PROCEEDINGS OF THE ASSOCIATION OF INDUSTRIAL MEDICAL OFFICERS

FORTY-FIRST MEETING

The forty-first meeting of the Association was held on Friday, December 14, 1945, at the London School of Hygiene, Dr. W. Blood in the chair.

Before the business commenced, at the request of the chairman members stood in silent tribute to the memory of Dr. W. D. Jenkins, one of the original members of the Association, who died in London on November 10, 1945.

Following the private business, papers were read as follows:

1. The medical officer and accident prevention, by Dr. J. A. A. Mekelburg (London); 'Silicosis in the haematite iron ore industry in West Cumberland,' by Dr. J. Craw (Whitehaven); 'Strikes,' by Dr. T. A. Lloyd Davies (Nottingham); 'Some observations on analysis of certified sick abstracts,' by Dr. J. Tarsh (Liverpool).

2. On Saturday morning, December 15, the meeting was continued at St. Mary's Hospital, Paddington, where Sir Alexander Fleming, F.R.S., addressed the Association on the discovery and preparation of penicillin. Dr. M. Y. Young described its use in common industrial conditions. Mr. Dickson Wright spoke on the surgical application of penicillin and demonstrated various pharmaceutical preparations.

Honorary Membership

Sir Henry Bashford, one of the original (founder) members of the Association, was elected an Honorary Member on his retirement from the post of Treasury Medical Adviser.

Circulation of Minutes

Dr. W. Gunn (London) suggested that the minutes of each meeting should be circulated to members. He pointed out that many members were unable to attend meetings and would like to be kept in touch with the proceedings of the Association. The matter was referred to the Executive Committee for further report.

Institute of Ophthalmology

Dr. H. F. Chard (Dagenham) stated that the Institute of Ophthalmology wanted assistance from industrial medical officers concerning type and frequency of eye complaints met with in factories. The Institute was willing to supply special cards for this purpose. Dr. J. C. Bridge (London) asked what was the purpose of such records. Dr. L. B. Bourne (London) explained that the object was to set up a standard of treatment of industrial eye injuries and that until basic information was available this could not be done.

The Industrial Medical Officer and Accident Prevention

Dr. J. A. A. Mekelburg said that the number of reportable accidents during the year 1944 was 283,581, and of these 1003 were fatal. Assuming an 8-hour day, the number of man-hours lost by these accidents becoming reportable is in the region of 62 million hours, to say nothing of the hours lost after the accidents became reportable. To put it another way—this is equivalent to closing down completely for a year a factory of 3000 working a forty-hour week. Such a closure would obviously be a major disaster. Each reportable accident is a major disaster to the individual concerned.

An accident can be defined as 'an unforeseen mishap or an untoward event which is not expected or designed by the sufferer.' Such an event has a threefold result. Firstly, in a physical or mental injury to the worker, the nature of the injury varies from minor degrees of shock to severe disablement or even death. Secondly, if the accident is such that it becomes reportable, the worker suffers financial loss with consequent domestic embarrassment. Although there have been substantial increases in compensation rates in the past few years, the amount paid is insufficient to permit the worker to meet his normal weekly expenditure. Thirdly, an accident occurring in the works inevitably results in disorganization in the department in which it occurs and interference with and loss of production. Drawing an analogy between accident and disease, an industrial disease may be defined in similar terms, for the disease is an accident to health arising 'out of and in the course of employment.'

As medical officers in industry we are intimately concerned with the health of the workers under our care, and every effort is made to combat the special health hazards peculiar to different industries. Possible health hazards are anticipated and precautions taken to avoid disease. An excellent example of this was the conclusion of the elaborate precautionary methods undertaken, with every considerable success, to prevent TNT poisoning in the filling factories—the prevention of occupational disease. The industrial medical officer is therefore already 'preventive-minded' in his field of medicine. Why should he not turn his activities to the prevention of the ordinary everyday accidents which occur in every works? Although immediately taken to repair injury by all available means, surgery, physiotherapy, rehabilitation, etc., and to get the injured worker back to his pre-accident job, a worker who has lost a hand, for example, will not be able to return to his job on a power press or guillotine. How much greater satisfaction would it have given if by careful anticipation the machine had been so guarded that an accident could not have happened. Part II of the Factories Act, 1937, deals exclusively with Safety. It is laid down that every prime mover, every part of transmission machinery and all other machinery shall be securely fenced. Section 17 of the Act, in dealing with the construction and sale of new machinery, states that certain parts of such machinery shall be effectively guarded. There have been lengthy discussions on this section; often when a new machine is installed it is found that there are other parts which must be guarded, and it is argued that these parts should have been guarded in the course of the manufacture of the machine. This is not always the case, so every machine must be given a thorough vetting before it is put into production.

It may be said that the job of guarding machines is the job of an engineer who knows all about machines, and it is his job to see that the machines do the work for which they were designed; but what is unfortunately often forgotten is that the machine is worked by a human being. That human being is only human and has his faults, and he must be prevented from injuring himself. On this question of the guarding of machinery, co-operation between the engineer and the medical officer, in fact co-operation all round, will result in the prevention of many accidents. It has been said many times that one of the duties of the medical officer is to know his factory; and to know the different processes carried out it is necessary to get about the works—it cannot be done from the consulting room. In the course of his daily tours of the industrial medical officer observe the working of machines. He has been trained to observe, and as the result of his observations he will
be able to visualize possible accident hazards. These could then be guarded against and accidents prevented. It is unnecessary to have special technical knowledge of machines, for when a danger point has been discovered and reported, it then becomes the duty of the engineer, the carpenter, the sheet-metal worker or the wire worker to devise something which will prevent an accident at that point.

Several accidents have been spoken of as if they were caused solely by machinery. But this is not the case, for the Chief Inspector of Factories shows, in his annual report for 1944, that only 15.6 per cent. of all reportable accidents were caused by power-driven machinery. The remaining 84.4 per cent. resulted from non-mechanical causes such as the handling of goods, persons falling, struck by falling body, the use of hand tools and stepping on and striking against objects. If a careful record is kept in the medical department of the types of accidents and the departments in which they occur, much useful information is obtained and steps can be taken to prevent recurrence. By indicating an accident on the medical record in, say, red ink, accident proneness may be spotted. Then by investigating the case it may be possible to prevent a serious accident by recommending a transfer to another department.

Incident records may be illustrated by two examples. During the war women were employed in the biscuit industry on what is known as ‘back of oven’ work. This job entails taking hot wires or pans with the oven in a rack on the oven and placing them on the oven rack to cool before packing. A very large number of small burns on the wrist and lower forearm were recorded. On investigation it was found that the pan-holder in use did not give full protection to the wrist and forearm. Another type of pan-holder was introduced and burns are now practically non-existent. A second example is also of interest. Biscuits for the Services were packed in canisters. These canisters had a circular form of section, which is a sharp edge upwards. Often doing the packing got innumerable cuts on the knuckles and wrists when placing the packets in the canisters. A tin guard was made to cover the opening and cuts were prevented. At first some of the operatives avoided the use of the guard when they got a chance, but later, when they found that their colleagues were not getting cuts and worked free of the fear of cuts, they all used them. It might be said ‘With all this trouble when a pair of gloves would have prevented the cuts?’

It is a fundamental point in accident prevention that the fitting of an appliance to, or the provision of some form of protective clothing for the worker, is an admission of failure. If workmen are compelled to do work in an environment that may be detrimental to health or even dangerous, and no provision is made to protect them, then the factory must be considered as a place of work where the health of the worker is endangered. If workers are exposed to conditions that injure them, then the employer must take steps to protect them.

A further example of this type of situation was the case of the dockers’ strike. This was the result of a demand on the part of the dockers that they should be given the right to enter and work on the docks. Initially, the dockers were not given this right, but eventually they were. The dockers had been working in a hazardous environment for many years, and the fact that they were not given the right to work on the docks was a clear indication of the employer’s failure to provide a safe working environment. A similar situation occurred in the case of the railway strike. In this case, the railway workers were not given the right to work on the railway lines, and this was a clear indication of the employer’s failure to provide a safe working environment.

It has been shown that there are several types of strikes. The first type is the general strike, which is usually called a general strike because it affects all sections of the community. The second type is the local strike, which affects only a particular section of the community. The third type is the national strike, which affects the whole country. The fourth type is the international strike, which is called an international strike because it affects workers in many countries.

The general strike is the most common type of strike, and it is usually called a general strike because it affects all sections of the community. The local strike is the least common type of strike, and it is usually called a local strike because it affects only a particular section of the community. The national strike is the second most common type of strike, and it is usually called a national strike because it affects the whole country. The international strike is the least common type of strike, and it is usually called an international strike because it affects workers in many countries.

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of the difference between the observed population and the expected population (if the age distribution of all males had been followed) which in all cases showed a serious loss of men from the road passenger transport industry (with the exception of tram drivers) after middle age.

The strong group spirit, antagonistic of authority, shown by merchant seamen, is an example of collective emotion. In the future, strikes—having their origin in emotional or fatigue phenomena—would be symptomatic of collective illness and become less and less an economic weapon. Until the gulf between employer and employed was bridged, strikes, as symptomatic of an illness of the community, would become increasingly more frequent.

Some observations on analysis of certified sickness absence

Dr. J. Tarsh referred, in the first place, to what he termed the background of sickness absence recording in industry. This includes relevant factors, such as methods of collecting data, the uniformity of its application, allowances for locality, type of work, shift work, night work, old established or newly established factory, private enterprise or state-controlled industry, and the like. Some of the pitfalls that he came up against in the recording of sickness absence were met by a process of trial and error and the path of bitter frustration. (1) If the recording of sickness absence and its subsequent analysis is intended to supply a sound knowledge of industrial medical practice, it will assuredly fail in that purpose, for an hour’s walk round the factory will teach you far more about industrial conditions than a week’s study of graphs, statistics and such like. (2) The process of obtaining data involves routine time and soul destroying. (3) The tangle of detail inclines one to inferences that are based on the ‘post hoc ergo Proper hoc’ line of argument. (4) The sympathetic approach to the problems of sickness absence from work so very necessary for a sound understanding of the difficulties of modern industrial conditions, is replaced by a carping and critical inquiry, forgetful of the old legal maxim ‘de minimis ne curat lex.’ Few doctors would exclude the taking of a case history from their process of arriving at a diagnosis; so recording, that has for its primary aim the taking of case histories, yet for the individual it is a duty, not justifiably be part of the industrial medical officer’s duties. Pre-employment examinations plus routine follow-ups; control of the first-aid rooms; examinations of cases referred from the welfare and labour departments; and examinations of employees who have sought the doctor off their own ‘bat’ all yield case-history data. But, and this applies with great force in a factory of many thousands of employees, much ill-health only comes to light from an inquiry into sickness absence records. Repeated absence for headache may indicate eye-strain; debility and anaemia when repeatedly advanced as the excuses for absence may indicate a problem for the welfare department, or conceivably, the need for an individual ventilating exhaust system for those using a dangerous substance such as carbon tetrachloride. Again, frequent colds, bronchial catarrh, especially amongst a group of stable and conscientious employees, may indicate a ‘wind-swept’ shop. The study of day-to-day findings well repays the effort involved. In the course of time, when the data and inferences from many industrial medical officers are collated at a central statistical department by those trained in analysis, surely much good will result.

Absenteeism is still front-page news. Absenteeism as presented by the Ministry of Mines is divided into voluntary and involuntary, the latter being explained by no more than absence for which a reasonable excuse is advanced. One can only guess at the real amount of sickness in the industry. Detailed analysis is obviously required. Again, the Ministry of Labour have advised a different method for the recording of analysis of absence from work. Fortunately the Industrial Health Research Board has advised a good workable system flexible enough for application to most industries, and in the past few months has published three instructive pamphlets on various aspects of sickness absence from work.

The data presented in this paper have been obtained in a manner similar to that advised by the Board and cover some 10,000 employees for the years 1943/1944. Remarks in this paper are confined to certified sickness absence only and such absence means absence of three days or more, certified by an outside doctor, for less than that period, even though certified, have been excluded as they are infrequent and have little bearing on the subject as a whole.

Table I

<table>
<thead>
<tr>
<th>Subdivision</th>
<th>Total</th>
<th>Works</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subdivision II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men (single)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women (single)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All absences recorded are covered by medical or hospital certificates.
TABLE 2

PERCENTAGE OF TIME LOST ON ACCOUNT OF CERTIFIED SICKNESS DUE TO THE MAIN CATEGORIES OF CERTIFICATION

<table>
<thead>
<tr>
<th>Category</th>
<th>Women (hourly paid) per cent.</th>
<th>Men (hourly paid) per cent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Colds and influenza</td>
<td>17-7</td>
<td>16-3</td>
</tr>
<tr>
<td>2. Respiratory conditions</td>
<td>15-5</td>
<td>14-2</td>
</tr>
<tr>
<td>3. Digestive</td>
<td>8-5</td>
<td>9-9</td>
</tr>
<tr>
<td>4. Nervous system</td>
<td>11-8</td>
<td>6-2</td>
</tr>
<tr>
<td>5. Accidents</td>
<td>1-56</td>
<td>2-9</td>
</tr>
<tr>
<td>6. Rheumatism</td>
<td>5-7</td>
<td>6-8</td>
</tr>
<tr>
<td>7. Miscellaneous</td>
<td>21-00</td>
<td>31-00</td>
</tr>
</tbody>
</table>

It may be noticed that colds, influenza and respiratory conditions constitute one-third of all absences but in a lesser degree in males. With regard to accidents, males lost twice as much time as females, as would be expected, and only slightly more for rheumatic diseases. The miscellaneous category covers a great deal of absence and needs further subdivision. This is a job for the Industrial Health Research Board.

Industrial fatigue is a definite entity but difficult to diagnose. General practitioners frequently dislike putting 'fatigue' on a N.H.I. certificate, and put as an alternative 'anaemia' or 'nervous debility'; these two groups have therefore been analysed (Table 3).

TABLE 3

DAYS LOST PER PERSON PER YEAR THROUGH CONDITIONS PRESUMED TO INDICATE FATIGUE

<table>
<thead>
<tr>
<th>Condition</th>
<th>Females (days)</th>
<th>Males (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anaemia</td>
<td>0-3</td>
<td>0-02</td>
</tr>
<tr>
<td>Nervous debility</td>
<td>1-25</td>
<td>0-24</td>
</tr>
</tbody>
</table>

It will be noticed that the females are absent fifteen and six times more than males.

The classification of days lost by the various age groups is illustrated in Table 4.

TABLE 4

DAYS LOST BY AGE GROUPS—ALL CAUSES

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Under 18</th>
<th>18-20</th>
<th>21-25</th>
<th>26-40</th>
<th>Over 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single men</td>
<td>5-75</td>
<td>9-0</td>
<td>10-5</td>
<td>11-5</td>
<td>17-7</td>
</tr>
<tr>
<td>Married women</td>
<td>3-0</td>
<td>6-5</td>
<td>7-7</td>
<td>8-75</td>
<td>10-25</td>
</tr>
<tr>
<td>Married men</td>
<td>2-9</td>
<td>9-2</td>
<td>13-7</td>
<td>13-7</td>
<td>23-9</td>
</tr>
<tr>
<td>Staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single men</td>
<td>2-9</td>
<td>9-2</td>
<td>9-0</td>
<td>7-3</td>
<td>5-9</td>
</tr>
<tr>
<td>Married women</td>
<td>2-3</td>
<td>5-4</td>
<td>8-6</td>
<td>11-3</td>
<td></td>
</tr>
<tr>
<td>Married men</td>
<td>8-9</td>
<td>5-9</td>
<td>5-75</td>
<td>5-9</td>
<td>7-6</td>
</tr>
</tbody>
</table>

Analysis of Figures. Analysis of age groups when related to the various certified sickness categories provides a great mass of data and therefore no more than a few general observations can be given here. These are presented with much trepidation for they are of little value unless other industrial medical officers publish their findings and so provide comparative data. (1) Persons of both sexes under 18 years of age lose only half to one-third as much time as all other age groups. Taking the other extreme of age, i.e. those over 40, it would appear that (a) men, both single and married, lose twice as much time as males under 40; (b) married women over 40 lose nearly twice as much time as single women under 40; (c) single women over 40 lose nearly twice as much time as single women under 40; the converse obtains with staff employees. (2) The time lost from all diseases is greater in the higher age groups. (3) Diseases of youth are colds and respiratory diseases. Diseases of age are digestive, rheumatism, female diseases, and (with men only) accidents. (4) Colds and influenza cause the greatest amount of lost time in general, attacking especially the older women. In the healthiest categories, i.e. single men and women under 18, they are some five to ten times more severe in machine shops than in assembly; in other categories this is not so marked. Women lose three times as much time due to these two conditions as men in machine shops, and twenty times as much as men in assembly. (5) Respiratory conditions cause almost as much lost time as colds, with women losing five times more than men. (6) Digestive conditions are responsible for a major proportion of lost time, negligible in lower age groups and severe in the highest. Women lose only 10 per cent. more than men. (7) Nervous conditions, other than nervous debility, e.g. neurasthenia, are a negligible cause of absence, but most severe in older women. (8) Accidents cause only a small amount of lost time, men over 40 losing ten times as much time as other men, and twice as much as older single women. Women lose only half as much time as men. (9) Rheumatism is an important cause of lost time, negligible in the young but severe in the older age groups, with single or married men about equal. It is twice or three times as severe in machine shops.

Finally, here are one or two deductions: Health is markedly better under 18 and markedly worse over 40. There may be a tendency for health to deteriorate on marriage and often to improve as the years go by. Women who remain unmarried over 40 suffer a severe deterioration in health.

BIRMINGHAM GROUP

A meeting of the Group was held at the Birmingham Accident Hospital on November 23, 1945, Dr. W. J. Lloyd in the chair. The subject for discussion was 'Airborne respiratory infection in industry,' opened by Dr. O. M. Lidwell, Medical Research Council, National Institute for Medical Research, Hampstead, N.W.3, and Dr. A. Brian Taylor, Physician to the Birmingham United Hospital.

Control of Respiratory Infection

In this discussion Dr. Lidwell was concerned only with the possibility of reducing the concentration of infective material suspended in the air. Such material will be drawn in with the inspired air and a high proportion retained in the respiratory tract. There is very little information as to the magnitude of an infecting dose under these conditions and the reduction necessary to produce an appreciable decline in the incidence of clinical infections is also uncertain. In addition, the relative importance of various localities, e.g. workshop, office, canteen, transport, cinema, etc., in determining the number of respiratory infections is not obvious and success in limiting cross-infection in any one might have only a small effect on the total number of infections occurring. These uncertainties serve to emphasize that the subject is in an experimental stage and that the results of controlled field studies are likely to be of considerable general interest.

Consider the air in any room; infective material may be introduced in a variety of ways. Ventilation with outdoor air will introduce a very large amount. Air recirculated through a plenum system may be more or less heavily contaminated according to the source from which the air has been drawn and the efficiency of the filtration system. Interchange of air with other rooms in the building by thermal convection or other sources of air displacement may be greater than is suspected. The inhabitants of the room will disperse their salivary flora by talking or coughing and, possibly, in very large numbers by sneezing. In addition, any activity may redisperse infective material from secondary reservoirs.
in which it has accumulated, e.g. dust on floors, shelves, etc., clothes and other textiles.

Simultaneously the infective material is being removed from the air of the room in three principal ways. Firstly, the suspended particles are continually sedimenting on to the floor and other surfaces, where, in the absence of any special measures, they contribute to the secondary reservoirs and may be redispersed. Secondly, there is a continual ventilation and air interchange. Thirdly, the bacteria and virus particles concerned may be dying at an appreciable rate either naturally or as a consequence of specific bactericidal or virucidal agents.

Aerosol contamination at any time depends on the balance struck between the rate of dispersion of infective material and the rate at which it is being removed. With steady conditions the relationship is a simple one and

\[ N = \frac{dN}{dt} \]

for ventilation this is equal to the number of air changes per unit time, and the sedimentation and death rates can be regarded as constant in effect to a numerically equal rate of ventilation.

Some numerical estimates may be of interest at this point. Bacteria-carrying particles, as ordinarily found, (there is, of course, no data referring to viruses) settling in still air at rates varying from 10-200 feet per hour (these settling rates would be attained by spheres of unit density of 5-25μ in diameter). These figures correspond to a sedimentation rate, in rooms of ordinary height, 10-15 feet, of 1-20 per hour, and an average value would be about 5. Mechanical ventilation is commonly of the same order of magnitude, 3-6 air changes per hour.

The natural death rate, while important in limiting build-up in the secondary reservoirs, is usually small compared with these figures. The rate of dispersion may be very varied. Most measurements of N refer to total bacteria-carrying particles irrespective of classification into pathogenic or non-pathogenic forms and it seems reasonable to use such figures for comparative purposes as indicative of the risk of exposure to pathogens should these appear. In ordinary circumstances the numbers of pathogens present are too small for reliable estimation, and attempts to use specific organisms, e.g. salivary streptococci, as indicators of human contamination, much as B. coli in water, have not been satisfactory.

Under normal fairly good conditions the numbers of bacteria-carrying particles, of all types, per cubic foot of air may average round 20-40. In urban outdoor air the figures are about one-tenth of these. Since an average man breathes about 20-30 cubic feet of air per hour it is clear that the total inhaled bacteria is often considerable and that a high proportion of pathogenic forms might constitute a serious risk.

Reduction in the amount of infective material in the air, i.e. reduction in N above, can be achieved by:

(a) Reducing the rate of dispersion. This can be achieved by attention to good manners, elimination as far as possible of carriers, general cleanliness, use of oil on floors to lay dust. The wearing of masks, while probably a very effective measure, is likely to be impracticable except in special circumstances. Mention may also be made of the principal ways. Firstly, cross-infection due to direct projection by attention to the relative positions of workers and the interposition of screens in particular places. The proportion of cross-infections of this route in all cases is not likely to be much affected by ventilation or germicidal agents.

(b) Increasing the rate of removal. The sedimentation rate is not, in general, susceptible of alteration.

Ventilation is the most certain method and, if properly carried out, the least likely to be associated with undesirable features. In the past ventilation requirements have been assessed on the basis of removal of odours, but it is clear from this discussion that removal of infective material may suggest a considerably higher standard than the six air changes per hour often accepted as being good ventilation. Experimental studies considering higher rates of ventilation have given very promising results. The principal obstacles to large-scale use are the engineering costs and the amount of heating needed in cold weather.

The use of ultra-violet irradiation or chemical vapours to increase the bacterial death rate will occupy the rest of this paper.

The Use of Ultra-Violet Irradiation. It is easy at moderate irradiation intensities to obtain rapid death rates of freshly sprayed organisms, either from the mouth or from culture, at moderate relative humidities. The organisms found in dry dust are very much more resistant. Increased relative humidity reduces the effectiveness. The death rate is proportional to the intensity, and an intensity of 10 milliwatts per square foot at 2537 A will lead to a death rate of nearly 100 per hour with sprayed saliva at 50 per cent. relative humidity. The low-pressure type mercury discharge lamp is the most suitable, the radiation being nearly pure 2537 A. Such lamps are manufactured in the U.S.A. by Westinghouse and the General Electric Co., and have an output of 2-5 watts at 2537 A. Similar lamps have been supplied by the British Thomson Houston Co., and a somewhat different model by Hanovia Ltd.

The practical difficulties in the use of ultra-violet irradiation for air sterilization in rooms and buildings are that the lamps must be so screened as to be invisible to the occupants of the room. In effect this means that only the air above the 6-7 foot level can be irradiated. Reduction in the infective material inspired by the occupants is then dependent on the vertical circulation of air in the room and if the radiation intensity above 6-7 feet is adequate the effective death rate over the room as a whole will be entirely determined by the vertical circulation. In ordinary rooms the maximum value of the death rate determined in this way may be between 12 and 60 per hour. It may be increased by the judicious placing of heaters and the use of fans to provide vertical circulation but it is difficult much to exceed these figures. An adequate radiation intensity in the upper parts is, of course, a mean value; with 20 milliwatts per square foot, will usually need about one 15-watt lamp per 1000 cubic feet of total room space. This will not be very effective against dry dust-borne organisms.

Chemical Bactericides. If it is suitable for use as an aerial bactericide, a substance besides being effective must be non-toxic, tolerable, economical and simple in use. A large number of substances have been proposed but none of them ideally fulfils these conditions. A large number of completely ineffective mixtures are advertised. Many consist essentially of pine oils with some formaldehyde and a little dye, but there are many other 'sweet-smelling' nostrums.

A few words may be said about the more potentially useful substances. In all cases the effectiveness is very dependent on relative humidity and the nature of the bactericide. For example, 25 per cent. relative humidity is the most resistant, saliva freshly sprayed from the mouth is moderately sensitive, sprayed cultures are usually very sensitive. Little killing effect is obtainable below 30 per cent. relative humidity, the rate of removal of odours is usually between 60-80 per cent. relative humidity and a less effective action at higher humidities.

Hypochlorous acid, usually obtained by spraying solutions of sodium hypochlorite, is an excellent bactericide at a concentration of about 0-02 g. per 1000 cubic feet of air. It is harmless but has an appreciable smell and may corrode metals. Reaction with organic matter leads to loss in the air, but the deodorizing action may be useful.
Resorcinol is effective at a concentration of 0.03 g. per 1000 cubic feet and is easily vaporized by heating. Maintaining this concentration is difficult owing to its rapid disappearance, probably by oxidation in the air. This substance has been promoted commercially. Propylene glycol and triethylene glycol have been used by American workers. Considerable quantities of propylene glycol are needed, 1-2 g. per 1000 cubic feet, and its behaviour in the hand is not very good, and glycol has a limited useful humidity range, which considerably restricts its possibilities in this country and we have no personal experience of it. Both these glycols are easy by heating and to maintain at the desired concentration.

We have recently explored the $\alpha$-hydroxy acids of the aliphatic series. All of those tried have an appreciable bactericidal action in the air. Lactic acid is probably the most effective of all the bactericidal agents so far examined against dry dust-borne organisms. At a concentration of 0.1 g. per 1000 cubic feet it is unobjectionable but becomes irritant not far above this level. Owing to decomposition when heated it must be steam distilled into the air. Among the other members of this series mention may be made of $\alpha$-methyl $\alpha$-hydroxy butyric acid. This may be vaporized very greatly without any appreciable loss from a suitable mask at 100-120° C., and irritation is not noticed at concentrations less than two to three times the working concentration of 0.08 g. per 1000 cubic feet. Lactic acid is readily obtainable and quite easily kept in a three-life mask but preliminary work has yet been carried out with the other hydroxy acids.

In conclusion there is one point concerning the relative effects of both natural chemical agents against dry dust-borne organisms. Total organisms, which in most environments are largely of this type, have been suggested as a reasonable index of the bacteriological cleanliness of the air. It does not follow that they are a reliable index of the effectiveness of various agents in reducing the risks of cross-infection. Certain infections may be primarily transmitted by material freshly sprayed from nose or mouth. Others, particularly those of the respiratory type, may also be acquired from infected dust. As at so many other important points there is a fundamental lack of knowledge here.

**Airborne Respiratory Infection in Industry**

In discussing the problem from the point of view of the physician Dr. Taylor has shown that among respiratory diseases are the chief cause of lost time due to illness among industrial workers, and statistics confirm this. The Ministry of Health in 1933 recorded the results obtained in a representative sample of over a million insured persons, and the figures show that well over a third of the cases were accounted for by respiratory diseases— influenza, bronchitis, tonsillitis, colds, pneumonia, etc., excluding pulmonary tuberculosis. Influenza probably includes a variety of respiratory conditions and is not a very exact diagnosis, but may well be included in this group. A cause of mortality, respiratory disease is less obviously important, though from the standpoint of the working man it may well be as significant as in the incidence of morbidity. In statistics of the principal causes of death, heart disease and cancer stand higher than diseases of the respiratory system, but it must be remembered that these are diseases of later life and therefore less likely to interfere with the average working life of the industrial population. Diseases of the respiratory system, excluding tuberculosis and influenza, represent about 13 per cent. of the causes of death and are considerably higher than any of the others. Tuberculosis comes between 5 and 6 per cent. and is therefore an important additional factor, especially as it is unpreventable provided that it is detected in time. These three are diseases of later life and are therefore obviously an important one, and its control would be of great assistance to the health of the population generally, as well as to industry in particular.

In considering these conditions of ill-health, infection is the most potent factor in their aetiology, and airborne infection is by far the commonest mode in which it occurs. One therefore has to take into consideration the question of the infection itself, its nature and dosage, and also the resistance and defence mechanisms of the body. Droplet infection by coughing and sneezing is probably the chief way in which the organisms are spread from one person to another. As the disease is notified as well as the virulence of the organisms. In epidemics with highly virulent infections rapid spread is notable. In more isolated cases, the lack of hygienic habits of the average person, possibly nose or mouth when coughing or sneezing is an important factor.

The training of people in industry along these lines should provide considerable improvement in the incidence of infection, but owing to the natural weakness of the human individual it is fraught with much difficulty. The segregation of individuals in the early stages of respiratory infections is an optimum recommendation, but the usual desire to work, or at least to avoid sickness, makes many people continue to attend their work then they would be better away, from their own point of view as well as from that of their neighbour. The wearing of masks, though in some cases quite practicable, is as seen in the difficulty of making miners wear masks to protect themselves from the dust diseases. The possibility of sterilizing the atmosphere has been studied extensively in the laboratory but the real possibility of this difficulty, especially as it may be possible to do it without the workers knowing, or at least without interfering with their personal comfort.

Another important point which may be considered is the resistance of the individual: this is under the control of numerous influences. It is well known that fatigue and malnutrition, too, allow the invasion of organisms much more readily. Over-long working hours, trying conditions of work as well as of life—as have prevailed during the last few years—must have had a very considerable effect on increasing the incidence of minor maladies, which has been noted among workers in industrial and medical infections. Inhalation of dusts, which has frequently been given as a possible cause of increasing susceptibility to infection, though perhaps the enthusiasm of manufacturers of proprietary brands of vitamin preparations has been partly responsible. Few, if any, reliable statistics have been published to show that the addition of vitamins artificially has notably influenced the sickness rate. It is improbable that there is any real evidence of vitamin deficiency that can account for the optimum levels laid down by the League of Nations Commissions are not always reached; war-time diets have, on the whole, supplied a fairly adequate amount of vitamins. It is also seen that the fat content of the diet, compared with peace-time, facilitates infection; but here again it is difficult to obtain any convincing evidence.

There is no doubt that atmospheric conditions do play a considerable part in the aetiology of airborne infections. In relation to the season of the year, the winter is well known as the most dangerous period, and the fall of temperature at this time is always coincident with an increase of cases. Excessive cold is even more noticeably important. The other outstanding factors are the humidity of the air, changes of temperature, and the effects of draughts and cooling on the skin. An increase in the moisture of the atmosphere has been shown to be conducive to the formation of colds, and artificial ventilation is necessary to disperse fumes and droplet infection, and to maintain an even temperature, but with a movement of air of more than 40 feet per minute.
draughts are felt unless the air blast is directed away from the workers. Ventilation by air blast should not be more than 200 feet per minute, and the air should not be more than 5 degrees below the skin temperature. The movement of air is, of course, an important factor in allowing the natural evaporation of sweat from the surface of the skin, and a comfortable mean is desirable for this winter's efficiency. In winter, the problem of controlling these important points in workshops—where excessive heat or excessive exposure to the outside elements make it difficult—increases the task that faces the industrial medical officer, who has to maintain the efficiency of his workers while interfering with industrial production and management.

A number of methods have been used to try to raise the immunity of workers to respiratory infections, but none has been very successful. The use of stock anticyclic inoculations has been variously reported on by different observers, but their uncertain effect is the most evident conclusion. Ultra-violet irradiation of the skin regularly and frequently has been tried, but here again no real success has occurred, and probably does not compensate for the trouble, expense and time required. Much attention has been devoted recently to the production of an anti-inflammatory vaccine, as the causal viruses are becoming known. The difficulty at the moment is that more than one type occurs in different epidemics, and until the epidemic starts it is uncertain which will be in operation. However, recent work has suggested that an effective vaccine may possibly be produced in the not distant future. The production of some bactericidal or bacteriostatic agent of the type of penicillin, which is effective against catarhal and other respiratory infections, may have a future whereby it will be of great value. At the moment the prophylactic use of penicillin is still uncertain, and its oral administration has not been successfully achieved owing to destruction in the gut. The possibility of overcoming this is in view. One must also remember in this connexion that many organisms of the catarhal group are insensitive, and others may become so by immoderate use of penicillin.

In conclusion, therefore, it would seem that the problem is made worse by the variety of aetiological factors. Control of infection in the air itself to prevent the passage from person to person is perhaps the most hopeful prospect for the future. The training of personnel on hygienic measures is difficult, though theoretically effective. Adequate control of working and of atmospheric conditions and prevention of overcrowding must be borne in mind, and will assist in diminishing the spread of infection. Inoculations and individual bacterial control are still in the experimental stage and at present not particularly helpful.

**SCOTTISH GROUP**

The annual general meeting of the Group was held on October 17, 1945, at the Institute of Hygiene, Glasgow University, Dr. H. M. Roberts in the chair. The following office-bearers for 1945–46 were elected:

Chairman: Dr. D. M. Watson.
Honorary Secretary: Dr. George Buchanan.
Honorary Treasurer: Dr. Edward Collier.

Executive Committee: Drs. J. Fleming, J. W. Henderson, N. Meiland, H. M. Roberts, D. G. Robertson and Grace Smith, with the chairman; Honorary Secretary and Honorary Treasurer, ex officio.

Prof. T. Ferguson said that Dr. Roberts had filled the chair during his term of office with dignity and tact, and had executed his duties in a delightful manner pleasing to all. He wished to propose Dr. Watson as successor to Dr. Roberts and, on his election, welcomed him to the chair for the years 1946 and 1947.

A dinner was held at the Grosvenor Restaurant, Glasgow, on October 20, 1945. Dr. D. M. Watson in the chair. This was the first social event held by the Group; in the words of the Honorary Secretary, ‘it is pleasant to record that the meeting was an outstanding success, and the chairman in his remarks hoped that it would become an annual event at which members and their friends could meet.’

On December 12, 1945, Members of the Group visited the miners’ rehabilitation centre at Uddingston. An introductory address was given by Mr. Alexander Miller, F.R.C.S., in which he stressed the importance of using rehabilitation of the injured as a continuous process beginning with early and adequate primary treatment at an orthopaedic department or fracture clinic and continuing throughout the out-patient department of the hospital and finally, where required, to rehabilitation centres. The centre at Uddingston was of special importance as this large industrial county was at present completely dependent for its hospital service on Glasgow; the need for more out-patient supervision had therefore become an urgent necessity until a regional plan for hospital services was established.

Almost 10 years ago the mining industry, recognizing the need of a suitable follow-up service for the disabled miner, initiated a rehabilitation scheme for disabled miners which was the first of its kind in Britain. Its aim was to treat the post-hospital patient and return him fit to gainful employment in his pre-accident or alternative occupation. The work of this was brought to the attention of the miners’ Welfare Commission, and in 1945 they agreed to take over the service and to establish the present centre in Uddingston as a non-residential centre. The centre at Uddingston was brought to the attention of the Miners’ Welfare Commission, and in 1945 they agreed to take over the service and to establish the present centre in Uddingston as a non-residential centre.

The centre must be viewed as a hardening centre and is not intended as an out-patient dispensary.

The social aspects of rehabilitation have always formed a major part of the work in the original rehabilitation scheme in Lanarkshire, and the miners’ Welfare Commission have agreed to the appointment of a social worker to the centre to allow expansion of this service in the field of rehabilitation. By means of the social worker a close contact is made with the hospital, the mining industry and with the general industries in the county so that on the surgeon’s recommendation steps are taken, after investigation if necessary, to reinstate the patient to his own or alternative occupation. By means of this close co-operation of surgeon and social service it has been possible to return almost 80 per cent. of the patients at the centre to the mining industry and to place a further 10 per cent. in alternative occupation. The present attempt by the Ministry of Labour to organize a scheme for rehabilitation and re-settlement of the disabled was too much of a revolutionary change; such a scheme could not give the measure of success anticipated until suitable personnel were trained to make itself effective. He considered that at this stage it might have been better to allow schemes of different types to function in selected areas where previous experience was available and where expansion of the scheme might proceed gradually. When such schemes had made their report then it was time enough to advise on a unified standard plan for the nation as a whole.

Following this introductory address a demonstration was given of the routine work of the centre. Early morning treatment was carried out by orthopaedic sisters (nurse gymnasts), the patient being taken through a course of individual exercises and gradually transferred to small class groups and then to larger groups. Traditional games were introduced, either under the supervision of the orthopaedic sister or, in the more advanced class, under the physical training instructor. Competitive games, indoor and outdoor, were demonstrated to show how the disabled might be encouraged to adapt physical disability to active functional use.