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The incidence of sepsis in the Royal Air Force

By D. L. MILLER*
Flight Lieutenant, Royal Air Force

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Infection with the *Staphylococcus aureus* has received much attention in recent years. The important problems of hospital cross-infection have rightly been given priority and have been the subject of many studies. Yet most staphylococcal infections occur outside hospitals, and, as the family doctor well knows, cause much distress, loss of working time, and occasionally serious complications. Little information is available on the frequency of sepsis and of resulting disability outside hospitals, perhaps partly because they are difficult to measure.

The Royal Air Force is clearly not typical of the general population, but the men are under close medical supervision and the occurrence of even minor maladies causing time off work is well documented. Thus reliable comparisons of morbidity between different groups and for different diseases can be made.

As a setting for an extensive field and laboratory study of staphylococcal disease and nasal carriage in the Royal Air Force (Miller, McDonald, Jevons & Williams, 1962) some service records of the incidence of sepsis were analysed. The results are presented here.

MATERIAL

In all R.A.F. stations a weekly record is compiled of men who have been sick in hospital, station sick-quarters, or at home for more than 48 hr., with the initial diagnosis. (The term 'admission' will be applied to all these events.) The annual Report on the Health of the Royal Air Force and Women's Services of the Royal Air Force is based on these records and on in-patient clinical notes. Statistics were taken from the Reports for the years 1956–58.

In addition, the weekly admission records were examined for seasonal variations in incidence, epidemics of sepsis, and differences in the incidence of sepsis in a recruits' training unit, a school for boy apprentices, and a group of 33 operational units. The recorded diagnosis, the month and place of admission, and the rank of all those admitted with a septic lesion were extracted for the years 1957–59. The septic lesions included were boils, carbuncles, abscesses, styes, septic cuts or abrasions, impetigo, acne (which was assumed to signify pustular acne if requiring admission), quinsy and dental sepsis. In the operational units records were inspected only to September 1959, and in some instances no records were available for the early part of the period. Where records were incomplete rates were estimated on the basis of the mean rate for all units for the corresponding months in other years.

* Present address: Central Public Health Laboratory, Colindale Avenue, London, N.W. 9.

RESULTS

Annual reports

In men, spells of sickness under the heading 'infections of the skin and subcutaneous tissues' (International Classification C44) during the years 1956–58, accounted for between 2·0 and 3·3 % of all admissions, or about 5 % of admissions other than those due to respiratory diseases which accounted for most of the annual fluctuation in the overall rates (Tables 1, 3). The mean duration of each admission was 7–8 days, a little shorter than that for all spells. Only 7 men were invalided from the service as a direct result of these infections, 4 of them before they had completed 6 months' service. There were no deaths.

Table 1. *Incidence and duration of admissions due to sepsis**

	R.A.F.			W.R.A.F.		
	1956	1957	1958	1956	1957	1958
Admission rate per 1000 persons per annum from						
All causes†	204	210	204	328	321	327
Sepsis	12	11	9	16	17	14
Proportion due to sepsis	5·9 %	5·1 %	4·5 %	4·8 %	5·4 %	4·3 %
Mean duration of admissions (days)						
All causes	11	10	10	11	10	10
Sepsis	7	8	8	10	10	8
Numbers of persons invalided from service due to sepsis	2	1	4	0	0	0

* Figures in this table and in Tables 2 and 3 were derived from Annual Reports on the Health of the R.A.F. and W.R.A.F.

† Excluding respiratory diseases.

Table 2. *Annual admission rates due to sepsis in men of different age groups*

	Admission rate per 1000 persons per annum			
Age (years)	1956	1957	1958	1956–58
Under 20	23	24	25	24
20–24	11	10	9	10
25–29	5	6	5	6
30 and over	5	4	4	4

The fall in the incidence of admission for sepsis in each successive year perhaps reflected a concurrent fall in the proportion of men under 20 years of age in the service. Admission rates fell with age and this fall was particularly sharp between those under and over 20 years of age (Table 2).

Women were more frequently admitted for sepsis than men, but these admissions formed a similar proportion of their total sickness (Table 1). The mean duration of admissions was longer than for men.

A comparison of the admission rates for some of the commoner groups of diseases in the R.A.F. emphasizes the importance of respiratory disease (Table 3). Septic skin conditions were prominent among the other groups. In women the incidence of diseases of the genital organs (Group No. C42(*b*)) and mental disorders was higher, but there were no other important differences from the men.

Table 3. *Annual admission rates due to some common groups of diseases in men*

International classification		Admission rate per 1000 persons per annum		
Special list Group No.	Disease	1956	1957	1958
C28–34	Respiratory diseases	129	285	157
C50	Accidents, poisoning and violence	45	45	45
C38	Diarrhoea and enteritis	17	20	20
C35	Diseases of stomach and duodenum, except cancer	13	14	14
C44	Boils, abscesses, cellulitis and other skin infections	12	11	9
C45	Other diseases of the skin	7	7	6
C19 and 49 (Pt 320–326)	Mental disorders	6	7	7
C36	Appendicitis	6	6	5
	All causes	333	495	361

Station sickness records

During the 3 years studied 961 individuals with septic lesions, as defined, were admitted in the 33 operational stations, an incidence of 10·8 per thousand per annum. 428 (45 %) had boils, carbuncles, abscesses, or 'cellulitis', 64 (7 %) sepsis of fingers or hands, 15 (2 %) styes, 50 (5 %) quinsies, 108 (11 %) dental sepsis and 296 (30 %) other septic lesions such as impetigo, infected cuts, blisters and insect bites, and acne. Most of the men were detained in station sick-quarters or at home, but 166 (17 %) required admission to hospital.

In these stations as in the whole service, the admission rate for women was higher than for men, while the rate for officers was little more than half that for all other ranks (Table 4). Adult recruits suffered more than twice the incidence of admissions of trained men, but there was no such excess among boy apprentices.

Lesions did not occur more frequently at any particular season of the year, but among recruits and boys some evidence of epidemics of staphylococcal infection occurring independently of season was found. When the monthly distribution of admissions was examined by the χ^2 test it was found to vary significantly from the expected in both situations (Table 5). Thus if admissions reliably reflect the prevalence of infection, then fluctuations of an epidemic nature occur. Evidence of similar fluctuations among trained men was less convincing. In only 2 of the 33 stations did the value of χ^2 reach a significant level ($P < 0{\cdot}05$), which might have occurred by chance. In several stations, however, admissions appeared to occur in 'runs' over several successive months. When examined statistically these sequences were sometimes significant, though the validity of thus grouping the data for statistical analysis is doubtful.

Table 4. *Annual admission rates in different groups* (1957–59)*

	Admission rate per 1000 persons per annum†
Trained personnel	
Men: officers	5
other ranks	10
all ranks	9
Women: all ranks	10
Boy entrants	9
Adult recruits	23

* Figures in this table and in Table 5 were derived from the station sickness records.

† Rates excluded those admitted with quinsy or dental sepsis to allow comparison with figures for the whole service.

Table 5. *Numbers of recruits and boy apprentices admitted each month with sepsis* 1957–59

		Jan.	Feb.	Mar.	Apr.	May	June
Recruits*	1957	2	6	2	8	2	2
	1958	10	3	6	8	12	6
	1959	4	0	5	2	3	8
Boys†	1957	2	5	4	3	1	3
	1958	4	0	0	1	0	1
	1959	1	3	1	0	1	2
		July	Aug.	Sept.	Oct.	Nov.	Dec.
Recruits	1957	2	3	1	3	1	6
	1958	5	1	6	4	3	3
	1959	4	7	10	12	9	7
Boys	1957	3	2	1	1	3	0
	1958	5	1	0	0	0	1
	1959	0	1	0	1	0	0

* $\chi^2 = 66{\cdot}62$ on 35 D.F. ($P < 0{\cdot}001$).

† $\chi^2 = 62{\cdot}26$ on 35 D.F. ($P < 0{\cdot}002$).

χ^2 was calculated on the assumption that the numbers of individuals at risk in each month was on average equal to the mid-year strengths of the stations concerned.

DISCUSSION

Since sepsis occurring outside hospitals is usually trivial it is perhaps surprising that it accounted for up to 1:30 of all admissions to sick-quarters and hospital, and that 1 % of all men in the service were admitted with sepsis each year. Furthermore those admitted for more than 48 hr. were detained on average for at least a week. Of these admitted few required treatment in hospital, however, and serious permanent incapacity was rare.

As it is usual in the R.A.F. to admit to sick-quarters any man who is unfit for duty these figures are a good measure of loss of working time due to sepsis. Most men in the R.A.F. are engaged in light engineering work and in providing supporting

services; so it is possible that, making allowances for age differences, the figures for loss of working time in civilian light industrial populations would be similar. Gould & Cruikshank (1957) found that about 5% of their patients in a non-industrial general practice suffered one or more lesions each year, but they do not say how many were prevented from working. Kay (1962) observed staphylococcal sepsis in 9% of his patients in a Manchester practice.

The differences in incidence between men and women, between young and older men, between officers and other ranks are perhaps not surprising. Women are frequently found to have higher sickness absence rates than men in industry, and the higher incidence of sepsis in the women in the W.R.A.F. was not proportionately greater than the excess for all causes. A high incidence of sepsis in adolescents and young men is also common experience. It appears, however, that although boy apprentices had a higher incidence of septic lesions than recruits (Miller *et al.*, 1962), they led to admission less frequently and were presumably generally less severe.

The evidence of epidemics of infection among recruits and boys, and the high incidence in recruits compared with trained men are of some interest. These differences, though less marked, recall those that have been found in the incidence of respiratory infections (McDonald, Wilson, Thorburn, Holland & Andrews, 1958); but differences in age could account for them and also for the low incidence among officers (Tables 2 and 4).

The absence of any seasonal fluctuation in the incidence of sepsis supports the findings from studies by Gould & Cruikshank (1957) in general practice, and of Elias-Jones, Gordon & Whittaker (1961) in infants.

SUMMARY

In 1956–58 septic lesions in men of the R.A.F. accounted for about 3% of all admissions to sick-quarters or hospital and about 5% of admissions excluding respiratory disease; 1% of all men in the service were admitted with sepsis each year. Incidence fell with age, particularly up to the age of 25 years. The rates for women were about 50% higher.

Recruits experienced more than twice as much sepsis as trained men and boy apprentices. Officers had only half the admission rate of other ranks. These contrasts could have been explained by differences in age. There was no evidence of seasonal variation in the incidence of sepsis, but in recruits and boy apprentices epidemics of sepsis unrelated to season occurred.

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