Observations ON NASOPHARYNGEAL EPIDEMICS IN PUBLIC SCHOOLS.*

BY
J. ALISON GLOVER, O.B.E., M.A., M.D.CANTAB.,
M.R.C.P., D.P.H.

CERTAIN semi-isolated communities, which are under strict control, seem to be designed for epidemiological study, and of these the public schools of England offer a unique field for observation. Few communities are more comparable and homogeneous in the age distribution, in the nationality, and in the nurture of the individuals comprising them. Yet, with the exception of the classical work of Clement Dukes, little systematic epidemiological work seems to have been carried out with this matchless material.

Surgeon Commander Dudley has, however, shown what can be done with somewhat similar material, and his two reports on the Royal Naval School at Greenwich, based largely upon the careful records of Surgeon Captain P. M. May, R.N., and published by the Medical Research Council,¹ are, I think, even more important contributions to school epidemiology than Dr. Clement Dukes's studies at Rugby.

As early as 1905 Dukes showed that the public schools were suffering an increased number of infectious diseases; this was largely due to the greater care exercised at home and at preparatory schools in preventing infectious disease, and to the consequent greater proportion of boys who reached public schools unprotected by previous attack. There is, I think, a general impression that a further post-war increase has taken place. Other factors may be concerned in this post-war increase, such as: (1) the greater prevalence of influenza since the epidemic of 1918; (2) the great increase in the number of boys sent to public schools since the war, causing overcrowding in classrooms and dormitories; and perhaps (3) the greater attention paid to what we may term (with Dr. Simey) "febricula."

I think all agree that most of the infectious diseases now prevalent in public schools are spread by nasopharyngeal or "droplet" infection, but I doubt if we all realize the enormous proportion of the total illness caused by direct nose-to-nose and mouth-to-mouth infection. The accompanying diagram shows the number of boys

Chart showing the large proportion of admissions for diseases usually conveyed by nasopharyngeal "droplet" infection to total admissions for diseases of all kinds. Shaded portions="droplet" infection; black portions=all other diseases and accidents.

all boys ill enough to go to bed being admitted direct to the sanatorium; this fact partly explains the somewhat high admission rates in this case.

Let us now divide the "droplet" infection into the several diseases. The figures are shown in Table I.

On the whole, the ordinary infectious diseases of child-

TABLE I.—"X" School "Droplet" Infections.
Admissions per cent. of the Total Boys per Term to the Sanatorium;
School without House Sick-rooms.

Year and term.	Total admissions.	Due to other diseases and accidents (non-repiratory).	Total due to droplet infections.	Droplet infections.					
				Feverish cold P.U.O. chill.	Tonsillitis, influenza throat, post-nasal catarrh.	Influenza.	Measles.	German measles.	Pneumonia.
1924.									
1	53	1	52	1	4	18	21	—	5
2	6	—	4	1	3	—	—	—	—
3	9	—	9	8	1	—	—	—	—
1925.									
1	43	1	42	1	1	40	—	—	—
2	15	2	13	8	5	—	—	—	—
3	57	4	53	7	1	—	—	44	1
1926.									
1	25	4	21	8	2	—	10	—	1
2	0	1	19	3	15	—	—	—	—
3	34	7	27	8	3	13	—	—	—
1927.									
1	46	7	39	1	1	34	—	—	3
2	39	10	29	5	23	—	—	—	1
3	33	8	25	7	18	—	—	—	—

hood occur less than would be anticipated, although measles comes twice in the four years, whilst German measles comes only once, diphtheria is absent, and mumps, chicken-pox, and scarlet fever are absent save for one or two sporadic cases. The absence of scarlet fever is remarkable in view of the fact that the tonsillitis at this school has been shown bacteriologically to be due mostly to infection by haemolytic streptococci, often of scarlatinal type.

Influenza, on the other hand, occurs in epidemic form in three out of four years in the Lent terms, and once as "gastric" influenza in a Christmas term. For comparison I will refer to a diagram from Dudley's² statistics of the Royal Naval School, showing a somewhat similar epidemic prevalence of influenza, whilst there is a fair amount of tonsillitis, which was so prevalent at "X" (it must be noticed that tonsillitis has only been recorded from the summer term of 1916). There are several interesting differences: scarlet fever and diphtheria appear in epidemic form, but measles and chicken-pox are almost entirely absent (nothing under 1 per cent. is shown) and German measles appears once, and then with an attack rate of only 5.5 per cent. This comparative absence of measles, German measles, and chicken-pox may perhaps be explained by the fact that the Greenwich boys come from the public elementary day schools, instead of from private boarding preparatory schools, and so probably have had most of these diseases before their entry at Greenwich, usually at the age of 12. The heading "feverish cold, chill, etc.," is apparently not recorded in the Greenwich statistics.

Dr. Dukes's Rugby statistics from 1871 to 1904 (*Health in Schools*, p. 467) have many points of interest, which include the absence of influenza before 1890, and even after that year the comparatively small size of the attack rates for this disease. Compared with Greenwich, the almost biennial visitation of measles, the frequent appearance of German measles, and the much greater prevalence of mumps, which all tend to offset the comparative absence of scarlet fever and the complete absence of diphtheria, are noticeable. The celebrated "fourth disease" appears in history in 1900.

Returning to the "X" statistics (Table I), large proportions of admissions are due to the following: (1) influenza (28 per cent.); (2) feverish cold, chill, pyrexia, and bronchial catarrh (15 per cent.); (3) tonsillitis 20 per cent. of all admissions for the four years under review. The three added together and compared with Simey's³ published figures for "febricula" at Rugby (which term he uses to include all three), even after allowing for the absence of house sick-rooms at "X," show an increase, due in part to a persistent infection with haemolytic streptococcus, which has been endemic at "X," but partly due, I think, to the three factors already suggested.

Some apparently regard it as almost impracticable to distinguish between epidemics of influenza and those of febrile colds, but we should try, though difficulty often arises.

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† Most of my information is confidential; the names of schools are given only when statistics are quoted from published work. I am thus unable to give the names of the many ladies and gentlemen to whom I am indebted for information, but whose help I very gratefully thus acknowledge.

THE COMMON COLD.

Dr. Lempriere⁴ states that colds and feverish catarrh account for 25 per cent. of the admissions to the sanatorium—excluding epidemics of influenza. This agrees with the figures of the causes of absence for six public elementary schools in Sheffield, where 30 per cent. of the attendances lost on account of illness were due to coughs, colds, bronchitis, etc. These figures covered a period of eight weeks in February and March, 1921, and showed that 80 per cent. of the absence was due to illness, confirming the opinion that in public elementary schools roughly 10 per cent. of school time is lost owing to illness. In Sheffield 10 per cent. of the sick absence was due to zymotic diseases, 6.7 per cent. to contagious diseases, and 30 per cent. to coughs, colds, bronchitis, etc., while 3.8 per cent. was due to sore throats. The period in question was not one of influenza prevalence in Sheffield.

Dr. D. K. Brundage⁵ has recently published a valuable paper analysing the sickness records of the Edison Company of Boston for the ten years ending December, 1924, and showing the comparative importance of the common cold and the other respiratory diseases in producing disability in adults.

These duration figures correspond fairly with figures in English public schools, the usual time in sanatorium for influenza cases being about ten days (1925, 10.35 days; 1926, 11.78 days; 1927, 9.36 days). Appended is a table of comparison between the Edison experience and that at "X."

Annual Experience per 100.

	Edison Company, Boston, ten years ending December, 1924, all absences of one day or over due to sickness.	"X" school four years ending December, 1927, all admissions to sanatorium.
Due to all diseases ...	104	95
Proportion due to respiratory diseases	54 per cent. of all absences	68 per cent., or 88 per cent. if measles and German measles be included.
Days lost per absence for influenza	9.8	Approximately 10.*

* Calculated from three years' experience at "Y" school.

INFLUENZA.

We are often in doubt whether an epidemic of febrile catarrh is influenza or not, but, as a rule, when the real epidemic comes there is no doubt about it; the character of the epidemic is a better guide even than the clinical character of the case. The true influenza epidemic has an explosive character, which was early remarked upon. Sir Thomas Watson wrote, in 1833: "On April 3rd I saw the first two cases that I did see of the influenza; all London was smitten with it on that and the following day." A diagram was shown illustrating this explosive character in a school epidemic reported on by Dr. Copeman.⁶ A similar explosive epidemic may be witnessed in a day school. In 1890, for example, half the boys of Chesterfield Grammar

School were attacked by influenza on the morning of Monday, January 27th.

High attack rates are very common, and in certain houses I have known the attack rate reach 95 per cent. There seems to be little or no correspondence between the height of the attack rate in an influenza epidemic and the prevalence of complications, such as pneumonia and otitis media. The pneumonia and otitis media are, in fact, secondary epidemics which may or may not occur. Thus, in 1890,⁷ on the training ship *Shaftesbury* 52 per cent. of the boys were attacked with influenza in eight days, but no case of pneumonia occurred. In the following April (1891) there was another epidemic; only 25 per cent. were attacked, but there were five cases of pneumonia. Dr. Lempriere has said true influenza is beyond the control of the school medical officer, but that this ought not to apply to that most persistent endemic condition, pyrexia of unknown origin (P.U.O.).

We must now ask ourselves if there is any immunity to be obtained against influenza; does, for example, a previous attack, or the use of vaccine, imply immunity? In the great epidemics of 1918 and 1919 there seemed to be evidence that a previous attack did confer some immunity against one or more of the subsequent waves of infection. Thus, at King's College School, Cambridge,⁸ where 100 per cent. of the boys were attacked by the epidemic in July, 1918, none were attacked in the epidemic of November, 1918, but 58 per cent. were again attacked in March, 1919. A somewhat similar sequence occurred at Rugby.⁹ In the July epidemic of 1918, 37 per cent. were attacked, in the November epidemic of the same year only 3 per cent., whilst in the March, 1919, 23 per cent. were attacked, those who had the disease in the July, 1918, epidemic having practically the same attack rate as the school as a whole. These attack rates include only admissions to the sanatorium. Dr. Simey,¹⁰ in 1922, considered that partial and temporary immunity is conferred by an attack of febricula against influenza, and by influenza against febricula. I am interested to know if he still holds this opinion, for in recent years it has seemed to me that no immunity is conferred by attack, but rather the reverse. In several epidemics recently there has been a tendency to a second attack only three or four weeks after the first; nearly 50 per cent. of the boys in one house had definite second attacks in the same term in one epidemic which I investigated in February–March, 1925. Here is the experience of a preparatory school of fifty-eight boys. In the Christmas term of 1924, 52 per cent. of the boys were attacked with influenza. In the Christmas holidays and the following Lent term twenty of those thirty who had been attacked in the Christmas term were again attacked by influenza; whilst of the twenty-eight who had escaped in the Christmas term fourteen, or 50 per cent., were attacked, so that the figures are against immunity being conferred by the first attack.

There is pretty general agreement that true epidemic influenza cannot be prevented by vaccines, but there is considerable difference of opinion as to whether the common or feverish cold, P.U.O., or febricula can be prevented,

TABLE II.—Influenza Attack Rates upon all Boys, Inoculated Boys, and Uninoculated Boys respectively.

School Term and Year.	All Boys.				Inoculated Boys.			Uninoculated Boys.			Vaccines used and when given.
	No.	Per cent. inoculated.	No. attacked.	Per cent. attack rate.	No.	No. attacked.	Per cent. attack rate.	No.	No. attacked.	Per cent. attack rate.	
Eton: Lent, 1927. [After Attlee]	1,019	30	443	44	302	149	49	717	294	41	Various "stock" mostly in Christmas holidays. Parke Davis A.C. 95. "Public School" 120
Haileybury: Lent, 1927. [After Lempriere]	530	40	101	19	215	34	16	315	67	21	
"X" Lent, 1927 ...	447	32	163	36	144	54	38	303	109	36	Various in Christmas holidays.
"X" Lent, 1928 ...	463	71	133	30	331	102	31	132	31	24	Special M. of H. in Nov., 1927.
"Y" Lent, 1926 ...	380	56	44	12	212	27	13	168	17	10	Various in Christmas holidays.
"Y" Lent, 1927 ...	383	91	72	19	347	62	18	36	10	28	Special M. of H. Vaccine given in November term, 1927.
Totals ...	3,222	48	956	30	1,551	428	28	1,671	528	32	

TABLE III.—"Y" School Bacteriological Findings.

Year.	No. of Swabs.	Pfeiffer's Bacillus.		Pneumococcus.		Types: I. II. III. IV.	Other.
		Positive to.	Carrier rate.	Positive to.	Carrier rate.		
1920	19	6 (all serologically identical with 1 Lister strain)	32	11	58	Not determined.	Meningococcus in 1.
1925	43	20	46	27	63	1† 0 5 21	Meningococcus in 3 (8 per cent.).
1926	52	25	48	24	46	0 0 2 22	Meningococcus absent: haemolytic streptococcus in 1.
1927	43	32 (27 very profuse), 72 per cent. no indol formation	73	28	65	1† 0 8 19*	Haemolytic para-influenza bacilli in 2, haemolytic streptococcus absent, meningococcus absent.

* Of these, 7 agglutinated with monovalent serums prepared from strains isolated from cases of pneumonia (4 Pn 85; 1 Pn B; 1 Pn 10; 1 Pn 160), and the other 12 were not serologically identified.

† The two Type I pneumococcus were found in carriers who had not had pneumonia.

and whether the incidence of complications such as pneumonia and otitis media can be diminished.

As to the efficacy of vaccines in the prevention of influenza or febricula in public schools there is some little published evidence of a somewhat conflicting character: Dr. Lempriere's¹¹ distinctly favourable observations at Haileybury, and Dr. Attlee's,¹² at Eton, which are much less so. By the kindness of Dr. Graham Forbes I have seen the summary of the evidence produced by a questionnaire sent out by the Medical Officers of Schools Association. In one or two epidemics, with the assistance of my colleagues Dr. Griffith and Dr. Scott, I have in two schools tried out special vaccines made from strains of organisms actually found at the schools in recent outbreaks. The evidence is conflicting and I think entirely inconclusive. One thing must, however, be remembered. The scales are weighted against vaccines by the fact that boys specially prone to influenza and colds are more likely to be vaccinated than boys who do not suffer from colds. In answering the questionnaire thirteen medical officers thought that vaccines did good and thirteen others considered them of little or no value. Strangely varying opinions were expressed. One medical officer, for example, says: "Cases of catarrh are fewer than in previous years. I believe the inoculations have done much good." Whereas another says: "No inoculations—only thirty-eight out of school, average four; if the whole school had been inoculated low incidence would have been attributed to this. I do not consider prophylactic procedure justified by the figures." One observer considers that "vaccines are useless in the presence of chronic nasal trouble"; whereas another observer states that he has "particularly noted good results from vaccines in adenoid cases." On the question of the prevention of complications, in one epidemic I had the opportunity of observing in the Lent term of 1927 a school of 450 boys among whom there were 163 cases of influenza (an attack rate of 36 per cent.) and 15 cases of pneumonia, five (that is, all those which were typed) of which were due to Type I pneumococcus, whilst the attack rate of the inoculated (32 per cent. of the total population had been inoculated with various stock vaccines) and of the uninoculated (68 per cent.) was almost exactly the same. None of the boys, however, who developed pneumonia had been inoculated. In November, 1927, 71 per cent. of the boys of this school were given a special vaccine* prepared in the Ministry's Pathological Laboratory, containing pneumococcus Types I and II, and although an outbreak of influenza occurred in the Lent term of 1928 with almost the same attack rate as in 1927 (36 per cent.), no cases of pneumonia occurred. But the uninoculated 132 boys not only had a slightly lower attack rate for influenza (23 per cent.) than the 319 inoculated boys, whose attack rate was 30 per cent. (boys only inoculated once omitted), but they also, like the inoculated, had no cases of pneumonia. In another school in the same term, where 90 per cent. of the total population had been vaccinated with a special vaccine of Pfeiffer's bacillus with pneumococcus Types I and II, prepared in the Ministry of

Health Laboratory from strains similar to those found in the previous year's epidemic, and administered in the previous November by the school medical officers, there was an almost complete absence of complications; but that had been true also of two previous epidemics, in one of which stock vaccine had been used for 56 per cent. of the total population, and also in much more severe previous epidemics of which we had no information as to the vaccinal condition. My own feeling with regard to vaccine against influenza and febricula is that the question is still entirely open, but if it is determined to recommend prophylactic inoculation against influenza, colds, and their sequelae, it is important that the course of vaccines should be given before the epidemic prevalence begins, preferably in November. This means that the injections should be given at school, and this requires a good deal of rearrangement of time-tables, but my experience is that if the injections be left to the Christmas holidays they are as a rule deferred to the period of epidemic prevalence which usually begins about January 14th to 21st.

Bacteriological Findings.

Drs. Griffith and Scott have examined many nasopharyngeal and tonsillar swabs taken by me in school epidemics. At one school, "Y," epidemics in four years were studied, the findings being set out in the following table:

Previous to the 1927 investigation a vaccine (Pfeiffer's bacillus with pneumococcus I and II) prepared at the request of the school authorities in the Ministry's Pathological Laboratory had been given in November, 1926—that is, before the epidemic season began—to 90 per cent. of the boys.

It is interesting to note that at "X" in the Lent term, 1927, when some fifteen cases of pneumonia occurred in every case (five) in which the pneumococcus was typed, the type found was Type I. Type I is sometimes termed the "pneumococcus of youth."

PROPHYLAXIS OTHER THAN VACCINES AGAINST INFLUENZA.

I am convinced that a more intensive prophylaxis against influenza and epidemic catarrh at the beginning of each Lent term (that is, during January and February) would well repay school authorities. Apart from the experience of most schools and all other experience, the Edison Company's charts, by Dr. D. K. Brundage,¹³ show admirably the periods of maximum incidence in January and February, when it seems that our chief efforts should be made. I recommend a special letter to parents and a special form of certificate for the Lent term. I have not seen any health certificate that mentions influenza or feverish cold, and I suggest that the Lent term certificate might be printed on red paper to distinguish it, and should include a statement that the boy had not had a severe or feverish cold for a week prior to the day of return. I have seen three striking examples of the mischief that boys can do by returning to school prematurely after influenza. Here is one. One of two brothers contracted mild influenza at home in London on January 13th, 1925; the boy travelled by the ordinary school train on January 16th in a compartment with seven other boys, and had dinner in the dining car. The seven boys in his compartment (four

* This vaccine contained pneumococcus Type I, 200 millions in 1 c.cm., pneumococcus Type II, 100 millions; *Streptococcus haemolyticus* (Dochez), 60 millions. A form of tonsillitis due to infection with haemolytic streptococcus (Dochez) had been common in the November term of 1927. The following term tonsillitis recurred in epidemic form, but Dochéz's streptococcus was not identified, although several other strains of haemolytic streptococcus were.

belonging to his own house) and the boy who sat next to him in the dining car fell ill with influenza on the 18th or 19th. His brother, who may have been infected at home, became ill on January 17th. The boys of the house to which this boy belonged almost all suffered severely from influenza, the attack rate being 95 per cent., and many of the inmates had two attacks. The attack rate in this house was by far the highest of any house in the school.

Temperature Taking.—I see no reason why the temperature of all boys should not be taken for the first three weeks of the Lent term, as is done in so many preparatory and girls' schools. Girls are certainly no less susceptible than boys, as is proved by evidence from co-education schools and from orphanages, etc., where boys and girls are under the same roof. Most of the evidence, including the Edison Company's experience before quoted, is, I think, that females are slightly more susceptible, yet the girls' schools appear to escape more lightly than the boys'. This is no doubt largely due to girls usually sleeping in cubicles, and that girls' schools are, as a rule, of more modern design than boys' schools, and partly to their being more under control than boys; but it is also, I believe, very largely due to the practice of taking every girl's temperature every night and morning for the first three weeks of term and to the immediate isolation of any girl with a slight pyrexia. Why a scientific procedure like taking a temperature should be regarded as "coddling" or "fussing" I cannot say.

Isolation of Slight Pyrexia.—The immediate isolation of any severe catarrh, or slight pyrexia, occurring within the first three weeks of term is of great importance.

Early School.—I am strongly of opinion that there should be no work before breakfast during January, February, and probably March, though I should have no objection to a short sprint in the open air. Not only are boys' resistances, I believe, at a lower level before breakfast (admittedly a point difficult of demonstration), but the heating of the classrooms is usually at an even lower ebb—a point which can often be easily shown. I have seen classrooms which started the day at 36° F.

Nasal Douching and Sprays.—Much previous experience with the meningococcus has rendered me sceptical as to whether good results follow the use of nasal douches or sprays. I have, however, met one schoolhouse in which their use appeared to be successful, and Dr. O'Brien¹⁴ has expressed "a considerable amount of faith" in the power of an antiseptic oily spray to give a reasonable amount of protection. Gargling I regard as a harmless procedure in catarrhal conditions, and possibly useful in tonsillitis, but I should not recommend any form of nasal douche or spray as a routine measure for healthy boys; "nasal drill" is less objectionable, but I am not enamoured of it.

Baths.—It seems probable that a proper skin reaction is one of our greatest defensive mechanisms against chill, and I strongly urge, with this end in view, that all hot baths or hot showers should be followed by cold showers. The Scotch douche (alternating hot and cold showers) might be well worth a trial as a prophylactic measure, especially for well-known susceptibles, and artificial sunlight might be worth trying for such boys as are known for their liability to colds.

Diet.—It appears to me important that in the Lent term fresh fruit, particularly oranges, or fresh vegetables such as salads, watercress, etc., should be taken daily.

PREVENTION OF INFECTION.

This is my main theme. Where does infection usually take place? There can be no doubt that by far the majority of infections take place in the dormitories. I have investigated the possibility of infection in classrooms, dining halls, chapels, etc. In comparing class incidence in badly ventilated classrooms with that in better classrooms, I found that the attack rate in the poor classrooms was 38 per cent., in the good 32 per cent., but as the younger boys were, as a rule, in the poor classrooms, and the older classes in the better ones, the age distribution may have accounted for this difference, although it is not always the younger ages which suffer most heavily in influenza epidemics in schools.

In an epidemic which I investigated some years ago,

in a great public school, most of the infection apparently occurred in common rooms, which were used alike for meals, for preparation of work, and for the accommodation of convalescents from influenza; the windows of these rooms could be opened for only a few inches—conditions which not unnaturally caused disastrous results, although the sleeping accommodation was admirable and on the cubicle system.

INFECTION IN SLEEPING QUARTERS.

I am convinced that the main body of infection is conveyed in sleeping quarters. Where else do the infecting boy and the recipient of infection maintain close proximity for as long as the ten hours they spend in the dormitory? Again, the movement of air is less than during the day owing to the cessation of movement and the shut doors, and, unless the ventilation is really efficient, air pockets form (particularly in corners).

Many boys sleep open-mouthed, the nasal filter is short-circuited, and the recipient receives the droplets of secretion containing the infection, particularly when sprayed by cough or sneeze through the open mouth. The way to minimize this infection is, of course, to keep the beds far apart with efficient cross-ventilation.

One of the things which have struck me in public and private boys' schools is the comparative crowding of beds which I have frequently encountered. The Royal Commission on Barracks which reported in 1861 insisted that there should be a distance of 3 feet between the edges of beds, 60 square feet floor space, and 600 cubic feet per bed.

The Board of Education in 1914, in issuing their Building Regulations for Secondary Schools,¹⁵ laid down the principle that there should be a space of at least 3 feet between beds, a floor area of not less than 65 square feet, and an air space of 700 cubic feet for each occupant; that ventilation must be adequate and that it is very desirable that a through current of air should be provided by arranging the windows on opposite sides of the room. Dr. Dukes¹⁶ lays down the standard of 800 cubic feet. Nevertheless in my experience it is quite an exception to find 3 feet space between beds. I have found, for example, six beds in 27 feet of wall space, and this in dormitories which were not cross-ventilated, and I have found dormitories ventilating into each other, and even into classrooms; dormitories with fifteen beds only 1 foot 4 inches between beds, with 52 square feet of floor space. In these crowded rooms direct bacteriological evidence of cross infection with haemolytic streptococcus was found, reminding one of the cross infection with meningococcus which one used to find in an over-crowded barrack room.

In the bed plan of a certain public school dormitory showing the grouping of cases of influenza (attack rate 50 per cent.), it may be coincidence, but the beds are less than 2 feet 6 inches apart, ventilation is "end" and not "cross," and there is much "dead space." In a dormitory from another school the beds are 22 to 18 inches apart, the ventilation is poor, the total floor space only 48 square feet per bed, the effective floor space less. Eleven of the fifteen boys were swabbed, and five of the eleven were carrying haemolytic streptococcus, a carrier rate (non-contact) of 45 per cent. [Both of the plans were shown to the meeting.]

TONSILLITIS.

I have investigated persistent epidemics of sore throat in three schools. In one the condition seemed due to non-haemolytic streptococci and there was a possible connexion with some sanitary defects; the infection at least cleared up immediately these conditions were rectified.

In the other two the infection was due to haemolytic streptococci. In one of these schools it was a long series of "dropping" cases of scarlet fever that caused attention to be drawn to the infection, in the other the tonsillitis was the feature of the cases which attracted attention, and there was only one sporadic case of scarlet fever, although many of the patients with tonsillitis carried strains of haemolytic streptococci which were serologically identified by Drs. Griffith and Scott with strains obtained from cases of scarlet fever. In one term nearly all the cases examined carried a haemolytic streptococcus identical with a strain isolated in New York by Dochez; this strain is associated with scarlet fever, but not, so far as is known, with it in

epidemic form. It seemed possible at the school where the dropping cases of scarlet fever occurred that we were seeing a phenomenon ("the warning rise") rather similar to that seen in cerebro-spinal fever¹⁷ (and possibly in diphtheria)—that is to say that when the carrier rate (that is, the carrier epidemic) reaches a certain height (namely, 20 to 30 per cent.) clinical cases may occur. The observations were, however, too fragmentary for this to be anything but a surmise.

In this school thorough "spacing out" of beds was carried out, together with improvement of the ventilation of the dormitories, and since then no more cases have occurred, six months having now elapsed.

This infection with haemolytic streptococci was in one or two instances, I think, definitely due to unsatisfactory conditions (overcrowding and poor ventilation) in sleeping quarters.

In connexion with tonsillitis the question of milk must be raised. I have only dealt with three samples of public school milk, and all were definitely dirty and bacteriologically bad. Other evidence seemed to show that the milk was not responsible for the tonsillitis, but, apart from this, I should not feel happy as a school medical officer unless either pasteurized or Grade A milk were in use. Pasteurization is best done on delivery at the school premises, as at Dartmouth.

I trust that medical officers of schools will forgive me if I suggest that there are great opportunities for interesting epidemiological study still unexplored in public schools. I suggest as examples:

(a) The epidemiology and bacteriology of otitis media in relation to scarlet fever, measles, influenza, and febricula.

(b) Relative sickness rates of boys' and girls' schools, and of day and boarding schools.

(c) Relative incidence of droplet infections upon children whose tonsils have been enucleated and whose adenoids have been removed, compared with children who have not been operated upon.

The adoption or recommendation of some uniform system of medical records by the Medical Officers of Schools Association would be of great service. I hope that association will renew its activities, which have been so helpful to me in preparing this paper, and keep before its members their paramount duty of devoting as much time and thought to the preservation of health in schools as they do to the care and treatment of the sick pupils. I urge, too, that the modern boy or girl is an intelligent being, and should be treated as such, and encouraged to take an interest and pride in keeping fit. This can be attained without fussing or coddling; public opinion nowhere has greater influence than in schools, and it should be formed to regard the training of the body against infection as being as manly an aim as its training to achieve athletic success or to endure fatigue.

SUMMARY.

In the following summary of my points I advance them not as "conclusions," or as proved by my observations, but merely for convenience.

1. "Droplet" infections are responsible for at least 80 per cent. of all sickness in our public schools. There is a well-marked "danger period"—that is, the first two months of the Lent term.

2. It is probable that no immunity to influenza or febricula is conferred by previous attack, and evidence of the protective value of vaccines is inconclusive. There is, however, slight evidence that some protection may be afforded against complications, particularly pneumonia; the subject deserves more systematic study. Vaccines if given should be administered well before the beginning of the danger period, probably best in November.

3. Intensive prophylaxis during the first half of the Lent term would probably amply repay the trouble. It should include:

(a) Special efforts to prevent boys returning to school after the Christmas holidays infected with influenza or febricula.

(b) Temperature-taking for three weeks.

(c) Immediate isolation of all pyrexias and catarrhs.

(d) No work before breakfast for at least the first six weeks of the term.

(e) All hot baths and showers taken during the day or after games to be followed by cold showers.

(f) Prevention of chill in watching matches, sports, etc.

(g) Increased provision for drying clothes, uniforms, and boots.

4. Infection mainly takes place in sleeping quarters, and proper spacing-out of beds and thorough "cross" ventilation in dormitories is of paramount importance. No school authority has done its duty to its pupils unless it has provided dormitory accommodation sufficient to allow of at least 3 ft. clear space between the edges of beds and thorough and through ventilation. Until these essential wants are met the provision of properly sited, amply spaced, and "cross"-ventilated dormitories should take precedence of all building requirements.

5. Milk should be pasteurized.

[Dr. Glover exhibited a large number of diagrams; of these it has been possible to reproduce one only.]

REFERENCES.

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TREATMENT OF BURNS AND SCALDS BY TANNIC ACID.*

BY

W. C. WILSON, M.B., F.R.C.S. Ed.

BURNS and scalds are accidents of great importance in domestic and industrial life. They are often fatal, or inflict serious incapacity and deformity on those who survive. These serious consequences, together with the comparative frequency of the accidents, constitute a grave problem for the medical profession. The object of this paper is to give a very brief account of the more important studies which have been made in the subject, to review our present knowledge of it, and to inquire into the results of treatment. More especially the recently introduced tannic acid method of treatment is discussed and described, and the results in a series of personally observed cases are presented. For ease of description thermal injuries, either by scalding or by actual burning, will be included under the term "burns."

CLINICAL COURSE AND PATHOLOGY.

A consideration of the clinical course and pathology of the condition is essential to a discussion of its treatment. It is customary to divide the clinical course into three stages, thus: (1) shock, (2) inflammation, (3) healing.

This classification is inadequate and misleading, and we prefer a division into four stages in the following way:

I. Shock ("initial or primary shock").

II. Acute toxæmia ("secondary or toxic shock").

III. Septic toxæmia.

IV. Healing.

Before proceeding to a consideration of these stages we shall refer briefly to the nature and causation of "shock." For a more complete account of the condition reference should be made to the numerous and exhaustive papers published by the Medical Research Committee.¹² The question has been reviewed by Cannon⁴ in relation to experimental traumatic shock, and the conclusion seems warranted that shock resulting from severe trauma, such as war wounds, is of two kinds—namely, "initial or primary shock" and "late or secondary shock," and these

* From the Surgical Clinics, Royal Hospital for Sick Children, Edinburgh, and the Clinic of Professor D. P. D. Wilkie, Royal Infirmary, Edinburgh.