in 1943-44 the incidence of septic hands was about 35 per cent. higher than that of boils, in the last year this position was reversed. The total sepsis shows an increase similar to that of boils alone. Severity, as judged by the numbers of compensation cases for septic hands, also increased in 1946-47. The numbers in the four years were 6, 7, 6, and 15 respectively. Comparison of the sexes indicates two interesting differences. The incidence of septic hands is uniformly higher among women than among men, whereas for boils no consistent sex difference appears. It is also noteworthy that the rates for women show a much steeper rise over the period studied than do those for men. For boils the male rate doubled, but the female rate almost quadrupled. For septic hands the corresponding increases were 24 per cent. and 115 per cent. Figures quoted below in a slightly different connexion indicate that these trends cannot be explained by a greater tendency to report sepsis on the part of ex-service personnel.

This rise in incidence and severity of sepsis, being based on a small and selected population, does not necessarily imply a general deterioration in communal health. Nor does it follow that the rates will further increase in 1947-48. It is of interest to mention that Gottlieb (1947) has noticed a marked increase in furunculosis in general practice during the latter half of 1947. Bourne (1947) noticed a similar increase in the autumn of 1946.

Seasonal Incidence of Boils and Septic Hands in Factory A

The usual method of determining the seasonal incidence, namely by averaging the rates for each month or each quarter, over the period studied, will not give reliable figures in this case. The period started in April, 1943, and finished in March, 1947. Throughout this time the incidence of sepsis was increasing. The average for, say,

April or May, would thus tend to be fictitiously low, and the average for February or March fictitiously high. The method will only give a reliable indication of the seasonal fluctuation if there is no superimposed annual trend.

The difficulty of disentangling the seasonal variation from the secular trend may be overcome as follows. A straight line is 'fitted' to the data to describe their upward trend, and the seasonal variation is determined *about this line*. As an example, the observed rates for boils in the second quarters exceed those expected from the trend-line by -0.3, 7.6, -12.0, and 2.6. The average of these figures is -0.5. The mean rate for boils throughout the whole period is 42.5, and so the corrected rate for the second quarter is $42.5 - 0.5 = 42.0$.

The figures thus obtained are given in Table 4. The maximum incidence of both boils and septic hands occurs in the fourth quarter. There is little to choose between the first three quarters, but the quarter ending in March has slightly lower rates than the other two. The range of variation for septic hands is 14.2, or just double that for boils.

These findings make it apparent that the seasonal trend shown in Table 2 for factories A and B during 1946-1947 was not peculiar to that year, but reflects a seasonal pattern which is common to different years, different areas, and to both types of sepsis.

TABLE 4
SEASONAL INCIDENCE OF BOILS AND SEPTIC HANDS IN FACTORY A: APRIL, 1943, TO MARCH, 1947

Quarters	Cases reported per million man-hours, of		
	Boils	Septic hands	Total
Ending March 31 ..	39.6	36.2	75.8
Ending June 30 ..	42.0	38.4	80.4
Ending Sept. 30 ..	41.8	39.8	81.6
Ending Dec. 31 ..	46.7	50.4	97.1

These rates are corrected for the effects of the secular trend during the period.

TABLE 5

NUMBERS OF NON-LOST-TIME AND LOST-TIME CASES OF SEPSIS BY QUARTERS IN THREE FACTORIES :
APRIL, 1946, TO MARCH, 1947

Quarter	Boils			Septic hands								
	Factory A			Factory A			Factory B			Factory C		
	Minor	Lost-time	% cases which lost time	Minor	Lost-time	% cases which lost time	Minor	Lost-time	% cases which lost time	Minor	Lost-time	% cases which lost time
April-June, 1946	99	2	2.0	73	2	2.7	57	8	12.3	171	6	3.4
July-Sept., 1946..	114	8	6.6	63	9	12.5	67	7	9.5	153	8	5.0
Oct.-Dec., 1946..	129	6	4.4	93	9	8.8	78	6	7.1	183	19	9.4
Jan.-Mar., 1947..	72	2	2.7	62	3	4.6	46	4	8.0	126	3	2.3

The populations at risk showed no appreciable change throughout the year.

Reference to the monthly figures shows that the peak incidence of both septic hands and boils occurs in October or November.

Severity in 1946-47

Table 5 shows the quarterly figures for cases of sepsis which did and did not cause loss of working time in the three factories. It will be noticed that in factory A the percentage of lost-time cases, both of boils and septic hands, was a maximum in the third quarter, whereas the highest number of cases did not occur until the fourth quarter. This suggestion that an increase in serious cases may precede a general increase is, however, not borne out by the figures for septic hands in the other two factories. This would be an interesting point to take up on a larger body of data.

Information is too scanty to decide whether an increase of frequency is always accompanied by an increase in severity. In 1946 the two factors were undoubtedly associated. But the lost-time cases for previous years in factory A are not available, except for the compensation cases of septic hand, which are too few in number to form satisfactory data. These few compensation cases did not especially occur in the autumnal rises for the years 1943-45, but no conclusion can be drawn from this. It is necessary to stress this point, because hospital records which deal with the more severe cases may or may not show some of the features of industrial cases.

Causes of 1946 Epidemic

It was thought that demobilization, by introducing a high staphylococcal carrier rate into the civil community, might have caused the 1946 epidemic, assuming that soldiers had a higher rate than civilians. But in October, 1946, the proportion of recent ex-service men among the cases of septic hand

was the same as their proportion in the factory. In addition the medical records of 100 recent ex-service men taken from the factory records showed that from April, 1946, to January, 1947, boils only occurred in 2, septic fingers in 4. As a rough control, 108 non-ex-service employees had 5 boils and 1 septic finger over the same period. From this evidence it cannot be assumed that demobilization was the cause of the 1946 epidemic.

In a further attempt to throw light on the cause, 111 cases of septic hand were taken from the records from April, 1946, to January, 1947, at random. Mock (1919) recorded an epidemic of infected hands associated with tonsillitis. But tonsillitis only occurred 3 times in these 111 cases, and in only one in association with the hand lesion.

In the World War 1914-18 scabies was a major cause of skin sepsis but it occurred in only 2 of the 111 cases in this series, and then not at the same time as the septic hand. From these data it only seems possible to draw negative conclusions. But during the same period (April, 1946, to January, 1947) 17 of the 111 cases also had furunculosis and 12 had another septic hand. In these 29 the carrier state seems to have been persistent. The septic hand cannot therefore be looked upon as an isolated incident, nor must it be regarded merely as a single surgical problem without associations of general importance.

Why do these two conditions, boils and infected hands, vary from year to year and have a seasonal peak? Does the carrier state vary, or is there varying tissue resistance or bacterial virulence?

Summary and Conclusions

The investigation concerns the epidemiology of boils and infected hands in a factory population. Records were available for both types of sepsis in one factory over the period April, 1943, to March,

1947. In another two factories, remote from the first and from each other, data of septic hands only were obtained for the year April, 1946, to March, 1947. In this year the average population of the three factories combined was over 8,000.

During the period of four years studied in the one factory the incidence of both boils and septic hands increased greatly. For boils the incidence in the final year was double that in the first year. The increase was more marked in women than in men.

There is no evidence that in this epidemic of 1946-47 the septic hands were related to demobilization, nor that they were associated with tonsillitis or scabies. In about 25 per cent. of a random group

of cases of septic hand there seems to have been a persistent carrier-state, as indicated by recurrent lesions.

Evidence is presented of a seasonal incidence pattern common to different years, different areas, and both types of sepsis. The peak incidence is in the fourth quarter (October or November), and the minimum in the first quarter of the year.

REFERENCES

- Bourne, I. H. J. (1947). *Lancet*, 2, 891.
 Gottlieb, I. (1947). *Ibid.*, 2, 808.
 Knott, F. A., and Blaikley, J. B. (1944). *J. Obstet. Gynec. Brit. Emp.*, 51, 386.
 Mock, H. E. (1919). "Industrial Medicine and Surgery." W. B. Saunders Co., Philadelphia, p. 580.
 Wright, J. (1944). *Brit. med. J.*, 1, 585.

BOOK REVIEWS

"PROCEEDINGS OF A CONFERENCE ON INDUSTRIAL OPHTHALMOLOGY"

(Sponsored by Columbia University College of Physicians and Surgeons in co-operation with the National Society for the Prevention of Blindness. Published by the Columbia University Press, New York. No price given.)

The conference was held in New York in May, 1945. The medical schools of the United States sent their representatives: ophthalmologists and others who were interested in the undergraduate and postgraduate teaching of industrial medicine. A large number of industrial establishments were represented by their medical officers, safety officers, and illuminating engineers. Several U.S.A. government departments were represented: the Industrial Hygiene Division, the Office of Vocational Rehabilitation, the Army Services, etc.

The Proceedings are published by the Columbia University Press, New York, and give a full account of the papers read at the Conference and of the discussions which followed each paper. Each paper is a valuable contribution by experts. Good lighting in industry is discussed at length in three papers: one deals with the principles of illumination which all ophthalmologists and industrial medical officers should know; the other two were read by illuminating engineers and are well illustrated. Two papers deal with job analysis, and

the prescribing of spectacles for special work distances.

Dr. Hedwig Kuhn gives very practical advice on the prescribing of bifocal lenses and occupational spectacles in different trades. A paper on visual screening methods by Dr. C. Berens and Dr. Lo Presti deals with different types of instruments which are used in industry to examine quickly the vision of workers. The most popular instrument is the Ortho-Rater. The other instruments used in industry for the examination of vision, visual acuity, muscle balance, binocular vision, colour vision, etc., are also discussed. The authors have come to the conclusion that at present there is no ideal visual screening apparatus available. The Snellen's test type, Maddox rod and Maddox Wing, and other orthodox methods are still recommended as the most reliable for use in industry. Two papers deal with colour vision in industry and the use of different colours in the factory. The toxic effects of industrial poisons on the eye are discussed by Dr. F. Kutscher. Other papers deal with eye injuries in welding operations; first aid in chemical eye injuries; the practical application of protective devices; the vision necessary in engineering, etc.

The discussion gave the participants an opportunity to clear up many moot points. It is only through such meetings of ophthalmologists, industrial medical officers, safety officers, illuminating engineers, and others interested in industrial medicine that our knowledge can be enlarged. It is to be hoped that in the future such conferences will be held in this country. J. M.