quantity of oil used in each case was equivalent to 20% of the mixture by volume, and it was finely dispersed by employing an emulsifier which operated on the jet principle. These strong emulsions tended to cream on standing, and it was essential to stir thoroughly before removing the requisite quantities for addition to the washing machine. There would appear to be no reason, however, why more concentrated emulsions containing up to 40 to 50% of oil should not be prepared; and the tendency to cream might be considerably minimized by using a more efficient homogenizer.

Process A—for Oiling Woollen Goods

1. Size of rotary washing machine, 34 in. by 54 in.
Dry weight of load, 70 lb.
2. Adjust the quantity of softened water used in the last rinse so that, when the machine is running with the load in, the gauge glass registers a dip of 10 in.
3. Adjust temperature of water to 100° F.
4. Add stock "fixanol" emulsion (20% oil content)—1½ gallons.
5. Run machine for 10 minutes, interrupting the rotation periodically to minimize any tendency of the goods to shrink.
6. Stop machine and unload.
7. Hydro-extract and dry in the normal manner.

This process will give a level deposition of oil equivalent to 5% of the weight of the goods.

Process B—for Oiling Cotton Articles

1. Size of rotary washing machine, 34 in. by 54 in.
Dry weight of load, 100 lb.
2. Raise temperature to 100–120° F.
3. Add stock "fixanol" emulsion (20% oil content)—1½ gallons.
4. Run machine for 2 to 3 minutes without interrupting the rotation.
5. Add stock "teepol" emulsion (20% oil content)—1½ gallons.
6. Run machine for a further 7 to 8 minutes without interrupting the rotation.
7. Stop machine and unload.

This process will give a level deposition of oil equivalent to 6% of the weight of the goods.

During the present hospital trial it was found that the majority of the "woollen" articles to be treated were in fact composed of a mixture of wool and cotton; in view of this it was necessary to use Process B for such articles, since it was found that if Process A, for pure woollens, was used there was an uneven distribution of oil between the wool and the cotton components. The use of Process A for articles of pure wool is optional, since they can also be effectively oiled by Process B. It must be stressed here that the successful operation of this type of oiling process depends largely upon its being preceded by an efficient laundry washing and rinsing procedure. This is particularly true if adequate rinsing of the load has not been carried out, or if there is an accumulation of lime soaps on the articles owing to the use of unsoftened water. Apart from these considerations there is no reason why the oiling should not be carried out by the normal laundry staff, and if the machines used are afterwards rinsed out with hot water no difficulty should be encountered with subsequent washes. After hydro-extraction the load can be finished by the normal methods. No appreciable amount of oil is lost during the calender-drying of cotton articles. There is a slight but unimportant decrease of oil content when blankets and other woollen articles are autoclaved at 5-lb. steam pressure. Thus wool test-pieces having an average oil content of 5.2% showed an average oil content of 5.07% after treatment in an autoclave at 5-lb. steam pressure for one hour.

Accumulation of Oil

Over a period of successive oilings and washings it was found that there was a definite accumulation of oil in the case of woollen articles, which can only be given a low-temperature wash. Mineral oil such as technical white oil is well known to be extremely difficult to remove completely from textile fibres, and it is therefore not surprising that a progressive building up should occur. It is not desirable that the oil content should rise appreciably above about 5 to 7%, and the degree to which this accumulation may occur will depend largely upon the efficiency of the particular washing process. It is therefore not possible to give any general recommendation by which it can be prevented. A fairly steady degree of oiling can probably be maintained if in the initial

oiling treatment an increased amount of emulsion is used and in all subsequent treatments the amount of emulsion is reduced below that given in the process chart. If laboratory facilities are available the most satisfactory method of control is to incorporate a wool and a cotton test-piece in the respective types of load and to remove, after each oiling, a sample for Soxhlet extraction with petroleum ether. In this way any serious accumulation of oil can readily be detected and appropriate adjustments in the amounts of emulsions used can be made.

Discussion

During the present investigation it has been found possible, by the use of suitable emulsifiers, to oil hospital bed-clothes, etc., to any required degree by means of very dilute oil-in-water emulsions. The particular advantage of the present process over that previously described by van den Ende and Thomas is that complete exhaustion of the emulsion takes place, and there is therefore no necessity for applying any oil-recovery process to the used liquor. Both positively charged and negatively charged oil emulsions have been employed, either separately or in equivalent amounts. The cation-active emulsifier "fixanol C" and the anion-active emulsifier "teepol" have been used in the present investigation, but there is no reason why other commercial emulsifiers of similar types should not be used. The methods described are applicable on a large scale in any hospital laundry that observes a correct washing technique.

We tender our thanks to the Council of the British Launderers' Research Association for permission to publish this paper.

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OILED FLOORS TO CONTROL RESPIRATORY INFECTION

AN ARMY EXPERIMENT

BY

P. H. R. ANDERSON, M.B., Ch.B., B.Sc.

Lieut.-Col., R.A.M.C.

J. A. BUCHANAN, M.B., Ch.B.

Capt., R.A.M.C.

AND

J. J. MacPARTLAND, M.B., B.Ch.

Capt., R.A.M.C.

The use of spindle oil to lay the dust on floors and so diminish the number of bacteria in the air was described by van den Ende, Lush, and Edward (1940), and by Thomas (1941). The importance of such air-borne organisms in the spread of respiratory and cross-infections has been emphasized by many writers (Cruikshank, 1935, 1941; White, 1936; Allison and Brown, 1937; M.R.C. War Memo. No. 6, 1941). It therefore appeared of some importance to see if oiling of floors could be used to cut down the spread of air-borne infections among soldiers in barracks. An experiment to test this possibility was suggested and arranged by Col. W. W. S. Sharpe, and was carried out between Dec., 1942, and March, 1943. It gave encouraging results, and, as the general conclusions seem to have aroused some interest (*British Medical Journal* leader, 1943), it may be of value to give a short account of the details.

Conditions of the Experiment

The experiment involved the men in two Army units, A and B, each of which was a large training centre occupying one complete barracks. Oiling of floors was carried out in unit A, while in unit B, which served as a control, the floors were untreated. The two barracks were almost identical in structure, and the men in each lived and worked under closely comparable conditions. The medical officers of units A and B were well known to each other and were able to agree on common standards for the diagnosis of respiratory infection. This was taken to include all cases arising *de novo* which fulfilled either one or both of the following criteria: (1) An upper respiratory

catarrh with obvious local signs. (2) A generalized "influenzal infection" accompanied by pyrexia.

The diagnosis of a respiratory infection was therefore based on objective evidence which, so far as possible, left no doubt as to the nature of the condition. The diagnosis was not made unless there was sufficient reason for supposing that symptoms and signs were due to recent infection. On this ground the following were excluded: (1) Men with chronic bronchitis. (2) Men with cough but without nasal discharge or pyrexia. Such coughs were attributable to excessive smoking, wax in the ears, training exposures to D.M. gas, or various minor causes. (3) Men who developed coryza or pharyngitis following vaccination: this group presented the only real difficulty, since a considerable but approximately equal number of men in the two units showed inflamed throats or a mild degree of coryza at the height of the vaccine reaction.

The proximity of the two units made it possible, if real doubt arose, for both medical officers to examine the man before a final diagnosis was made. In general the matter was not in doubt, since the great majority of respiratory infections were straightforward examples of acute coryza, pharyngitis, laryngitis, tracheitis, acute bronchitis, or influenza. Over the period of observation both units were receiving recruits at intervals of about a fortnight, so that during the 17 weeks of the experiment a large number of men came under review who were experiencing communal barrack life for the first time.

Oiling of Floors

In unit A the wooden floors of all barrack-rooms, sleeping-huts, offices, and lecture-rooms were treated with spindle oil at regular intervals. The oil was applied in such a way as to leave an imperceptible film on the surface after thorough impregnation of the wood. Oil treatment of the floors of unit A began in Nov., 1942, and four applications were made at about monthly intervals up to the end of March, 1943. The oil was non-inflammable and caused no unpleasant smell. The best results were obtained if the floors were first thoroughly swept with a stiff broom, then dry-scrubbed, and finally swept with a soft broom before the oil was applied. This was done with old sacking, which was dipped in the oil, squeezed to get rid of excess, and then well rubbed into the floor along the grain of the wood; no excess of oil was allowed to collect or remain on the floor. The surface dried in about six hours, and one gallon of oil was enough to treat about 1,000 square feet of floor space. Second and subsequent applications made at intervals of about four weeks occupied less time than the first; care was again taken to ensure that the oil was thoroughly rubbed in and no excess left on the surface. After treatment the floor was not scrubbed, but was easily kept clean by brushing or occasional mopping with a rag moistened in oil. Within the unit the regimental officers and men welcomed the oiling of floors—a point of some importance. The floors were easier to keep clean, scrubbing being unnecessary, and the presence of dirt on the oiled floors was so readily apparent that the men were stimulated to adopt cleanly habits.

The floors of unit B—the control unit—were left untreated, and in both units careful weekly records were kept of all men reporting sick with a respiratory infection during the 17 weeks ending March 27, 1943.

Results

The results are shown in the accompanying Table. It is clear that the weekly rate of new cases of respiratory infection per 1,000 men was consistently lower in unit A, where the floors were oiled, than in the control unit B, where no such treatment of floors was adopted. It is also of importance to note that unit A suffered no major epidemic of respiratory infection, while unit B sustained a severe outbreak of almost epidemic proportions between the middle of February and the first week of March.

Discussion

It is not claimed that this is in every respect a perfectly controlled experiment, but the basis of comparison between the two units is probably uniform enough to support the validity of the results. At each unit almost identical conditions prevailed as regards buildings, sleeping-space per man, stress of training, contact with sources of infection outside the barracks, and the standard of black-out ventilation. The units were large (strength 1,300 to 1,700) and yielded obvious respiratory infec-

Table showing Weekly Rate of Respiratory Infections per 1,000 Men in Test and Control Units

Week Ending	Respiratory Infections per 1,000 Men	
	Unit A (Floors Oiled)	Unit B (Control; no Oil on Floors)
5/12/42	4	18
12/12/42	3	27
19/12/42	4	20
26/12/42	2	17
2/1/43	4	47
9/1/43	2	47
16/1/43	8	38
23/1/43	12	45
30/1/43	7	32
6/2/43	11	48
13/2/43	9	58
20/2/43	9	56
27/2/43	12	52
6/3/43	8	48
13/3/43	8	44
20/3/43	5	31
27/3/43	9	20
Weekly average	7	38

tions in sufficient numbers to reduce the doubtful cases to an insignificant proportion of the whole. Another factor of importance was that close collaboration between the medical officers of the two units helped to eliminate extraneous factors which might have introduced error.

The success in curtailing the spread of purely respiratory infections by oil treatment of floors assumes all the greater significance since it is possible that such important diseases of the barrack-room as virus influenza and cerebrospinal meningitis may also be lessened in their incidence by the same simple procedure.

Summary and Conclusions

Treatment of wooden floors with spindle oil at regular intervals significantly lowered the rate of respiratory infections in a large military unit as compared with the incidence in a similar control unit, living under comparable conditions, where oiling of floors was not practised.

In the unit where floors were oiled the average rate of respiratory infections was 7 per 1,000 men, as against 38 per 1,000 men in the control unit. During the 17 weeks of the experiment, from the week ending Dec. 5, 1942, to that ending March 27, 1943, no major outbreak of respiratory infection appeared in the test unit; in the control unit an outbreak of almost epidemic proportions prevailed between the middle of February and the first week of March.

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THE DETERMINATION OF BASAL METABOLISM ON OUT-PATIENTS

BY

J. DOUGLAS ROBERTSON, M.D., D.Sc., Ph.D., D.P.H.

(From the Courtauld Institute of Biochemistry, Middlesex Hospital)

Measurement of the basal metabolism is not often employed as a routine investigation in this country. One cause may be that most clinics insist that the subjects live in hospital for a few days in order that the test can be carried out at or near the bedside. Such a preliminary preparation is neither popular with the patient nor looked on favourably by the hospital whose beds are already outnumbered by patients requiring urgent medical and surgical treatment. In this paper proof will be given that in fact it is not necessary to use hospital beds for this test and that determinations on ambulatory patients are satisfactory. At the same time certain technical points on the measurement, accuracy, and constancy of the basal metabolism will have attention drawn to them.

The method of determining the metabolism was that of the closed circuit, the accuracy of which has already been reported (Robertson, 1937). The apparatus used was the Benedict-Roth with recording kymograph. All machines were alcohol-checked