BRITISH MEDICAL JOURNAL

LONDON SATURDAY JUNE 28 1941

THE REDUCTION OF DUST-BORNE BACTERIA IN THE AIR OF HOSPITAL WARDS BY LIQUID PARAFFIN TREATMENT OF BEDCLOTHES

BY

JOHN C. THOMAS

Major, R.A.M.C.; Officer in Charge of a Military Laboratory

AND

M. van den ENDE, M.B Capetown, Ph.D.Camb.

National Institute for Medical Research, Hampstead

Until recently it had been commonly accepted that respiratory infections are spread direct by droplets disseminated from the upper respiratory tract of infected persons or carriers. Large droplets (0.1 to 1 mm.) may be sprayed for a distance of fifteen feet, but, by reason of their size, fall rapidly to the ground. Small droplets (less than 0.1 mm.) evaporate before reaching the floor and may remain floating in the air for long periods as nuclei of small clumps or as single bacteria (Wells and Wells, 1936).

That there is a third possible channel of infection, mainly on dust, is becoming increasingly obvious. It is with this method of spread that we are particularly concerned in this paper. Bloomfield and Felty (1924) demonstrated that there is relatively little or no horizontal expulsion of streptococci from the respiratory tract of infected persons. More recently (1940) Hare has shown that a considerable number of organisms stream diagonally downwards. These may be caught on the bedclothes or fall to the floor, where they dry, and may be re-projected into the air with bed-making or sweeping. Cruickshank (1941) and Thomas (1941a) have shown that large numbers of haemolytic streptococci do accumulate in hospital dust, while Wright, Shone, and Tucker (1941) have demonstrated diphtheria bacilli in the dust of their isolation wards. Until the relative responsibility of each of these methods of spread is finally determined, and especially in the abnormal conditions in which we are living to-day, it is necessary to provide adequate safeguards against all three.

We have previously shown that a very large percentage of aerial contamination from dust can be removed by treating wooden or linoleum-covered floors with spindle oil (van den Ende, Lush, and Edward, 1940; Thomas, 1941b). Van den Ende, Edward, and Lush (1941) showed that both the amount of dust and the numbers of streptococci released from infected bedclothes by beating under experimental conditions were reduced by 90 to 100% by previous treatment with a 30% solution of liquid paraffin in white spirit. This treatment of bedclothes, together with the application of spindle oil to the floor of a ward, has been found by van den Ende and Spooner (1941) to reduce the number of organisms present in the air of the ward throughout the day; the increase in the bacterial content of the ward usually accompanying bed-making and sweeping was reduced to a minimum. The ward in which their experiments were performed was, however, not ideal for the purpose, because of the interchange of dust which occurred between adjacent sections of the ward, and, furthermore, the number of pathogens recovered from the air was small.

This paper describes experiments in both large and single-bed hospital wards, in some of which there were enough haemolytic streptococci in the air to allow them to be used as indicator organisms. Owing to the nature of the infections treated in the wards it was also possible to regulate the experimental conditions much more accurately.

Bacterial Counts

1. *Air.*—The medium employed in all our experiments was 1 in 500,000 gentian-violet blood agar. For air sampling, plates were exposed in slit-machines (Bourdillon, Lidwell, and Thomas). The gentian-violet medium has been shown to be relatively selective for haemolytic streptococci (Garrod, 1933), and reduces the growth of air-borne saprophytes by 95%. Continuous counts were made with the machines adjusted to suck 1 c.ft. of air per minute. In all our diagrams each vertical block represents the count of organisms collected from 10 c ft. of air in ten minutes. Altogether 647 plates were used for these experiments.

2. *Dust.*—Dust samples were collected into sterile bottles and freed from obvious mineral matter, such as pieces of grit and coal. Amounts of 100 mg. were shaken for 15 to 30 seconds in 100 ml. of sterile nutrient broth and then allowed to settle for fifteen minutes. At the end of this period of clarification 2 ml. was transferred to a second bottle containing 18 ml. of broth and again shaken. Varying amounts (0.5 to 0.05 ml.) of this final dilution (0.1 mg. dust per ml.) were plated out into gentian-violet blood agar in duplicate. In a few cases counts of the total organisms were made on serum agar. The counts can, of course, only be regarded as approximate, and probably low, as we have counted as single organisms what may have been clumps of organisms adherent to one another or to dust particles.

3. *Bedclothes.*—Counts were made with a special extractor designed by one of us (M. v. d. E.). This consists of two flanged aluminium plates, fitting closely together with a rubber ring and held by three screw clamps set in U-shaped arms to allow for a fringe of blanket when the apparatus is assembled. In the lower plate is an inlet attached to a 50-ml. syringe by a length of rubber tubing;

in the upper plate is an outlet fitted with a tap and a small glass funnel (Fig. 1). The whole is sterilized by autoclaving.

For use the two halves of the chamber are clamped on to any desired part of the material to be tested, and 50 ml. of nutrient broth is drawn backwards and forwards through the fabric some twenty or thirty times. Finally, a little of the broth is driven upwards into the funnel, the tap is closed, and aliquot parts are plated out into gentian-violet blood agar.

Tests of Efficiency of Blanket-sampling Apparatus

Known volumes of a serum-broth culture of haemolytic streptococci (Group C) were spread over the centre of 6-inch and 1-inch squares of woollen blanket material; at the same time, equal volumes were placed in empty sterile Petri dishes. The 6-inch squares were extracted with 50-c.cm. amounts of broth by means of the special apparatus, each 1-inch square was mechanically shaken with 50 c.cm. of broth in a stoppered bottle containing glass beads, and to each Petri dish was added 50 c.cm. of broth. One set of extractions was made immediately, and the second after the infected blanket squares had been dried in high vacuum over P_2O_5. The streptococci in the broth extracts were counted by the technique adopted by Miles and Misra* (1938). A second test was done with circular pieces of the same woollen blanket exposed to a uniformly distributed aerosol of streptococci in a sealed room. One set of these samples, each with a surface area 4.9 sq. in. (equal to the area extracted by the special apparatus), was extracted by mechanical shaking with broth. The other samples, which were larger, were extracted with the special apparatus. The results, which are given in the accompanying table, show that there was no significant difference between the numbers recovered by the use of the special apparatus and those recovered by thorough shaking with broth. The number of streptococci recovered from hospital blankets should therefore give a fairly accurate indication of the numbers actually present.

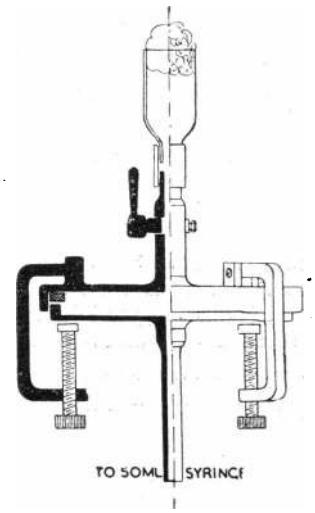

FIG. 1.—Apparatus for making bacterial counts on bedclothes or fabric materials.

Table showing Experimental Recovery of Streptococci from Blankets

Impregnation	Method of Sampling		Count from Petri Dishes
	With Special Apparatus (Fig. 1)	Mechanically Shaken	
Broth culture dropped on to blanket: (a) Sample immediately	59 millions	60 millions	79 millions
(b) Sample after drying over P_2O_5 ..	64 ,,	80 ,,	64 ,,
Exposure to uniform mist of streptococci	5,000	5,250	

* This technique involves the use of glass capillary pipettes which deliver 50 drops of broth per c.cm. (see Wilson, 1922). Our pipettes were specially made for us with parallel-cided capillaries drawn to the required dimensions, and sealed into 6-mm. glass tubing.

Treatment of Bedclothes with Liquid Paraffin

For our preliminary experiments complete sets of bedclothes (1 wool-cotton counterpane, 3 blankets, 2 sheets, 1 draw-sheet, 2 pillow cases, and 1 pair pyjamas per bed) were treated at Hampstead. For our large-scale ward experiments sixteen sets were treated in the hospital laundry. Van den Ende, Edward, and Lush showed that the ideal concentration of oil for treating bedding is 30%, and that with this concentration the final bedding is not oily to touch and yet contains an effective proportion of oil (blankets, 3%; bed-linen, 6 to 7%). One difficulty experienced was that the blankets absorbed so much of the parent liquor that only a few could be processed at one time unless larger volumes of oil were available.

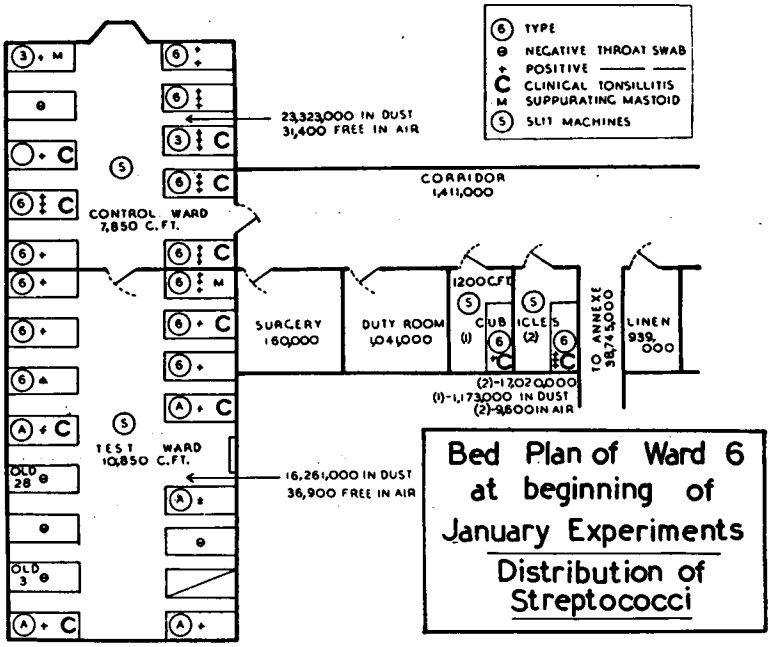

FIG. 2.

Our "oiling party" consisted of Cpl. T. Bury, R.A.M.C., and seven others. Treatment of 160 articles (48 blankets, 48 sheets, 32 pillow-cases, 16 counterpanes, 16 pair pyjamas) fully occupied the party for three hours. Thirty gallons of the 30% solution of liquid paraffin in white spirit was placed in a large tank. The bedclothes were soaked in this solution, partially wrung out by hand, and then transferred to a hydro-extractor. Centrifuging was continued until only a thin trickle of the solution was running from the outflow. The outflow from the hydro-extractor was recovered by blocking the outlet drain and by baling from the trough while the machine was running, and was then returned to the soaking-tanks. From the hydro-extractors the bedding was put through a drying chamber which had previously been heated. In order to minimize fire risk the heat was turned off immediately before placing the bedclothes into the dryer, but the draught fans were kept in operation. Although in this experiment the sheets were not ironed, previous experience has shown that this can be done with

an ordinary single-bed calender. Reduction of the temperature of the steam bed minimizes the loss of oil on the roller pads.

Ward Trials

The ear, nose, and throat wards, in which our experiments were performed, consisted of a main ward divided by a glass partition and door into a 16-bed and a 10-bed section (Fig. 2). Each could be completely isolated. The larger section was used as a test ward and the smaller for control experiments. The floors in both sections were treated with spindle oil. Small single-bed isolation cubicles, each of 1,200 c.ft. capacity, were also used. Consecutive air samples, each of 10 c.ft., were taken with a slit-machine—the first three samples usually during a quiet period, to determine the minimum number of bacteria in the air. During the ten minutes in which the fourth air sample was taken the floors were swept in order to show that no dust could be raised from the oiled floors. During the sixth ten-minute period beds were made. Sampling continued until static conditions again obtained. Simultaneous counts were made in both test and control wards. To overcome the difference in size of the two wards, we made more beds in the test ward than in the control ward on each occasion. Cubicle experiments were carried out as suitable cases presented throughout the whole period.

Distribution of Streptococci in the Wards

It was found that in any ward in which there was at least one patient with a streptococcal infection of the upper respiratory tract the causal organism could be recovered from the ward air, from the floor dust, and from the bedclothes throughout the infective period. During an epidemic of tonsillitis which occurred in January there were at one time nine cases in one ward. The dust obtained from this ward in one sweeping was estimated to contain over 100 million streptococci, and on one occasion nearly 70,000 of these organisms were suspended in the ward air (Fig. 2). The ward blankets that were examined contained between a half and one million streptococci each. Colonies from each test were typed, and the majority were found to correspond to the patients' infecting organism. A few other types were recovered (particularly Types XII and XXV and a Group G Lancefield strain), although no patient or member of the staff had such types in either throat or nose. As many as 30 to 50 streptococci could constantly be recovered on any plate from 10 c.ft. of ward air. We found this count to be regularly increased by bed-making or by any manœuvre which involved disturbing the bedclothes.

Similar counts were obtained in another ward, also with an outbreak of tonsillitis, when automatically exposed plates showed increases of aerial streptococci with the service of a meal, with bed-making, and, in particular, during visiting hours (Fig. 3). Again we recovered organisms of types different from those exhibited by the inhabitants of the wards, and this seems to be most probably accounted for by their persistence upon the bedding. Analysis of bedclothes again yielded up to a million streptococci per blanket.

The increase in aerial streptococci during bed-making was even more strikingly demonstrated in single-bed cubicles, in which there is less dilution owing to their smaller cubic capacity (Fig. 4). The highest count we recorded in a cubicle was 374 streptococci in 2 c.ft. of air. Counts of 150 to 200 have often been observed in these circumstances. Dust counts were higher in these cubicles than in the wards, probably because of a greater difficulty in sweeping them thoroughly and because dilution of infected dust is less than in a ward. The dust of one cubicle, swept up in the morning, contained over 20 million streptococci per gramme, and the dust collected the same evening 5 millions per gramme. It is significant that these dust samples, when retested after a fortnight on the bench, showed very little reduction in the number of viable streptococci present, counts of 13 to 14 millions per gramme still

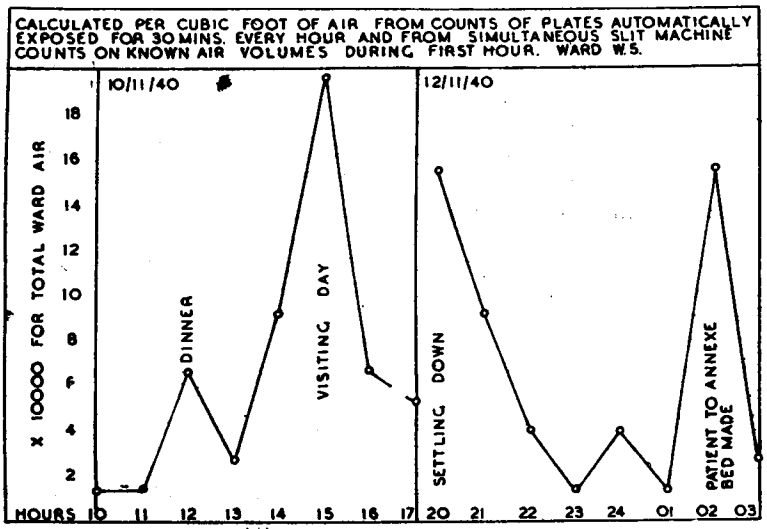

FIG. 3.—Streptococci in ward air

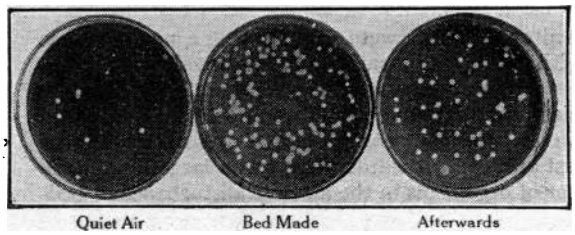

FIG. 4.—Aerial streptococci during bed-making.

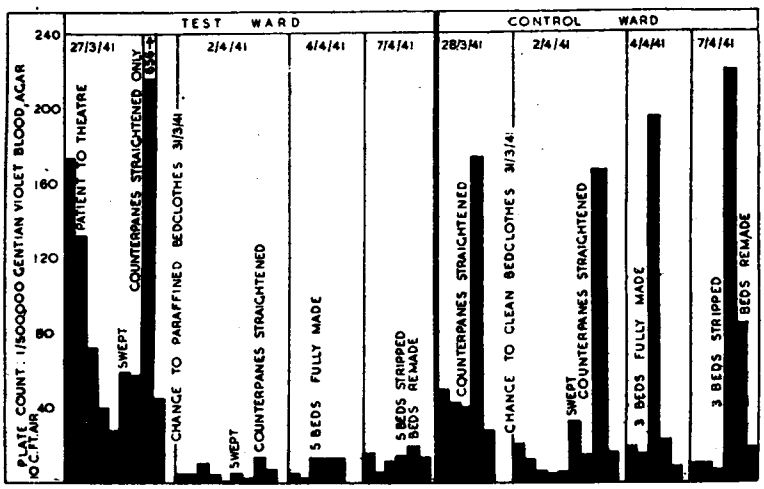

FIG. 5.—Reduction of aerial organisms by treatment of bedclothing.

being obtained. Smaller numbers of streptococci were usually obtained in dust swept up from linoleum floors than in that from wooden floors, probably because the former can be swept more efficiently.

In one cubicle experiment the total number of organisms in 10 c.ft. of air rose from 15 to 1,528 as a result simply of straightening the counterpane and blankets of a single bed. Having regard to the reduction factor of our gentian-violet medium, this is equivalent to a dispersal of 2,500 organisms per cubic foot of air.

Ordinary bedclothes therefore represent such a powerful and persistent reservoir of infection that there is real danger of cross-infection from this source.

Reduction of Dust-borne Organisms in Air by Liquid Paraffin Treatment of Bedclothes

The experiments with paraffined bedclothing fall into three main groups: (a) experiments in which a whole ward was placed in treated bedding and another in clean bedding as a control; (b) experiments in cubicles in which a patient known to be emitting streptococci was transferred to paraffined bedding after a control period in ordinary bedding; and (c) the reverse experiment—changing such a patient into ordinary bedding after a control period in paraffined clothing. Ideally it is desirable to combine (b) and (c) with one patient, but this is rarely practicable: the patients soon cease to produce large numbers of organisms with adequate treatment, and an acute infective period of ten to fourteen days would be necessary for such an experiment.

(a) Ward Experiments

The ward experiments were made during a non-epidemic period, with most of the patients fully convalescent. The numbers of streptococci recovered were therefore small, and for the most part we have relied upon total counts as an index. In a preliminary control period we established that in both test and control wards there was a large increase in the number of organisms in the air with disturbance of bedclothes, even when this entailed only the straightening of counterpanes. At the end of this control period the beds in the test ward were supplied with paraffined bedding, while those in the control ward were given clean but untreated bedclothes. The men in the test ward were not told that their bedding was oiled, and at the time of the change were so used to the air-sampling machines running that they noticed nothing unusual.

Counts were made for periods up to eleven days. Some of the treated bedding was used continuously for more than a month, and when tested in cubicles had lost nothing of its efficiency. The increase in the bacterial content of the air associated with bed-making rapidly reappeared in the control ward, and, as was to be expected, became gradually greater. In the experiments shown diagrammatically in Fig. 5 the mean count during bed-making in the control ward was 194 organisms per plate. During the same period the test ward showed a mean count of less than 15, in spite of the fact that on each occasion five beds were made in the test ward as compared with three in the control ward. The use of paraffined bedclothing therefore reduced the number of organisms liberated during bed-making by 93% even in a large ward of sixteen beds.

(b) and (c) Cubicle Experiments

The results of one of the most striking experiments are shown in Fig. 6. The occupant of the cubicle developed a severe Type VI streptococcal tonsillitis during the January epidemic, and was transferred to clean bedding in a cubicle on the second day of his illness. The floor of the cubicle was not oiled, and the fact that two days after his transfer plates exposed during bed-making and sweeping grew 141 streptococci may partly be due to this. The floor dust collected that morning was estimated to contain over 13 million streptococci per gramme, and a further 4,900,000 per gramme had accumulated by the evening. From

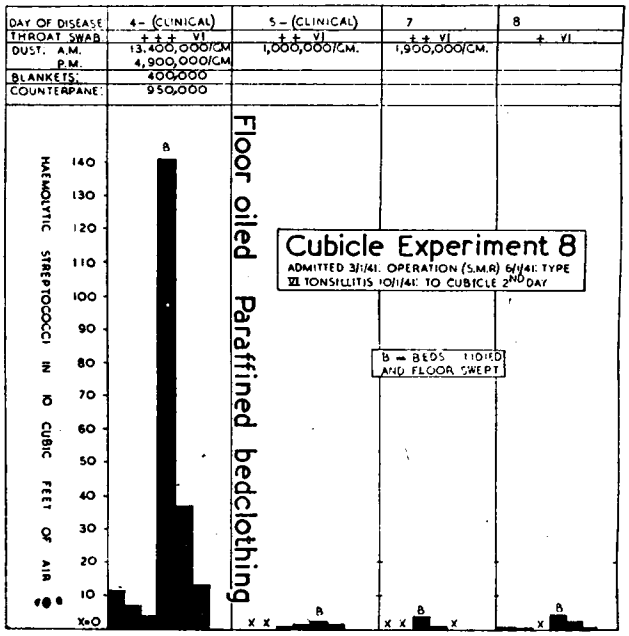

FIG. 6.

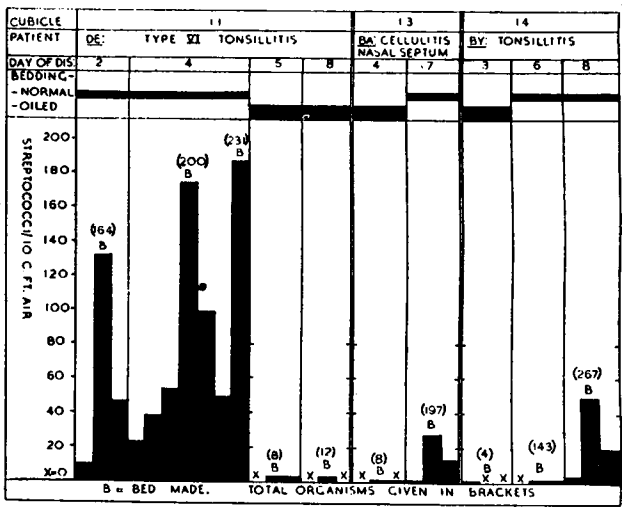

FIG. 7.—Reduction of aerial streptococci by paraffined bedclothing.

samples taken from his bedclothes it was calculated that in this period of forty-eight hours his blankets had collected 400,000 streptococci each, while the counterpane contained nearly a million of these organisms. On that day the floor was oiled and he was changed into paraffined bedclothes. This resulted in a striking fall in the numbers of streptococci projected into the air, the mean count up to the eighth day being less than 4 organisms per plate, in spite of quite vigorous bed-making. That he was emitting streptococci during this period was shown by analyses of floor dust, which contained a million streptococci per gramme on the day after the change and nearly 2 millions per gramme two days later.

A similar, and equally striking, experiment is shown in Fig. 7 (cubicle 11). In this case the floor had been oiled for some months, and at the time of this experiment the

floor treatment was still effective. Control experiments up to the sixth day of the disease showed that 130 to 180 streptococci could be recovered from 10 c.ft. of air during bed-making, and it is significant that two such peaks can be produced within thirty minutes of each other. A change to paraffined bedclothing led to an immediate fall both of total organisms and of haemolytic streptococci by more than 95%. Throughout this period the patient had a luxuriant growth of streptococci in his throat.

The reversed experiments are equally illuminating (Fig. 7, cubicles 13 and 14). Here two men, one with a severe cellulitis of the nasal septum and the other with an acute follicular tonsillitis, were placed direct in paraffined bedclothing for four and three days respectively. This period is sufficient to allow large numbers of streptococci to accumulate on the bedclothes. At the end of this period it was only by hard shaking of the bedclothes that we were able to grow a single streptococcus from the air. These patients were then changed to ordinary bedclothes, which immediately began to liberate considerable numbers of streptococci whenever the beds were made.

The experiments have shown, therefore, that the treatment of bedclothes with a dust-laying oil greatly reduces the number of organisms which can be liberated from them. We think it significant that its use, in the same degree as the use of spindle oil on floors, has never yet failed to reduce the swarms of bacteria, both pathogens and saprophytes, which are showered into the air whenever a bed is made or a blanket moved.

Discussion

That dust may be responsible for cross-infections has been known for many years (Flügge, 1897; Neisser, 1898; Kirstein, 1902), but the importance of these earlier observations seems to have been neglected in succeeding decades. Interest in the infectivity of dust has more recently been revived, and cases have been reported in which cross-infection has undoubtedly been due to dust. The presence of streptococci in ward dust has been shown by Deicher (1927); Allison and Brown (1937); Cruickshank and Godber (1939); Glass (1941). The importance of dust in the spread of respiratory infections in hospital wards has, however, not received general recognition, and little attempt has been made to guard against the danger of dust-borne infection.

Ward dust comes from two main sources—floors and bedclothes—and from these it is distributed into the air by sweeping or by bed-making (Cruickshank, 1941; Miles and others, 1940). Dust on the floor is readily made relatively innocuous by treatment with a dust-laying oil, a fact which has long been known, but has not been adopted by hospitals until recently. The treatment of floors with a dust-laying oil prevents the organisms deposited on them from being distributed into the air. Bacteria are not destroyed by the oil, and the dust swept up must therefore still be treated as infective and disposed of suitably.

Bedclothes constitute an equally if not a more serious source of aerial contamination. Streptococci accumulate upon the bedclothes of any patient with a streptococcal infection of the upper respiratory tract. Deicher could recover streptococci from the walls and furnishings of scarlet fever wards. Glass has obtained similar results in puerperal fever wards, and in the wards in which our experiments were performed it was possible to recover streptococci even from the ceilings. Hare (1941) showed that the accumulation of streptococci could occur also in the environment of healthy streptococcus carriers. The rate at which streptococci accumulate is of importance. With cases of acute follicular tonsillitis placed in clean bedding we have been able to demonstrate an accumulation of nearly a million streptococci in a single blanket in two days.

Although the bedding from such cases is normally disinfected, the same does not hold for every patient who develops a sore throat in hospital. Ward blankets, unless obviously dirty, are only too often used over and over again. The same holds for blankets on theatre trolleys. The risk of spreading infection by this means is only too obvious. Blanket dust is one of the main sources of air-borne streptococci in hospital wards, and may play an important part in air-borne cross-infection. The simple act of making a bed may throw into the air as many as 2,500 organisms per cubic foot, and it is common, in infectious wards, for blankets to contain anything from a half to one million streptococci each. We have shown that on occasion as many as 70,000 streptococci may be freely suspended in still ward air, and that even in a large ward, where considerable dilution must occur, this number is doubled or trebled when a bed is made. In smaller wards the rise is proportionately greater, and a tenfold increase is not uncommon. Cruickshank found 200 streptoccocci deposited upon a pair of Petri dishes in an hour during bed-making and toilet. This would correspond to a recovery of 2,500 streptococci by a slit-machine or 40 per cubic foot of air. These counts are of the same order as we observed in our single-bed cubicle experiment. A patient in such a cubicle may therefore be inhaling between 500 and 1,000 streptococci an hour, of which 90% would have been retained within the respiratory tract (Lehmann, Saito, and Gfrörer, 1911). We do not know what number of organisms constitute an infective dose, but there can be no doubt that in a ward in which no precautions are taken against dust the risk of respiratory infection is very great.

These experiments have shown, further, that during bed-making the number of organisms liberated from bedclothes is reduced by 90 to 95% by treating them with liquid paraffin. This reduction, which occurs both in large wards and in small isolation cubicles, is of the same order as that found by van den Ende, Edward, and Lush in their laboratory experiments. As in the dust of oiled floors, the organisms on oiled blankets, although prevented from being distributed into the air, are still viable and potentially pathogenic.

The application of liquid paraffin from a solution in white spirit requires specially designed hydro-extractors, with an automatic return of the liquor direct to the soaking-tanks, which are not available in hospital laundries. Moreover, the use of white spirit as a solvent involves special fire precautions. In these experiments we were concerned, however, only with establishing the efficacy of the principle involving the application of dust-laying oils on bedclothes. Experiments with simple oil-water emulsions applied in the form of a spray, and with oils other than pure medicinal paraffin, are at present in progress.

Dust-laying methods can, of course, only be expected to be effective against the spread of infection when the patients are confined to bed. They cannot prevent direct infection among ambulant patients, with whom droplet infection probably plays the major part, or in cases in which infection is spread by other means than through the air. It seems essential, therefore, that all hospital patients exhibiting β-haemolytic streptococci in their throats should be confined to bed. If this is done the combination of the method of laying dust on bedclothes with the use of spindle oil on ward floors will greatly assist in reducing the incidence of ward infections. It will probably find special application in scarlet fever, diphtheria, and ear, nose, and throat wards.

Other sources of dust, though probably less important, should not be neglected. Thus damp dusting or dusting with oil-impregnated dusters is essential, and the possibility that streptococci may be carried upon the clothing of doctors, nurses, and ward orderlies must be considered.

These points require further investigation, and it is now necessary to undertake experiments on a large scale, to determine whether a continuance of all available methods of dust-laying will result in a significant reduction of the incidence of cross-infections in hospital wards.

Summary

Attention is drawn to the very large numbers of streptococci which may accumulate in the dust and in the bedclothes of hospital wards.

It is shown that many of these organisms are projected into the air every time a bed is made or in any way disturbed, and it is suggested that these represent a very real danger.

The treatment of bedclothes with liquid paraffin, while not visibly affecting them, causes a 95% reduction in the number of organisms distributed into the air during bed-making.

It is suggested that this method of dust-laying, combined with the use of spindle oil on floors, may assist in reducing the incidence of cross-infections in hospital wards..

We are indebted to Major-Gen. H. Marrian Perry, C.B., O.B.E., F.R.C.P., Director of Pathology, Army Medical Services, for allowing one of us to carry out his part of this work in a military laboratory; to Colonel E. B. Marsh, *M.C.*, R.A.M.C , for placing so many facilities at our disposal; to Dr. C. H. Andrewes, F.R.S., and Dr. R. B. Bourdillon for much helpful advice; to Dr. Otho Fitzgerald, medical superintendent of the hospital, for the use of the hospital laundry; to the medical officers and nursing staff who have co-operated so readily with us; and to our assistants, Sergt. H. G. Stevens, R.A.M.C., and Cpl. T. Bury, R.A.M.C., for their continued help in the laboratory.

REFERENCES

Allison, V. D., and Brown, W. A. (1937). *J. Hyg., Camb.*, **37**, 153.
Bloomfield, A. L., and Felty, A. R. (1923). *Johns Hopk. Hosp. Bull.*, **35**, 115.
Bourdillon, R. B., Lidwell, O. M., and Thomas, J. C. To be published.
Cruickshank, R. (1941). *Lancet*, **1**, 493.
—— and Godber, G. E. (1939). Ibid., **1**, 741.
Deicher, H. (1927). *Z. Hyg. InfektKr.*, **108**, 167.
Flügge, C. (1897). Ibid., **25**, 179.
Garrod, L. P. (1933). *St. Bart's Hosp. Rep.*, **66**, 203.
Glass, V. (1941). *Lancet*, **1**, 524.
Hare, R. (1940). *Canad. pub. Hlth. J.*, **31**, 539.
—— (1941). *Lancet*, **1**, 85.
Kirstein, F. (1902). *Z Hyg. InfektKr.*, **39**, 93.
Lehmann, K. B., Saito, Y., and Gfrörer, W. (1911). *Arch. f. Hyg.*, **75**, 152.
Miles, A. A., and Misra, S. S. (1938). *J Hyg., Camb.*, **38**, 732.
—— *et al.* (1940). *British Medical Journal*, **2**, 855, 895.
Neisser, M. (1898). *Z. Hyg. InfektKr.*, **27**, 175.
Thomas, J. C. (1941a). *Lancet*, **1**, 433.
—— (1941b). Ibid. In press.
van den Ende, M., Edward, D. G. ff., and Lush, D. (1941). Ibid., **1**, 716.
—— Lush, D., and Edward, D. G. ff. (1940). Ibid., **2**, 133.
—— and Sooner, E. T. C. (1941). Ibid., **1**, 751.
Wells, W. F., and Wells, M. W. (1936). *J. Amer. med. Ass.*, **107**, 1698.
Wilson, G. S. (1922). *J. Bact.*, **7**, 405.
Wright, H. D., Shone, H. R., and Tucker, J. R. (1941). *J. Path. Bact.*, **52**, 111.

It was recently announced by the Board of Trade that arrangements had been completed for the manufacture of an adequate supply of high-tension batteries to meet the needs of deaf persons who use hearing aids. A standard range of batteries to be manufactured in wartime has been drawn up and embodied in a specification to be issued by the British Standards Institution (B.S. 966) High-tension batteries for hearing aids must be as small in size and as light in weight as possible, and in peacetime these requirements were met by making up the batteries from very small unit cells. At the present time there are heavy demands for these midget cells for batteries for other purposes, and it has become necessary to standardize a range of batteries for hearing aids made up from cells which, so far as can be seen at present, will be available in sufficient quantity to enable hearing aids to continue to be serviced with the minimum of inconvenience to all concerned. There are eleven batteries in the standard range, and these should prove adequate to cover the requirements of all existing makes of hearing aids which employ H.T. batteries, though it may be found that some instruments will need minor modification in order to accommodate them. Such modification applies to the battery casing only, and no modification to the mechanism of any instrument is called for. Copies of this new specification will be available shortly from the British Standards Institution, 28, Victoria Street, S.W.1, price 2s. 3d. post free.

RECENT EXPERIENCES IN THE TREATMENT OF GONORRHOEA IN THE MALE *

BY

R. M. B. MacKENNA, M.A., M.D., F.R.C.P.

Major, R.A.M.C.; Command Specialist in Dermatology, Northern Command

In military practice the incidence of venereal disease is surprisingly low, and in this I have no doubt that we are reaping the benefit not only of the far-sighted policy of the Ministry of Health, but also of the standard of work which medical officers in charge of clinics have maintained during the past twenty years. The Medical Services of the Army also deserve much credit. For many years the officers of the Royal Army Medical Corps have insisted on educating the troops for whose health they are responsible on the dangers of promiscuous intercourse; as is widely known, their preventive work in the venereal field has reached a very high standard. In the active treatment of venereal diseases their standards have been equally high, and the population at large owes a debt to the Army Medical Services which, while unrecognized by the majority—venereal disease not being a subject for public discussion—is nevertheless very real. Despite the disturbances of war the Medical Services have taken steps to ensure that the prevention of venereal diseases and the treatment of these diseases are in keeping with modern standards.

Experiences in the Use of Sulphapyridine

We have found that the local application of sulphapyridine to chancroidal ulcers is a satisfactory form of treatment.

Some of our experiences in the treatment of gonorrhoea with sulphapyridine may be of interest to the profession. At the outset I wish to emphasize that I here refer to practical work. A war is in progress, and it is our duty to get the men fit and back to their units as soon as possible. For this reason the necessarily slow methods of pure clinical research have not been possible; but our work is controlled by a system of surveillance after the patients leave hospital, and we are able to assess from this, with a great degree of accuracy, whether our belief in the methods of treatment we use is based on mere optimism or on therapeutic achievement. The fact that this surveillance is usually carried out by medical officers in districts remote from ours makes this form of control of our work more satisfactory and perhaps less liable to criticism than otherwise it might be. I will refer to this subject later in the paper.

When, a little over a year ago, I took over my duties as officer in charge of a dermatological division, the cases of gonorrhoea were being treated on routine lines. Sulphapyridine was administered thrice daily, the average dosage being 3 grammes a day. Treatment was given for a week or ten days, during which time the men were kept in bed and on a light diet The results were satisfactory, but not outstandingly so.

As you probably know, in the Army cases of gonorrhoea are treated in hospital and the men are not allowed to carry on with their duties. This confinement to hospital may be irksome to the individual, but from the medical standpoint it is of the greatest benefit both to the patient and to the physician. I soon came to the conclusion that with the

* Being part of an address delivered to the North of England Branch of the British Medical Association at Newcastle-upon-Tyne, October 31, 1940.