doubt, detrimental to health.” It was suggested that the components of this adverse environment were: (a) poor ventilation; (b) low air velocity; (c) bad design of kitchen; (d) insufficient size of kitchen; (e) excessive radiation from ranges, this factor dominating.

Without hesitation it was recommended that “coal fired ranges, whether of obsolescent or modern type, are quite unsuitable for routine cooking purposes in existing married quarters in Malta during the summer months, viz., from May to October.”

This paper was then forwarded to higher authority as an appendix to a letter by G.O.C. requesting that as an interim measure an issue of oil cooking stoves and primus stoves be authorized to these quarters.

ACKNOWLEDGMENTS

I have to thank Colonel T. B. H. Tabuteau, O.B.E., D.D.M.S., Malta Garrison, for permission to forward this paper for publication; and Sergt. Fleming, R.A.M.C., and Pte. Brown, R.A.M.C., for sweating in a good cause.

PULMONARY TUBERCULOSIS: CERTAIN ASPECTS OF ITS PREVENTION IN THE BRITISH ARMY

BY

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Royal Army Medical Corps

INTRODUCTION

The Army is a community which can influence the environment of its members to an appreciable extent. It also has the advantage of being able to control the entry into, and to banish undesirable members from, this community. None of these powers is absolute. It is often subject to the low environmental standards of adjacent communities; undesirable qualities in candidates for entry are not always detectable; banishment is a long process even when the defect requiring it is revealed. Tuberculosis in the Army will be considered in the light of these facts.

IMPORTANCE

This disease has never been important merely on account of its incidence alone. This has usually been lower than that obtaining in corresponding civilian groups and that for other infectious diseases in the Service. Its importance has depended on (1) its infectious nature; (2) its chronicity; (3) its tendency to relapse.
The first two factors raise difficulties in nursing and isolation.
The second two call for the repatriation of cases discovered abroad and raise problems in transporting infectious cases, particularly as few of them are fit for air transport and few ships are properly equipped for this duty. All factors have combined to require the patient’s discharge from the Service.

## Incidence

**TABLE 1.—INCIDENCE OF TUBERCULOSIS**

<table>
<thead>
<tr>
<th>Year</th>
<th>Incidence in the British Army (Males) per 1,000</th>
<th>Discharges in the British Army (Males) per 1,000</th>
<th>Incidence in the British Army in India (Males) per 1,000</th>
<th>Standardized Death Rates (Males), England and Wales</th>
<th>Formal Notifications (Males), England and Wales</th>
</tr>
</thead>
<tbody>
<tr>
<td>1933</td>
<td>1.2</td>
<td>1.07</td>
<td>0.8</td>
<td>0.707</td>
<td>31,633</td>
</tr>
<tr>
<td>1934</td>
<td>1.0</td>
<td>0.94</td>
<td>1.0</td>
<td>0.648</td>
<td>30,747</td>
</tr>
<tr>
<td>1935</td>
<td>1.1</td>
<td>0.86</td>
<td>1.1</td>
<td>0.608</td>
<td>28,117</td>
</tr>
<tr>
<td>1936</td>
<td>1.0</td>
<td>0.96</td>
<td>1.3</td>
<td>0.581</td>
<td>28,077</td>
</tr>
<tr>
<td>1937</td>
<td>1.1</td>
<td>1.02</td>
<td>1.2</td>
<td>0.577</td>
<td>28,475</td>
</tr>
<tr>
<td>1938</td>
<td>0.97</td>
<td></td>
<td>1.1</td>
<td>0.534</td>
<td>27,813</td>
</tr>
<tr>
<td>1939</td>
<td></td>
<td></td>
<td></td>
<td>0.539</td>
<td>25,355</td>
</tr>
<tr>
<td>1940</td>
<td>1.2*</td>
<td>1.47</td>
<td>1.1</td>
<td>0.648</td>
<td>26,260</td>
</tr>
<tr>
<td>1941</td>
<td>1.2*</td>
<td>1.68</td>
<td>1.9</td>
<td>0.712</td>
<td>28,966</td>
</tr>
<tr>
<td>1942</td>
<td></td>
<td>1.08</td>
<td>1.3</td>
<td>0.664</td>
<td>29,560</td>
</tr>
<tr>
<td>1943</td>
<td></td>
<td>1.06</td>
<td>0.9</td>
<td>0.724</td>
<td>30,121</td>
</tr>
<tr>
<td>1944</td>
<td></td>
<td>1.20</td>
<td></td>
<td>0.702</td>
<td>30,044</td>
</tr>
<tr>
<td>1945</td>
<td></td>
<td>1.11</td>
<td></td>
<td></td>
<td>29,124</td>
</tr>
<tr>
<td>1946</td>
<td></td>
<td>1.50</td>
<td></td>
<td></td>
<td>29,003</td>
</tr>
<tr>
<td>1947</td>
<td>2.16</td>
<td>2.58</td>
<td></td>
<td></td>
<td>28,879</td>
</tr>
<tr>
<td>1948</td>
<td>1.40</td>
<td>3.13</td>
<td></td>
<td></td>
<td>28,863</td>
</tr>
<tr>
<td>1949</td>
<td>1.06</td>
<td>2.77</td>
<td></td>
<td></td>
<td>28,981</td>
</tr>
<tr>
<td>1950</td>
<td>1.21</td>
<td>2.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* United Kingdom only.

## Analyses

Direct comparison of the civil with military rates is impossible for the following reasons:

(a) Incidence:
   (i) Diagnosis within the Service is more easily, hence more frequently, established.
   (ii) The military group is selected by mass miniature radiography (but see below).
   (iii) Army strengths fluctuate, so that it is virtually impossible to construct a standard population.

(b) Mortality:
   By discharging its sick, the Service artificially reduces its mortality to vanishing point.

The post-war increase in the Army incidence rates is due to several factors, partly statistical and partly diagnostic in origin.
(a) Statistical:
   (i) Pre-war, the number of cases was assessed from a count of the Hospital Record Cards (Army Form I. 1220). The diagnosis, in this case, was confirmed. Post-war numbers are derived from a return of cases admitted to hospitals during the month (Army Form W. 3166), when the diagnosis, often tentative, is subject to correction.
   (ii) Cases which arose during the rapid decline in post-war strengths were usually correlated with a later, and lower, strength.
   (iii) Prisoners of war suffering from phthisis, who were released in 1944 or 1945, were accounted for in those years whereas they might have contracted the disease in previous years.
   (iv) The National Service Acts ensured that large numbers of susceptible young men were enlisted for short periods so that the Army, temporarily, was subjected to the conditions of civil life. The proportion of National Service men to Regulars in 1950 was 100/96.

(b) Diagnostic:
Mass miniature radiography was introduced at the end of the war (though not universally applied until 1947), to reduce the numbers of sub-clinical cases entering the Service. As the examination was then undertaken only after enlistment, the immediate result was to increase the numbers discovered within the Army. This factor is gradually being eliminated as the results of radiography are becoming available to the Ministry of Labour and National Service Boards which select men for service with the Forces.

The discharge rate, which is still compiled now in the same way as it was pre-war, shows a similar trend which is due to the same factors. The greater post-war increase is due to the policy of delayed discharge. Pre-war, a case of phthisis was discharged to civil life as soon as arrangements could be made for his reception. During the war it became increasingly difficult to arrange, so cases were retained within the Service. This policy caused a "pile-up" in the years immediately following the war and this was exaggerated by the released prisoners. The Service now provides special hospitals for these cases.

CONTROL OF THE DISEASE
With any disease, control measures, to be successful, must be based on a knowledge of its ætiology. Factors generally accepted as being important in the spread of tuberculosis are:
   (A) The infecting micro-organism (infection).
   (B) Nutrition.
   (C) Natural and acquired resistance.
(D) Other environmental factors.
(E) Administrative services and "real wages" (1).

Not all these factors are directly applicable to the Army.

(A) Infection

The Service has always emphasized the importance of this factor and has dealt with it by—

(I) Selecting only those deemed free from infection.
(II) Ensuring the early diagnosis of the case.
(III) Reducing the chance of barrack-room spread.

(I) Selection

Pre-war this was based on the history and a physical examination. It is doubtful if the former served any useful purpose as it was taken in the form of answers to a questionnaire, and the applicant soon realized that the correct reply to every question was "No." The physical examination was exhaustive and included careful chest measurements. This procedure was probably more effective in rejecting potential cases of pulmonary tuberculosis than unaided stethoscopic assessment of the chest. The limitations of the examination were tacitly admitted by the presence of a regulation which required each recruit to be weighed thrice during training and, if on any occasion he failed to gain weight, required him to be examined as a suspected case of phthisis (2).

Since the war mass miniature radiography has been introduced to cover this deficiency. All recruits are now so examined either before or immediately after joining the Service. The results of radiography on the 1949 "intake" are summarized below:

<table>
<thead>
<tr>
<th>Description</th>
<th>Per 1,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Total number of recruits (including women) examined</td>
<td>1,000</td>
</tr>
<tr>
<td>(b) Number recalled for further examination</td>
<td>33.5</td>
</tr>
<tr>
<td>(c) Number adequately investigated by the end of the year</td>
<td>24.5</td>
</tr>
<tr>
<td>(d) Proportion diagnosed as tuberculous (active)</td>
<td>1.1</td>
</tr>
<tr>
<td>(e) Proportion diagnosed as tuberculous (inactive)</td>
<td>1.8</td>
</tr>
<tr>
<td>(f) Proportion diagnosed as &quot;other disease&quot;</td>
<td>6.5</td>
</tr>
<tr>
<td>(g) Proportion in whom no abnormality was detected</td>
<td>14.9</td>
</tr>
<tr>
<td>(h) Proportion who failed to complete the examination</td>
<td>9.0</td>
</tr>
</tbody>
</table>

The high proportion of persons who thus failed to complete their examination was due to the following causes:

(i) Time factor (many completed their examination in the following year).
(ii) The nature of the abnormality revealed by the miniature film. When this was known to be irrelevant—e.g., missing ribs—some formations refrained from taking further action.
(iii) Premature postings overseas.
(iv) Clerical errors.
If it be assumed that the uninvestigated cases would have fallen into the groups in the same proportion as the fully investigated, the distribution becomes:

<table>
<thead>
<tr>
<th>Proportion</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>33.5</td>
</tr>
<tr>
<td>(d)</td>
<td>1.4</td>
</tr>
<tr>
<td>(e)</td>
<td>2.3</td>
</tr>
<tr>
<td>(f)</td>
<td>9.7</td>
</tr>
<tr>
<td>(g)</td>
<td>20.1</td>
</tr>
</tbody>
</table>

The rate of 1.4 per thousand is much below that found in other surveys, e.g.,

<table>
<thead>
<tr>
<th>Survey</th>
<th>Group</th>
<th>Date</th>
<th>Rate per 1,000</th>
<th>Size of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Health</td>
<td>All groups</td>
<td>1943-1949</td>
<td>3.8</td>
<td>4,000,000 (3)</td>
</tr>
<tr>
<td>Royal Navy</td>
<td>Males</td>
<td>1941</td>
<td>3.3</td>
<td>166,598 (4)</td>
</tr>
<tr>
<td>Civil Servants</td>
<td>Males, aged 15-25</td>
<td>1946-1948</td>
<td>6.8</td>
<td>4,123 (5)</td>
</tr>
<tr>
<td>Civil Servants (repeat X-ray)</td>
<td>Males, aged 15-25</td>
<td>1946-1948</td>
<td>4.7</td>
<td>2,531 (5)</td>
</tr>
<tr>
<td>Young Adults</td>
<td>All groups</td>
<td>1934-1945</td>
<td>5.0</td>
<td>10,000 (6)</td>
</tr>
</tbody>
</table>

The difference can be explained partly by:

(a) The preliminary selection of the Army group; those who were radiographed in the Service would have been examined twice.
(b) The inclusion of the higher age groups in the Royal Naval and Ministry of Health groups.
(c) A high infection rate in H.M. ships, Civil Service offices and hospitals.
(d) Persons whose names are on the Tuberculosis Register are reported by the Medical Officer of Health of their district to the Ministry of Labour and National Service before their “call-up.” This procedure ensures that these men are critically examined.

The precise significance of the tuberculin reaction is still in doubt. It is generally agreed that its presence indicates—(a) past infection; (b) either recent infection or unhealed infection (7); and its absence the reverse, though it is known that “reversion” may occur in persons who have escaped repeated reinfection even though an X-ray of the chest reveals undoubted, though healed, tuberculous lesions (8). In a survey in Tennessee this phenomenon was found in 24.5 per cent (9). McDougall (10) believes that this loss of sensitivity does not necessarily imply a loss of immunity. Myers (11) believes that a reaction may indicate the likelihood of future active disease. Some evidence that non-reactors fare better, in a “normal community,” than reactors is given by the following surveys:

(a) Of 1,002 soldiers, 575 were found to be reactors at the beginning of their service and 427 non-reactors. Within the observation period of six years, 8 per cent. of the originally tuberculin-positive group had developed clinical tuberculosis as compared with 4.2 per cent. of the non-reactors (12).
(b) Of 800 school children having calcified lesions, 3.7 per cent. developed pulmonary tuberculosis within five years. Of 400 who were tuberculin-positive, but without radiological signs, 0.7 per cent. developed the disease within the same period. Of 500 who were negative both to X-ray and to tuberculin, 0.22 per cent. developed the disease (13).

(c) The Prophit Survey results disagreed with these. In it the reactors suffered only one-third of the morbidity of the non-reactors. However, this trend was reversed in the case of the controls and was more than one-half in the case of the Navy boys, that is, among those not exposed to repeated infection. Also, none of the naval cases occurred during Survey observation, but presumably afterwards while under active service conditions. The other groups worked in the highly infected surroundings of hospitals (14).

While up to the present the Army has found it administratively impossible to test all recruits in this way, one believes that tuberculosis could be excluded with the reactors, provided always that the service environment remains as it is. A survey (15) recently undertaken by the Army for the Medical Research Council showed the following results:

- Number tested: 5,130
- Number positive to 1 I.U. O.T.: 2,294 (44.7 per cent.)
- Number positive to 100 I.U. O.T.: 1,121 (21.9 per cent.)
- Number negative: 1,651 (32.2 per cent.)
- Doubtful: 64 (1.2 per cent.)
- Tests incomplete or refused: 67
- Number with normal X-ray: 5,085
- Number with tuberculous lesion (active) and positive tuberculin reaction: 5 (incl. 1 at 100 I.U.)
- Number with tuberculous lesion (inactive) and positive tuberculin reaction: 10 (all at 1 I.U.)
- Number with tuberculous lesion (inactive) with negative tuberculin reaction: 3
- Number tested but not X-rayed: 34

Until the proportion of non-reactors among the young of the country rises considerably, any question of excluding reactors is of academic importance only, because of the numbers required. It may become practicable when its counterpart in cattle has succeeded in freeing our herds from tuberculosis.

(II) Early Diagnosis

(a) In many walks of civil life, a person suffering from active phthisis may be fit enough to continue his work—and, incidentally, infect his associates—and be unconscious of any disability. This state is rarely possible under service conditions. Work, physical training and organized games would rapidly give rise to symptoms. Even if these were disregarded by the patient, signs of
physical deterioration would soon be noticed by his officers and instructors. Communal life also puts a man under the constant supervision of his fellows, who rarely seem to fail in taking appropriate action when their suspicions are aroused. Close medical supervision, also, is exercised in observing the men about their work and play as well as at formal inspections, inoculation parades, etc. Once suspicion is aroused, the man can be admitted to hospital while investigation proceeds, and he can even be isolated before the diagnosis is established. Regulations (16) prescribe steam disinfection of fomites (or formalin or cresol disinfection when the use of steam is contraindicated), and local disinfection of the barrack-room and place of work by scrubbing with 1\% per cent. cresol in water.

No specific instructions require the surveillance of contacts, but even pre-war it was customary to check these by weighing and physical examination each month for six months. Nowadays, where possible, it would be usual to examine them by M.M.R. Regrettably this is rarely available and never overseas. Full plates of a few special individuals may be taken, but often even this course is impracticable.

(b) Tuberculin Sensitivity.—It would seem that this is an ideal opportunity for using the Mantoux test on all contacts. The non-reactor, who remains so after the incubation period has elapsed, is more certainly free from active infection than if he had been fully investigated (17). One can expect this group to form at least one-third of the normal Army sample, and this proportion may be expected to rise owing both to reversions within the relatively tuberculosis-free service environment and to a declining risk of infection in civil life. Within this group, conversion can be considered as a sign of infection (18) and an increase in sensitivity as one of possible infection. On the other hand, known reactors, who have either lost or reduced their sensitivity in the relevant period, are most unlikely to have acquired a recent infection. This method of investigation should be possible for a Regimental Medical Officer to effect, if dry sterile syringes and tuberculin can be supplied. By doing so it should be possible to reduce considerably the number of contacts of whom further investigation is necessary. Further, if an unusually small proportion of non-reactors was found, a wider survey might indicate other sources of infection.

(c) Mass Miniature Radiography.—Both the Royal Navy and Royal Air Force use this method more often than at entry only. With the Army's greater strength, its scattered distribution and the fact that its M.M.R. units are fully employed in radiographing the new intakes, it has been found impossible to institute a further routine examination. Unfortunately, although the civilian M.M.R. units now radiograph a considerable proportion of the National Service "intakes," they operate on a regional basis which is not coincident with the Army's deployment of these men. Because of this, it will be impossible to release Army units for other tasks until only a small proportion of the intakes have not been radiographed by civil units and these can be posted to areas in which an Army unit operates.
(III) Reducing Barrack-room Spread

This measure is directed against all upper-respiratory infection and includes:

(a) Adequate ventilation.
(b) Avoidance of local overcrowding.
(c) Preventing dust.
(d) Disposal of fomites.
(e) Education.

(a) Ventilation depends mainly on adequate spacing. New barrack schedules allow 70 square feet and 595 cubic feet per bed, also rooms are to hold either four or eight men only. Existing scales allow 60 and 600 respectively, but more men are housed in larger rooms. Air exchange is probably adequate when windows and doors are closed, but instructions require them open whenever weather permits. The bed space (six feet between centres) (19) is probably sufficient to limit direct droplet spread.

(b) With the old scales of few lighting points and fewer heating points, local overcrowding around the points was common, as was the spread of upper respiratory infections. This was demonstrated when, among troops engaged in snow-clearance and coal-haulage during the cold winter of 1947, in spite of fuel lack, huted accommodation and, often, insufficient drying facilities, sick rates fell, presumably because men went to bed to keep warm instead of crowding around a stove. The new scales have legislated for this fact by specifying an improved lighting standard, central background heating and open fires in “sitting rooms.” These features and improved institute facilities should limit local overcrowding.

(c) Dust prevention has recently been shown to be an important factor in preventing cross-infection in hospitals (20). Regulations (1938) specified the dry sweeping of barracks as a major factor in the spread of tuberculosis (21). The importance of its prohibition is indicated by the frequency with which outbreaks of respiratory infection follow its neglect.

(d) Instructions forbid the interchange of clothing, blankets, pillow-slips, sheets and cutlery without preliminary appropriate cleansing. Special attention is paid to introducing efficient methods of washing communal crockery and cutlery, mainly to reduce the incidence of gastro-intestinal disease but, incidentally, of the respiratory. Soldiers are also encouraged to expose their bedding to the sun whenever possible.

(e) Health talks and films stress the personal method of reducing infection.

(B) Nutrition

Pre-war the Army was fed on a complex system of allowances and issues against repayment both by the R.A.S.C. and by N.A.A.F.I. This had the virtue of variety and the calorie value was estimated as between 3,600 and 4,000. The standard depended mainly on the attention the unit paid to its “housekeeping.” During the war full rations were issued, and this system with the addition of a
small "ration cash allowance" has continued. This system allows for little
elasticity, but on the other hand restricts maladministration. Unfortunately
the calorific value is less. A survey undertaken within the Army in 1947-8
showed the following facts:

(i) About 11 per cent. of the ration was wasted in distribution, cooking
and serving.
(ii) The calorific value of the official ration formed only about 75 per
cent. of the soldier's requirements.
(iii) The soldier more than adequately made good this deficiency at his
own expense.

The survey considered that the soldier's needs would be satisfied by the
following scales:

<table>
<thead>
<tr>
<th>Type of Work</th>
<th>Net Calories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>3,200</td>
</tr>
<tr>
<td>Moderate and hard</td>
<td>3,600</td>
</tr>
<tr>
<td>Very hard</td>
<td>4,000</td>
</tr>
</tbody>
</table>

The present service ration is based on the civilian ration and is subject to
similar, though not to such frequent, variations. The deficiency between the
average soldier's requirements and the calorific value of the ration continues
to be made up at his expense. The Service strives to minimize the loss by
maintaining a high catering standard, by providing convenient kitchens, and
by avoiding wastage, e.g., replacing unskilled potato-peeling by hand by
machines. In spite of this, and because civilian institutional catering standards
have risen, Army catering has lost the lead it once held.

(C) Resistance

(i) Natural.—There is still a real danger that natural resistance to tubercu-
losis can be over-emphasized to the lay person so as to conjure up the bogey
of hereditary and inevitable disease in his mind. This makes him unable or
unwilling to accept its essentially infectious nature. Nevertheless, natural
resistance or susceptibility has been observed. Kallman and Reisner (22),
after studying the incidence of tuberculosis in uniovular twins, concluded that
"The chance of dying from tuberculosis is practically zero for a tuberculosis
patient who is the monozygote twin of a person who remains free of tuber-
culos is despite exposure to infection." This fact has little significance to the
Service, but the findings of the Prophit Survey that Irish and Welsh nurses in
London hospitals suffer a significantly higher morbidity than English irrespective
of whether they were tuberculin reactors or not on entry (23) is of interest.
Pre-war, a high proportion of the Army was Irish and this was particularly true
of the medical and nursing services. It is probable that a high proportion were
non-reactors. That few developed clinical tuberculosis is presumably due to
the low infectivity of their service environment. This predominance no longer
obtains.
(ii) **Acquired.**—(a) "There remains little doubt that in most circumstances the risk of young adults developing tuberculosis is less in those infected at some time in the past than in those not previously infected and now infected for the first time. It is necessary to add that this difference in morbidity has been clearly demonstrated only in groups known to be exposed. It does not follow that the difference would be observed, or be of the same magnitude, in groups undergoing less exposure. The risk bears particularly on the years following primary infection" (24). This phenomenon could be explained by assuming that primary infection induced both a rapidly acquired sensitivity which waned over the first few years, and a more slowly acquired immunity which waned equally slowly. The finding of the Prophit Survey that the morbidity rate among those nurses originally tuberculin-negative was high in the first year and low in subsequent years, and that the reverse was true among those tuberculin-positive on entry (25), appears to support this view. Willis (26) has shown that animals which have lost their hypersensitivity retain their resistance to reinfection in high degree. A survey among Africans in the Rand gold mines showed that the higher the degree of allergy the greater the risk of developing tuberculosis (27). These observations also appear consistent with this theory.

(b) The Army has recently introduced B.C.G. vaccination on a voluntary basis for all regular R.A.M.C. other ranks and all members of Q.A.R.A.N.C. No officer or other rank R.A.M.C. who specifically requests the vaccination will be refused. Vaccination will be given only to those of the above categories who are also non-reactors to 0.1 ml. (100 International Units) of Old Tuberculin. Separate needles and syringes are prescribed for each dilution of tuberculin and for the vaccine, and these will be autoclaved. Records of each vaccination and its results, described as to the state and size of the reaction and as to the presence of abscess or glandular enlargement, will be kept. Retesting for Mantoux conversion is required after six weeks and, if negative, the procedure will be repeated after a further six weeks. Annual retesting for sensitivity will be performed.

(D) **Environmental Factors**

The relevant accommodation standards have been considered in connection with infection. Beyond these, it is realized that amenities are necessary if the young soldier is to be discouraged from leaving barracks to find them, often under insanitary surroundings. This factor is most important in countries which have a high rate of tuberculosis infection, e.g.,

<table>
<thead>
<tr>
<th>Country</th>
<th>Incidence per cent.</th>
<th>Mortality per Million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>...</td>
<td>2.3</td>
</tr>
<tr>
<td>Singapore</td>
<td>...</td>
<td>2,500 (1938) (29)</td>
</tr>
<tr>
<td>Egypt</td>
<td>...</td>
<td>3.0</td>
</tr>
<tr>
<td>Jamaica</td>
<td>...</td>
<td>2–6.0</td>
</tr>
</tbody>
</table>

Mortality: Hong Kong (28), Singapore (29), Egypt (30), Jamaica (31).

The real rates are probably even higher. In the first two places, the custom of providing professional partners in dancing halls materially increases the risk.
Amenities include barracks sited in pleasant surroundings, preferably about a mile from towns, institutes which cater for most tastes, and adequate playing fields.

(E) Administrative Services

In the Army a comprehensive medical service provides both treatment for disease and a true health service. The latter includes routine medical examinations, inoculations and vaccinations, health education, and medical supervision over all activities.

Since the war the idea of "positive health," as opposed to the mere absence of disease, has been popularized. This, shortly, seeks to encourage the individual to want to keep himself in the highest possible state of physical fitness, and enters the psychological field and is closely allied to morale. Though the question of "positive health" and morale is of great importance, their implications are too wide to be considered in this paper.

Special Groups

Certain service groups are exposed to a high degree of infection. These include medical personnel, those working with civilians or "overseas troops" and those married to tuberculous wives.

Medical Personnel

Medical personnel, coming into contact with tuberculosis, are selected by physical examination, radiological examination, bacteriological examination and tuberculin testing. Only those tuberculin reactors showing either radiologically clear chests or evidence of healed lesions are employed. The examination, less tuberculin testing, is repeated quarterly and when the tour of duty is completed. B.C.G. vaccination is offered to non-reactors.

Precautions on the lines of those practised in London hospitals are enforced. These include education of orderlies and nurses, education of patients and ward precautions.

The aspects stressed in the education of staff are:

1. Infection is controllable.
2. Proper disposal of fomites.
3. The danger of fomites, sputum, saliva and dust.
4. The danger of eating in tuberculosis wards.
5. The need to control their patients' coughing.
6. The need to keep their hands free from infection.
7. The need for adequate rest and leave.
8. The need for taking regular outdoor exercise.
9. The need for avoiding common infections.
10. The need for reporting even minor degrees of ill-health urgently.

Patients are taught that—

1. Coughing spreads the disease to others.
2. Coughing aggravates their condition (by distending cavities).
3. Coughing is controllable.
4. Sputum, saliva and articles soiled with these are dangerous and should be controlled to avoid others being contaminated.

Ward precautions are taken regarding the following:
1. Sputum pots will be handled only with gloves and incinerated.
2. Gowns or white coats will always be worn.
3. Masks will be worn when nursing patients who cannot control their coughing. They will not be reversed nor be used in a way that allows this, e.g., putting in pockets.
4. Dry sweeping is forbidden; vacuum cleaning is desirable.
5. Bed linen must not be agitated, either when making beds or when sorting.
6. Ventilation must be adequate. Patients will be nursed on verandas if possible.

Nurses and orderlies are now permitted to work on tuberculosis wards indefinitely. The previous system of limiting the period to six months was abandoned when it became apparent that the rapid change produced an untrained staff who were a danger to themselves as well as being inefficient in their duties.

Contact at Work
The risk is appreciable to the young clerk working under cramped conditions with others locally recruited in a country with a high infection rate. Usually, the latter are examined only physically. Segregation is the only practicable solution until M.M.R. makes repeated radiography of employed civilians possible. A similar risk from elderly civilian clerks in this country has been almost eliminated by this method. Domestic servants constitute a minor risk to the soldier but, indirectly, through his family, this risk becomes serious. Contact is limited as much as possible, but repeated M.M.R. is desirable.

Marital Tuberculosis
This requires treatment similar to the case in civil life. Many of the problems, e.g., re-housing, are solved more easily. Open cases would not be allowed to proceed overseas.

Summary
The control of tuberculosis in the Army has been considered with particular reference to the reduction of infection.

The problem of excluding the infected recruit has been traced from the pre-war rejection of the clinical case by physical examination, through the present phase of rejecting the sub-clinical case by radiography, to the possibility of excluding infection in the future by excluding all tuberculin reactors. The prompt detection of cases arising within the service is examined in the same light.
The place of resistance, nutrition, environment and positive health in the aetiology of the disease is mentioned.

The protection of certain groups who are specially at risk and the reduction of chance infection in general are examined.

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