PERSONAL CONTACT IN RELATION TO THE SPREAD OF INFECTIOUS DISEASE AMONGST SCHOOL CHILDREN.*

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IT has long been recognized that since compulsory education has been in force in this country the public elementary schools have been extremely important factors in aiding the spread of the commoner infectious diseases. Outbreaks of one disease or another have frequently been traced to the presence in school of some child whilst in an infectious condition. Of late, owing partly to considerable activity on the part of various individuals interested in the sale of certain disinfectants, and partly to some sensational articles in the lay and the medical press, the importance of personal contact as the paramount factor in the spread of infection in schools has been somewhat obscured, whilst an undue prominence has been given to the danger of infectious dust and dirt on the floors and walls of the class-rooms, as well as to infected articles of school use. Without in any way denying the possibility of occasional infection by these means, it is my conviction that such indirect infection should be considered only when all possibility of direct personal contact has been eliminated. That possibilities of direct personal infection in the schools exist to a degree not generally known I hope to be able to show in this paper. My remarks and the figures quoted in this paper are restricted to the following five diseases, viz.: scarlet fever, measles, chicken-pox, whooping-cough, and mumps, no reference being made to such communicable diseases as ringworm, impetigo, and ophthalmia, all of which are very common in schools; nor to diphtheria, which fortunately is not very prevalent in Liverpool.

There has been in Liverpool now for some years, an arrangement between the Education and the Health Departments whereby teachers and school attendance officers notify the medical officer of health direct, cases of infectious diseases occurring amongst the scholars or at their homes, as soon as the cases come to the knowledge of these officials. For the last two years the teachers have at the request of the medical officer of health also indicated the classes in which the infected scholars have been taught, and have specially drawn the attention of the Department to such cases of infectious disease as have been detected in school and sent home. On the visit of the sanitary inspector to the homes of infected scholars the day following the notification further particulars are obtained; amongst them, the date when the first symptoms of the disease were observed and the date of the last attendance at school. The daily list prepared by the clerk gives all this information in tabular form, so that it is possible to tell at a glance what children have been present in school in an infectious condition, and what class or classes they attended. In the preparation of this tabular list it has been taken for granted that a child whose date of last attendance at school was subsequent to the date of onset, was a child attending school in an infectious condition. Difficulty arises, however, when the alleged date of the onset of symptoms and the date of the last attendance at school coincide. In this case the child may or may not have been infectious whilst at school. In scarlet fever, the onset being usually somewhat sudden and severe, the probability is that the majority of the cases in this group are not infectious in school, but in whooping cough and the milder forms of measles, chicken-pox and mumps where the disease may commence insidiously and without a definite onset, a large proportion of the cases are almost certainly infectious in school for some time before they are noticed. This is all the more likely when one considers how unobservant of the symptoms of disease the parents too frequently are, the result being that the sanitary inspector's notes often post-date the commencement of the illness. This group of cases must therefore be taken into consideration and a certain proportion of them must fairly be regarded as having been at school whilst infectious.

In addition to the above we must consider some children who return to school before a cure is affected, a few also in certain diseases, who, as in diphtheria, may possibly be carrier cases, and a perhaps not inconsiderable number of missed cases. These last include those cases in which the mildness of the symptoms leads neither parents nor teachers to suspect an infectious ailment, as well as some cases which, though the parents know or suspect them to be infectious, yet through fear of the loss of a prize medal for attendance, or of injury to business, or from some other cause they insist upon attending school in the hopes

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that the attention of the teachers will not be drawn to their condition.

It is probable that these last groups do not comprise a large number of children, but the damage they may do is considerable, owing to the longer period during which they are brought into contact with the other scholars.

I have recently analysed the returns for Liverpool, so far as they relate to the year 1908, and the following table summarises the results for the five diseases before mentioned, though for obvious reasons carrier cases and missed cases are omitted.

The main headings have been sub-divided into the age periods, under 7 and 7 years and over, this sub-division roughly corresponding with the division into children attending the infants' departments and those attending the upper departments. The column headed "Total Cases known to have been Infectious in School" includes those which were detected as well as those which escaped detection by the teachers. The column headed "Doubtful Groups" refers to those cases of which the alleged date of onset coincided with the date of the last attendance at school.

It will be noticed that 856 cases of these diseases were detected in school and sent home, or about 7 per cent. of the total cases, whilst in addition another 880 cases are known to have been in school in an infectious state, though they escaped recognition by the school officials, thus bringing the total up to 1,736, or 14·2 per cent. of all the school cases for the year. For the undetected cases the duration of the infectious period whilst they were in school varied from one day to one or more weeks in some cases of scarlet fever and whooping-cough. When we compare the proportion of the children on the rolls known to have been present in school in an infectious state under the age of 7 with those over that age, we find that in each disease there is a much greater preponderance amongst the younger children, the proportion varying from slightly more than 2 to 1 in the case of scarlet fever to 22 to 1 in measles, whilst for all diseases it is 7 to 1. The percentages of the scholars on the rolls infectious in school were for all diseases 3·5 per cent. under 7 and ·5 per cent. over that age, or 1·3 per cent. for all ages.

The total percentages in the table are probably above the average owing to the prevalence during 1908 of mumps, a disease with which neither parents nor teachers have been of late familiar, and which in its mildest form is extremely difficult to be certain of. But children with obviously swollen cheeks frequently escaped the notice of the teachers until whole departments became involved in the epidemic. On three occasions I found in the infants departments between 25 and 30 children suffering from mumps of varying degrees of severity taking their lessons with the other children, and not even suspected by the teachers, although numerous cases of mumps were known to exist amongst the scholars of the departments and amongst the children of the neighbourhood. The result was that but few children in these departments escaped, whereas a reasonable amount of observation on the part of the teachers might have prevented the epidemic. The figures for mumps were as high as 30 per cent., whilst scarlet fever, which showed the smallest number detected in school, had 5·5 per cent. of the total school cases in school in an infectious condition.

If we consider a fair proportion, say a quarter, of the cases in the column headed "Doubtful group," to have been infectious in school, the total percentage would be brought

TABLE SHOWING INFECTIOUS CASES PRESENT IN SCHOOL DURING 1908.

Disease.	No. of School Cases.	Cases detected in School.		Cases infectious in School but not detected.		Total Cases known to have been infectious in School.		Percentage of School Cases known to have been infectious in School.			Doubtful Group, all ages.
		Under Seven.	Seven and over.	Under Seven.	Seven and over.	Under Seven.	Seven and over.	Under Seven.	Seven and over.	All Ages.	
Scarlet Fever	2386	22	22	40	47	62	69	6.3	4.8	5.5	625
Measles	2920	85	8	99	14	184	22	7.7	4.0	7.3	1114
Chicken Pox	1341	44	12	77	36	121	48	12.6	12.3	12.6	503
Whooping Cough	2224	51	6	253	59	304	65	16.2	17.5	16.3	911
Mumps	2846	428	178	146	109	574	287	32.5	26.5	30.0	1072
Total	11717	630	226	615	265	1245	491	15.2	12.2	14.2	4225

up from 14·2 per cent. to 22 per cent., or, in other words, out of five infected school children one was present in school in an infectious condition.

With regard to the spread of infection caused by these children, the cases detected in school will in some cases have done but little harm, if they have been recognized in the initial stages of the disease by wide-awake teachers. But children who, though infectious, escape recognition until, perchance, physical inability or the occurence of a second case in the home prevents their attendance, are probably the ones most responsibe for the spread of infection.

What has been termed the sanitary conscience of the teachers is often tested very severely and needs much encouragement and stimulus. The teachers know that a great deal, including the Government grant, the head teachers' salaries and the number of assistant teachers allowed, depends to some extent upon the average attendance of the scholars, whilst, in addition, many teachers have the feeling that by keeping up a good attendance they will stand well with the committee. With all these inducements to keep up the average attendance it is not to be wondered at that teachers here and there are met with who are most reluctant to send any child home unless the evidences of infection are so obvious that it would be impossible to overlook the case. But cases of doubt are frequently met with, and on such occasions there can be no two opinions as to the proper course to adopt. The child should at once be taken out from its class, sent home and excluded until the disease has developed and the child has been cured, or until the doubt has been cleared up.

It would be of great value from the public health, as well as from the educational and financial point of view, if head teachers, but more especially the head teachers and first assistant teachers in the infants' departments, could have, soon after being appointed, the opportunity of receiving some clinical instruction at a fever hospital. Probably in two or three demonstrations at a hospital with beds for measles, whooping cough, scarlet fever and diphtheria, and perhaps one at a skin hospital, they would learn enough to stand them in good stead all through their teaching career, and such knowledge would react in the future for the benefit of the scholars by saving many from exposure to infection, and would materially assist in keeping down epidemics. At these demonstrations teachers would be exposed to no more risk of infection than they are almost daily in their schools.

It is not instruction in the differential diagnosis that is desired, so much as the recognition of the ordinary symptoms of the commoner infectious and contagious diseases. Obviously, the earlier a case is discovered and excluded the less the danger to the other scholars.

Dr. Kerr, in one of his Annual Reports to the London County Council, speaking of two schools in London, says, "much was done by the head-mistresses, who were possessed of special knowledge, to prevent the spread of measles in their schools, and these schools suffered much less than their neighbours solely from this reason. A sound hygienic knowledge on the part of mistresses in infant schools would be of immense use, apart from the question of school closure, in keeping down infectious disease."

Whilst it is impossible to say definitely how many of the children have been infected in the schools, a very considerable number of the cases are known to have been exposed to infection there.

So far as it is possible to judge from the evidence at my disposal, schools and neighbours' houses rank first in importance as centres where infectious diseases amongst school children are spread, next coming courts and streets, whilst the homes played a comparatively unimportant part.

Having shown that the presence of infectious children in the schools is a common occurrence, it is necessary briefly to consider the methods by which the infection may be carried to the susceptible child. Two methods of spread, namely, by direct and by indirect infection, have been suggested; but whilst all are practically agreed in recognising the former method, the latter method has been the subject of some controversy. Two factors are essential for each, the infectious child at school and the susceptible child at school; but the latter method requires the infectious child to infect the dust (or some article of school use) and the susceptible child to be dosed with the dust, whilst by the former method the infectious child can pass the infection direct to its susceptible classmate. Putting aside indirect infection by means of pencils, slates, etc., which, though quite a likely method, probably very rarely occurs, let us turn our attention for a short time to the school dust.

A condition analogous to that found in schools is occasionally met with in the scarlet fever wards of an isolation hospital.

It will probably be the experience of many of the members of this branch, that occasionally a child is admitted, say, at the end of the first week of a mild attack, with no very definite symptoms, but with the history of a rash, sore throat and temperature. The medical officer, taking into consideration the history, &c., decides to put the child into the scarlet fever ward, where it is kept in bed for perhaps a fortnight. Then the child is allowed up, and perhaps a few days later develops a typical attack of scarlet fever, which in some cases may be labelled with truth "relapse of disease." In other cases, however, reconsideration must lead the medical officer to call in question his original diagnosis, and to regard the so-called relapse as in reality a primary attack. Why, and possibly in this connection it matters little whether this be the primary attack or a relapse, although he has been in the ward for two weeks inhaling dust, which if infectious at all, must be far more concentrated and dangerous than is ever likely to exist in a school class room, should this susceptible child become infected only after it has been exposed to the danger of personal contact with the other children in the ward?

In the case, too, of secondary infection occurring in a ward, any spread of the infection is usually confined to those children who are up and about and who have had opportunity of coming into close contact with the super-added infection.

Important investigations made a few years ago by Cameron for the Metropolitan Asylums Board into the causes of return cases of scarlet fever and diphtheria, led him to the conclusion that "Very many more return cases were due to personal infection than to defective disinfection," and he further stated that it was his impression that disinfection has not any appreciable effect either upon the number of return cases or of secondary cases which occur at varying intervals after it has been carried out.

Large sums of money are annually spent by many educational authorities upon so-called disinfectants, which, as used in the schools are too frequently merely deodorising liquid soaps. The sensation of having done their best and the comfortable feeling of false security given to the teachers by the use of these disinfectants are often perhaps the only practical results of this expenditure.

It is not desired to deny the possibility of the presence occasionally of a small amount of infectious material from time to time in the dust, but probably this does not exist in a virulent form for any length of time outside the body, and in any case its admixture with the rest of the dust would so dilute it that the actual quantity inhaled by any scholars would be infinitesimal and practically negligible, seeing that the question of dosage is an important one.

But even should it be proved that the dust may at times be infectious, what is called for is its removal rather than its attempted sterilisation. Daily damp sweeping with the use of the damp duster in the mornings, frequent scrubbing of the class rooms and plenty of fresh air are adequate to remove or to render harmless the small amount of infectious material that may become deposited.

It must be further remembered that the daily removal of every particle of infectious dust leaves unsolved the problem of how to minimise the risks of infection by personal contact. In dealing with this question in which quite a number of different factors are involved, a few suggestions may be made in conclusion:—

1. Teachers should receive special training in the detection of the symptoms of the ordinary communicable diseases, and they should be encouraged to exclude at once all actual or doubtful cases.
2. Rules regarding the exclusion and readmission of cases of infectious diseases and of contacts should be carefully devised, special stress being laid upon the importance of the home enquiries.
3. Parents should be educated, by leaflets or otherwise, in respect of their duties and responsibilities with regard to infectious diseases and isolation.
4. The re-introduction of the former "epidemic grant" is very desirable.
5. School buildings should be so planned as to allow adequate floor and cubic space for infants.
6. Proper ventilation, actual as well as potential, should be enforced.
7. The present method of awarding prizes for good attendance requires some alteration.
8. The question of the lower age limit for attendance at school should be reconsidered.