Dust and Disease

A Plea for Routine School Disinfection.

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"He was all right, doctor, until he began to go to school," is a remark with which most of us who take an interest in school hygiene are only too familiar. Could anything more clearly indicate the influence of the public school upon the spread of the common infectious diseases of childhood?

As a paper read by me at the Congress on Hygiene and Demography, in September last, represents my carefully considered views on school disinfection, I have made free use of many of the arguments employed in the paper in question in preparing this article.

Among the numerous problems confronting educationists, none perhaps is more insistent or more difficult of solution than that of the prevention of infectious disease. Viewed from any standpoint—hygienic, educational or financial—school epidemics are deplorable; yet, as is evidenced by reports from all parts of the country of the closure of schools owing to infectious outbreaks among the scholars, all the remedies and all the palliatives hitherto brought to bear against them have done little more than touch the fringe of the evil. It is strange, therefore, that one of the most obvious preventive measures—the systematic daily disinfection of schoolroom floors—is commonly overlooked or ignored. Why disinfection is necessary, and how it should be done, will be shown hereunder.

The most common school diseases are measles, diphtheria, scarlet fever, and whooping cough, while the available data tend to show that tuberculosis may exist among school children to a much greater extent than is usually believed. The facts that the first four of these diseases are generally infectious before they can be diagnosed, and that both scarlet fever and diphtheria remain so after the patient has apparently recovered, greatly increase the difficulty of preventing outbreaks among school children, and of confining within moderate limits such outbreaks when they have occurred.

The presence in most schools of a certain proportion of children in the infectious stages of one or other of the diseases already mentioned cannot be avoided, and seeing that each of these diseases is caused by a specific germ, such children cannot fail to diffuse infectious material, which, if allowed to accumulate on the floors, to become mingled with the dust and be inhaled by the other children, must give rise to fresh cases of the disease. This being so, it will be admitted on all hands that the one intelligent method of preventing these diseases is the timely destruction of the causal agent.

The view held in certain quarters that infection through the medium of infected articles—particularly dust—may be ignored, cannot be justified. The more rational view is that while direct infection—i.e., infection transmitted from child to child by actual contact—is the more common form, there is the strongest evidence for the belief that germ-laden dust is responsible for a vast amount of infectious disease. In this connection it is worthy of note that Prof. C. A. E. Winslow in some recent experiments described in the American Journal of Public Health, obtained 22,700 acid-forming streptococci per gram from an average of nineteen samples of dust taken from New York schoolrooms.

The case for routine disinfection is clearly and succinctly stated by Dr. Henry Kenwood, Chadwick Professor of Hygiene in the University of London, in a paper on "The Disinfection of School Premises," published in the School World of September, 1908: "No one who is conversant with all the facts," he says, "will dispute the contention that the periodical disinfection of school premises is an important branch of school

hygiene which is often culpably neglected. A systematic disinfection of school premises is, with rare exceptions, performed only as a consequence of the epidemic prevalence of infectious disease among the scholars, and even then the methods adopted are not always those which the more recent scientific work has demonstrated to be the most effective. Yet the facts which indicate the necessity for this precaution, as a routine practice, are of a very striking and convincing nature. . . . Missed early or mild cases spread much infection in school classrooms; and frequent disinfection is an easily practicable means of reducing their potency for evil. In addition to these mild cases of infection, there may be 'carrier-cases,' namely, children who are passive carriers of infection while not themselves affected in any way by the germs they harbor in their throats or in their noses, etc. In some school outbreaks of diphtheria, the 'carrier-cases' in a class from which several sufferers have previously been removed have been found to be far more numerous than the actual sufferers; but while in good health and fully capable of benefiting from schooling, they may disseminate virulent germs upon the other scholars and the desks, floors, books, etc., of the classroom, when they cough, sneeze, recite or sing. Flügge and others have demonstrated that the germs may thus be sprayed into the atmosphere for several feet from the individual. The infection of scarlet fever, diphtheria, measles and whooping-cough from such insidious sources, remaining unrecognized in periods when the class attendance is good, may light up a considerable measure of school infection. But the plea for routine disinfection of school premises does not end with the case in reference to common infectious diseases; there are cogent grounds for adopting the practice as a serviceable precaution against the spread of consumption and certain disease-producing organisms on skin, hair and clothes, which are known sometimes to constitute a part of classroom dirt and dust. . . . It is indeed surprising that so little should be done in the face of the recognized frequency of classroom infection and the consequent epidemic prevalence of disease, and in the face of the evidence that is gradually accumulating of the valuable results accruing from the daily disinfection of school premises."

The Scotch Education Department, in a Memorandum entitled, "The Cleansing and Disinfecting of Schools," has expressed its views as follows: "The 'close smell' so familiar in the schoolroom is due partly to the subtle organic impurities of the air breathed out by the children, partly to the decomposition of organic dirt on the children's bodies or in the room. Such decomposition is normally caused by microbes. Hence, to cleanse a schoolroom properly, it is necessary to destroy the germ-life as well as to remove the visible dirt. This is why periodic disinfection is advisable, *even when no known infectious disease has been present.*" Children in the infectious stages of one or other of the diseases already mentioned cannot fail to diffuse infectious material, and that that material, if allowed to accumulate on the floors—to become mingled with the dust and to be inhaled by the children—must give rise to fresh cases of the disease is a proposition which should be evident to all unbiased minds.

I am strongly of opinion that the method of disinfection to be employed should be the liquid spray, which is preferable to gaseous disinfection for two reasons: (1) Because the liquid disinfectant comes into actual contact with the infected matter and (2) because the liquid disinfectant tends to prevent dust —the common vehicle of infection—from rising into the air. Fumigation is used still in many places in spite of the repeatedly demonstrated fact that this method cannot be relied upon to destroy the organisms of disease. A better control can be obtained by more direct measures against the organisms of disease and the envelope of dirt by which they are habitually surrounded and conveyed, and this is why the liquid spray should always be employed in preference to fumigation.

Care must be taken that the disinfectant employed be efficient; otherwise disinfection will be merely a waste of time and money. With the aid of modern scientific methods, the selection of an efficient disinfectant need present no difficulty, for by means of the Rideal-Walker test it is possible to determine the germi-

cidal efficiency of any preparation and thus convert disinfection from a speculative and frequently useless process into a reliable and scientific method of preventing the spread of infection. It may be well to explain here that by the Rideal-Walker method the germicidal value of a preparation is arrived at by dividing the strength of the disinfectant under test, which will kill a certain organism in a given time, by the strength of pure carbolic acid required to kill the same organism in the same time and under exactly similar conditions. For example, if a 1 in 2,000 solution of disinfectant X will kill a certain strain of typhoid bacillus in five minutes and a 1 in 100 solution of carbolic acid will kill the same organism in the same time, (and at the same time) the carbolic acid coefficient of X is $2,000 \div 100 = 20.0$. Similarly, when dealing with a disinfectant of lower bactericidal power than carbolic acid, if a 1 in 70 solution is required to perform the same task as a 1 in 100 solution of carbolic acid, the coefficient is $70 \div 100 = 0.7$.

Disinfectants selected for use in schools should be

(1) Inexpensive,
(2) Highly efficient,
(3) Non-poisonous.

The importance of (1) is obvious. The importance of (2) lies in the fact that a disinfectant of high efficiency will bear a correspondingly high dilution. When working with a high dilution—such as 1 in 500—there is complete absence of the nauseating odor and injury to woodwork, etc., inseparable from the use of the low dilutions called for in the case of disinfectants of low efficiency. As regards (3) in view of recent fatalities through the use of poisonous disinfectants it will surely be conceded that given equal efficiency the non-poisonous is always to be preferred to the poisonous; and, it may be added, there are non-poisonous preparations available which equal in germicidal efficiency bichloride of mercury, the most powerful of the toxic variety.

Having selected a disinfectant possessing the above mentioned characteristics, the next step is to decide the proper dilution in which to apply it. The following simple rule will settle this point: Taking 1 part of pure carbolic acid in 25 parts of water, as the recognized working dilution employed by hospitals, etc., for general disinfection, the corresponding dilution of any preparation submitted is obtained by multiplying this factor by the coefficient of the article in question. Thus, with a disinfectant having a coefficient of 5, the corresponding dilution would be 1 in 125; where the coefficient is 20, the corresponding dilution is 1 in 500.

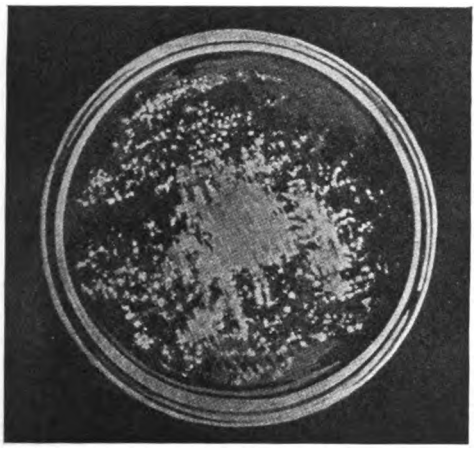
Disinfection should be carried out in the following manner: When school is over for the day, the floor of each classroom should be moistened with the above solution by means of one of the modern sprinkling-cans with specially fine rose designed for this purpose, and swept in the usual manner while still damp. The desks and seats should be dusted with a cloth wrung out of the same solution. Dry dusting and sweeping should on no account be permitted; they merely displace the bacilliferous dust, which, after floating in the air for a time, settles again on the floor and desks. Once a week the walls to a height of six or seven feet from the ground should be moistened with the same preparation by means of a spraying machine; seats, desks, hat and clothes pegs should be treated in the same manner, particular attention being paid to the last named, while care should also be taken that the tops of the cupboards and other inaccessible places where dust may collect are thoroughly wetted with the solution. Every quarter the spraying operations should be extended to include all parts of the walls and ceiling.

The practical value of floor disinfection may be gathered from the following experiment: A certain area of floor space was divided by a chalk line, and both halves were swabbed with water containing a strong culture of B. prodigiosus (a bacillus much used by bacteriologists in experimental work by reason of its distinctive coloring). One half of the space was thoroughly sprinkled, by means of one of the fine rose sprinkling cans above referred to, with a 1 in 500 solution of a disinfectant having a Rideal-Walker co-efficient of 20 and so left until the following morning; the other half was sprinkled with water only. Two agar

plates (as used by bacteriologists in the growth of germs) were then smeared with swabs taken from both the disinfected and non-disinfected spaces, with results clearly shown in the above illustrations. On plate 1, which was smeared with the swab taken from the non-disinfected floor space, crowds of colonies of bacteria may be seen, whereas on plate 2, treated with the swab taken from the disinfected area, no growth is visible.

If further argument in favor of routine school disinfection be required, it may be found in the fact that *the evil effects of breathing bacilliferous dust cannot be gauged solely by actual absence through illness.* Many of the minor ailments so contracted may be too mild to warrant absence from school or to call for immediate treatment, while being serious enough to lower the vitality of the child to such an extent as to affect its receptive capacity during school hours. Children are legally enforced to attend school and it surely follows that they should be allowed to do so without encountering any danger which is avoidable by ordinary measures of human precaution.

The position may be summarized as follows: The presence of a certain proportion of infectious children is admittedly unavoidable. These infectious children must diffuse a certain amount of infective material, the removal of which by means of frequent and thorough washing of classrooms and cloakrooms is, on the ground of expense, impossible, or is at least so regarded by the education authorities; the daily sprinkling of the floors with a disinfectant solution offers an inexpensive and easy method of minimizing the harmful effects of that material during the intervals between cleansing. Viewed in this light—*not as a panacea or as a substitute for cleansing*—it is difficult to understand why the benefits to be derived from this process should not appeal more generally to those responsible for the management of our public schools.



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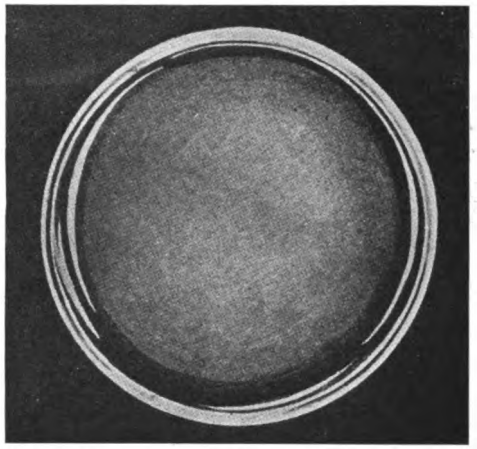

Photos by Jessie Tarbox Beal

DISINFECTED PLATE