50 per cent. of the total danger sources are thus under observation. It may be of interest to state that in the year 1930 a total of 81,000 animals were reported ill and suspect, 43,880 head of cattle were killed in Prussia as a result of this method, and over nine million marks were paid the owners of the slaughtered animals in the same year as compensation. The owners of herds are in ever greater degree learning to appreciate the economic advantage resulting from the elimination of all tuberculous cattle. This growing interest, coupled with propaganda stressing the value of sending the cattle to pasture as compared with the unhealthy process of keeping them stabled, is resulting in a steady increase in stock free from tuberculosis.

Milk Inspection

Mention should be made of still another extremely important measure against the infecting of man with bovine tubercle bacilli—namely, the official inspection of the milk, and the process of pasteurizing and other methods of applying heat in order to destroy any disease germs contained therein. The new "Reichsmilchgesetz" (national milk law) of 1930 contains drastic provisions concerning the inspection of stock, the methods of milk production, and the sale of milk. An especially important provision of the milk law for decreasing the menace of infection is that every cow furnishing milk to be sold as of certified high quality must come under the scope of the "tuberculosis exterminating method," and that it is also prohibited to use the milk for human consumption, even when boiled, of cows suffering from any form of open tuberculosis or even highly suspect. Another factor in the prevention of infection with bovine tubercle bacilli is the practice, quite common in Germany, of regularly boiling milk for private consumption, especially in the case of milk intended for children.

It is to be hoped that the measures here described will bring about in the not too distant future a reduction to a minimum of the danger that menaces mankind from tuberculous cattle.

IMPORTANCE OF RESEARCH

In conclusion, I should like to point out that the researches being carried on in Germany and other countries into human tuberculosis caused by bovine bacilli are important, not merely as a criterion for the dangers of the bovine bacillus for man, but also as a means of shedding light on many other important tuberculosis problems. This is especially so of the most recent observations on bovine bacilli in the sputum of human adults. Whereas according to the case history at least one-half of the cases of phthisis reported by Munro and Griffith must have developed from an infection acquired many years earlier, in childhood, the cases of pulmonary tuberculosis examined bacteriologically by me are probably all due to an infection acquired in adult years. There is no other explanation for the fact that of my cases of phthisis which were proved or suspected to have been exposed to bovine infection as adults, 20 per cent. were infected with bovine bacilli, whereas in the sputum of 281 other phthisis patients formerly examined in Germany, bovine bacilli were found to be the cause of the infection in only two cases—that is, 0.7 per cent.—and even in these two cases human bacilli were also present. Naturally our figures are as yet too scanty to permit us to form a definite opinion. I am convinced, however, that a systematic continuation of such research work into "bovine phthisis" will furnish us with valuable information concerning a problem which is to-day again claiming general interest—I refer to the question of the importance of childhood infection on the one hand, and of adult infection on the other, in human pulmonary tuberculosis.

THE END-RESULTS OF THE TONSIL AND ADENOID OPERATION IN CHILDHOOD AND ADOLESCENCE*

BY

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We have been asked to deal with this subject particularly from the statistical point of view. First, let us define two things:

1. For brevity, the single word "tonsillectomy" will be used throughout this paper to mean the double operation for the removal of tonsils and adenoids.

2. "End-result" means anything which may result *after convalescence* from the operation is *complete*; therefore all the more immediate risks of the operation are excluded from this paper.

The assessment has been attempted by many authorities, but in view of the vast number of tonsillectomies now performed, it would seem that no more important or urgent subject for a centenary discussion in this Section could have been chosen.

Increased Use of Tonsillectomy

Table I and Diagram 1 show the number of elementary school children officially recorded by the education authorities as operated upon in England and Wales and in London for a number of years. While in London the

TABLE I.—Number of Tonsillectomies Officially Recorded Annually in Public Elementary School Children for London and England and Wales Respectively.

	London	England and Wales
1923	7,656	47,685
1924	8,051	49,436
1925	12,179	60,871
1926	13,165	68,250
1927	14,843	80,548
1928	17,372	92,171
1929	17,186	97,518
1930	18,119	109,738
1931	18,178	—

DIAGRAM 1.—Number of tonsillectomies performed on elementary school children in England and Wales annually, 1923 to 1930. (Board of Education: Annual Reports of the Chief Medical Officer.)

curve shows some evidence of becoming stabilized, the increase in England and Wales is still rapid. This rapid increase (to two and one-third times as many in 1930 as in 1923) has occurred in spite of repeated warnings from the

* Read in opening a discussion in the Section of Oto-Laryngology at the Centenary Meeting of the British Medical Association in London, 1932.

Chief Medical Officer of the Board of Education in his annual reports (especially that of 1923¹¹), that these operations should only be undertaken when absolutely necessary, and that many cases of hypertrophy do not require operative treatment. Maxwell¹ estimates that 250,000 tonsillectomies are performed in this country yearly.

The School Medical Officer for London² says that 6.7 per cent. of all children examined in the statutory age groups (5-8-12) were referred for operation, and that the better facilities for conducting operations have doubtless influenced the examiners in referring cases, no less than the parents in following their advice. The entrant infants provide by far the largest quota—10.3 per cent. boys and 9.2 per cent. girls, compared with 5.4 per cent. 8-year-old boys, 6 per cent. 8-year-old girls, and with 3.2 per cent. 12-year-old boys and 4 per cent. 12-year-old girls. The Council's auriest examined 1,361 "representative" children; 174 had already been operated upon for adenoids, and of the remainder, in only 237 (17.4 per cent.) was the nasopharynx found to be normal. Adenoids were present in 54.9 per cent. with or without tonsillar enlargement, and 15 per cent. had enlarged or septic tonsils. Including those whose adenoids had already been removed, adenoids were or had been present in 67.7 per cent. When a great authority states that in only 17.4 per cent. of "representative" children is the nasopharynx "normal" it is clear that the term is not used in the ordinary dictionary sense, but that a hypothetical ideal rather than a "normal" nasopharynx is the standard he employs.

AGE INCIDENCE OF OPERATION

Although the function of the tonsil is unknown, its natural maximum before, and its atrophy after, puberty suggest that the age at which the operation takes place may be of great importance in the result. Another diagram (not reproduced) compares by percentages the ages of operation in three series: 500 Children's Hospital patients at Great Ormond Street,³ 1,001 elementary school children at Newcastle,⁴ and the 502 cases reviewed by the Medical Committee of the Board of Education⁵ in their Interim Report on Adenoids and Tonsils. In each the maximum is at 6 years; 6 to 7 years is also the age of maximum incidence of the operation in America. Tonsillitis reaches its maximum age incidence at about 10 years and acute rheumatism at 7 to 8.

We estimate that in England and Wales the number of elementary school children who are tonsillectomized before reaching the age of 14 now amounts to 14 per cent. of the whole, and the percentage is rising rapidly. In London it exceeds 33 per cent. In the wealthier public schools of this country the percentage is far higher, and percentages of 65 or over of children tonsillectomized before entry are common.

For twenty-six large boarding schools, with a total child population of nearly 12,000, the average figures are 55 per cent. for boys and 48 per cent. for girls, and are still rising rapidly, the increase during two years (1930-1) being 2.6 per cent. for boys and 4.7 per cent. for girls. These percentages for the children of the wealthy and professional classes are equalled in the United States, where Collins⁶ found that 61 per cent. of the children, from 10 to 14 years, of medical officers of the Army, Navy, and public health services had been tonsillectomized. At a recent meeting¹ in London of forty-six male medical students and recently qualified medical men, it was found that exactly 50 per cent. had been tonsillectomized.

A high proportion of tonsillectomized children is not, however, always a class distinction in an educational institution. A large boarding school with about 900 boys (ages 11.5 to 15.5) of the public elementary school class, where the medical attention is exceptionally good, has now 45.6 per cent. tonsil-

lectomized, whereas a famous public day school with 700 boys has but 44.5 per cent. of them tonsillectomized. In Minnesota,⁷ of 1,328 high school students (11-20 years), 41.3 per cent. of the boys had had their tonsils removed, the corresponding figure for the girls being 33.3 per cent.

The higher incidence of tonsillectomy upon males seems general, and is remarkable as the incidence of tonsillitis and also of acute rheumatism is higher upon females in similar environment.

One-third of 12,530 young white women students who entered the University of California⁸ between 1920 and 1929 had had an operation for the removal of tonsils; one-third were thought to have normal tonsils, and the remaining one-third had "pathologic" tonsils, including remnants of tonsils or buried or projecting tonsils.

In contrast with these high percentages, Dr. Gustav Seiffert,⁹ the medical officer of health for Munich, told one of us this spring that in that city not more than 0.5 per cent. of secondary school children have been tonsillectomized, whilst in the country districts around hardly any children have had the operation. Even in the country districts of south-eastern Missouri only 2 per cent. of school children are tonsillectomized.

ASSESSMENT OF END-RESULTS

Less than half a century ago one of us went to a good preparatory school of fifty boys. That period of life is recalled with extraordinary vividness, and it is almost certain that of those boys not one had had tonsillectomy; nor is it likely that any of the 650 boys of the subsequent public school had had the operation; old school photographs do not reveal any greater prevalence of what is sometimes called the "adenoidal facies" or "mouth breathing" than is seen to-day, and the incidence of infectious disease and particularly of middle-ear disease was certainly no greater. The *Times*, in its recent excellent series of articles on "Fifty Years Ago," included one on changes in public schools, but the author did not mention that, whereas fifty years ago a tonsillectomized pupil was an extreme rarity, to-day he is in the majority.

When we contemplate this change which has occurred in one generation we find that, since we were children, a new disease (curable only by surgery) has apparently arisen, a disease of which the incidence varies from 0.5 per cent. in the town of Munich to 14 per cent. in English elementary school children and to 65 per cent. at a wealthy public boarding school. Although tonsillitis seems to fall fairly equally upon the rich child and the poor, yet tonsillectomy falls four or five times as heavily upon the rich, and when we hear that in only 17 per cent. of children is the nasopharynx normal, it certainly seems time to pause and reckon up the end-results of tonsillectomy. Especially is this felt when it is considered that our experience so far as it has gone, in the highly tonsillectomized public schools in this country, agrees generally with Cunningham's⁸ carefully controlled observations in Californian students. She states that the group of tonsillectomized students gave a history of higher incidence of all illnesses and operations than did either the group with normal tonsils or the group with "pathologic" tonsils, and, further, that the proportion of the amount of illness reported before and after tonsillectomy suggested that the removal of tonsils had little influence in lessening the susceptibility to most infections. No impartial observer would deny that in certain cases tonsillectomy is a valuable operation with most gratifying end-results. "In a properly selected case there is no single operation in children's medicine more successful or that shows such dramatic results as that of tonsillectomy" (Paterson³). By a strange irony the conspicuous success of the operation in such cases has brought about its vain repetition in so many doubtful cases as to imperil its reputation and render it difficult to believe

* Average or mean of observed quantities, usual state or level, *Concise Oxford Dictionary*, 1929.

that there can be justification for so widespread an attack upon a normal structure of the body (Paton¹⁰).

Assessment of the end-results of the vast numbers of tonsillectomies now performed in children is rendered difficult by the variety of diseases for which the operation is performed, by the vague criteria for operation both local and general, and by the difference of opinion as to the most appropriate age to operate. Moreover, the difficulty of marshalling adequate controls is so formidable that fully to discuss it might occupy this whole paper. Shortly, it involves that for every separate condition the age of operation must be taken into account, together with an adequate control series of patients suffering from the same condition but untongillectomized, whilst for every condition (save only disease of the tonsil itself) a second control series of patients suffering from the same condition but with normal tonsils will be required. Further difficulty is introduced by imperfect tonsillectomy, for in most conditions—especially in focal sepsis—remnants of tonsils are more dangerous than the whole unoperated tonsil, and as a large number of operations leave tonsillar remains (49 per cent. according to McLaggan,¹¹ 53.8 per cent. to Paton,¹² 41 per cent. to J. P. Clark,¹³ 73 per cent. to Rhoads and Dick¹⁴), this must be provided for by showing patients with remnants either in a separate control, or including them with the unoperated morbid tonsils control series.

CRITERIA FOR OPERATION

Owing to the vagueness of criteria for operation in many cases, almost any series of tonsillectomies will contain in itself three classes of case: "X," those patients in whom it is certain the tonsils are diseased; "Y," those in whom there is a reasonable doubt as to the tonsils being diseased; and "Z," those in whom tonsillectomy is done as a preventive or curative measure, although perhaps, apart from a slight hypertrophy, the tonsils appear healthy. The proportions in which these classes are present in any series will therefore vary greatly. The Great Ormond Street Hospital³ series would, for example, probably contain a far larger proportion of the "X" class than a series composed of 500 tonsillectomized preparatory or public school boys, many of whom would probably be of the "Y" but most of the "Z" class. In any comparison between a series of tonsillectomized children and any control series, one must remember that the child who is often ill is the more likely to be operated on.

Much work has been done on the subject in America, where the labours of A. D. Kaiser of Rochester, N.Y.,¹⁵ R. L. Cunningham,⁸ and Collins and Sydenstricker⁶ are especially noteworthy. In England the assessment of end-results of tonsillectomy in children has been mainly as to its effects on the incidence of rheumatism, chorea, and carditis, and although the numbers investigated have been smaller than the American, good work has been done by many—Campbell, Close, Fordyce, Gray-Hill, Hunt, R. Miller, McSweeney, Osman, Poynton, Sheldon, A. P. Thomson, Vining, and Warner, to mention but a few. If, on account of the differences in criteria for operation and in control, these many studies can scarcely be compared or treated statistically, we can take the synoptic view, and console ourselves with Stephen's³⁹ words: "All really important matters are decided, not by a process of argument worked out from adequate premisses to a necessary conclusion, but by making a wise choice between several possible views."

The divergence of these "several possible views" is, indeed, very great and by no means new. Ten years ago, for example, H. S. Sington,³⁶ studying from the point of

view of the general practitioner the end-results of complete tonsillectomy in 53 children under 10 years, came to the conclusion that once convalescence after the operation is complete, the child's health is so greatly improved that the practitioner has hardly ever to attend him again; and that the child is not so liable to other and fresh illnesses as one who retains this lymphatic tissue. In the same year, W. W. Stacey,⁴⁰ working upon 235 cases, and excluding the end-results in 66 children who had no symptoms but in whom the operation was performed on physical grounds of enlarged tonsils and adenoid growth alone, stated: "After making every allowance we can only show 50 per cent. of success with a technique as perfect as surgery can be. . . . I am perfectly clear in my mind . . . that operative measures should only be adopted when all else fails."

The last ten years have seen great changes in opinion as to the criteria for tonsillectomy. The adenoidal facies has been shown to have little connexion with adenoids, the "aproxia," so often attributed to adenoids, being really a toxæmia produced by mild but continued antral or ethmoidal sinusitis, or both together. Doubt has been cast upon its value in preventing frequent colds, and chronic mild sinusitis is now considered by some a more important cause of these. Cleminson³⁷ has demonstrated the importance of sinusitis in children, and such papers as those of Bedford Russell,³⁸ Layton,³⁵ and Warwick James and Hastings³⁴ must modify opinion still further.

Different Indications for Tonsillectomy

We can obtain a fair general idea of the relative frequency of the different indications for operation in the vast bulk of tonsillectomies now done under the medical treatment schemes of education authorities from a table given by W. M. Ash,¹⁶ showing the indications in 1,691 cases. Of these children 20 per cent. were operated on for frequent sore throats and tonsillitis; 12 per cent. for frequent colds; 12 per cent. for chest conditions; 11 per cent. for enlarged turbinates (10 per cent. of these having associated deviated nasal septum); 11 per cent. for earache and obstructive deafness; 4 per cent. for tubal catarrh; 6 per cent. had otitis media; 6 per cent. enlarged cervical glands; 4 per cent. had rheumatic conditions; 9 per cent. "systemic and general conditions"; 3 per cent. eye conditions; 4 per cent. "reflex conditions."

Thus, the indications in about 44 per cent. of the operations were frequent infections of throat, nose, or chest; in 20 per cent. deafness or ear trouble, and in 4 per cent. rheumatism—in all about two-thirds of the cases. Perhaps the end-results in such cases seem somewhat easier to assess statistically than the end-results of operations done for "systemic and general conditions."

Epidemiological Observations in Public Boarding Schools

The records (as far as they have gone) of sickness in the schools co-operating in the investigation into school epidemics seemed to afford an opportunity to estimate provisionally the effect of tonsillectomy on the incidence of colds, sore throats, and ear disease. These records of all cases of sickness entailing one or more days' loss of school work relate to two and one-third years in a population of some 14,000 pupils, for the most part between the ages of 13½ and 18 years, in twenty-seven large boarding schools and two large day schools. Slightly more than half of the pupils have been tonsillectomized. We gratefully acknowledge the kind permission of the Committee of the Medical Research Council to use some of these interim findings.

Full study of "recurrent" colds and sore throats occurring in the same individual must await the completion of the inquiry, and we wish to stress the fact that

these findings are provisional, and may be modified by the experience of subsequent years.

DISEASE INCIDENCE IN THOSE WITH AND WITHOUT TONSILS

The relative incidence on tonsillectomized and non-tonsillectomized pupils of infections was studied in the following instances:

1. Influenza, nasopharyngeal catarrhs, tonsillitis, bronchial catarrhs, bronchitis, and pyrexia of uncertain origin, in all the schools during the Lent term of 1932—which was distinguished by a large epidemic of influenza;

2. Influenza in one school which had a specially high attack rate of influenza during the Lent term, 1932;

3. Epidemic tonsillitis and febrile nasopharyngeal catarrhs during three epidemics in three different schools in three different terms;

4. Measles in three epidemics at different schools;

5. Scarlet fever, rheumatism, otitis, pneumonia, and appendicitis for all schools for the whole two and one-third years.

NASOPHARYNGEAL AND INFLUENZAL INFECTIONS

1. The Lent term of 1932 brought a sharp epidemic of influenza to most schools, accompanied by the usual trailers—tonsillitis, febrile catarrh, etc. In the boys' boarding schools there were 8,263 boys (4,552, or 55 per cent., tonsillectomized), and the attack rates were as follows:

TABLE II.—One Term Attack Rates: Boys' Boarding Schools Only. Lent, 1932

Disease	Tonsillectomized Boys	Non-tonsillectomized Boys
Influenza	26.7 per cent.	27.3 per cent.
Tonsillitis	5.3 "	4.8 "
Febrile nasal catarrh	5.7 "	5.6 "
Afebrile nasal catarrh	3.7 "	2.9 "
Bronchial catarrh	0.9 "	0.8 "
Pyrexia of uncertain origin	1.2 "	0.7 "
Total nasopharyngeal infections:	43.5 "	42.1 "

This close correspondence was exactly paralleled in the girls' schools, where the influenza attack rate was 11.50 per cent. in tonsillectomized, and 11.56 per cent. in non-tonsillectomized, the total nasopharyngeal infection rate being 61 per cent. and 62.1 per cent. respectively.

2. In the school which had a particularly high attack rate of influenza there were 579 boys, 300 (51.8 per cent.) being tonsillectomized; 361 boys were attacked by influenza, and 44 had two attacks. Tonsillectomized boys had an attack rate of 65.3 per cent., and 8.7 per cent. had two attacks, whilst for the non-tonsillectomized the rates were 59.1 per cent. and 6.5 per cent. respectively.

With regard to (1) and (2) it may be said that these results strongly suggest that tonsillectomy has no influence on nasopharyngeal infection. Here a fallacy which has already been mentioned must be emphasized. The tonsillectomized group probably includes more of the delicate and ailing children who in the past did not get on and were always ill. The non-tonsillectomized series, on the other hand, probably includes a larger proportion of boys who never ail anything—that is, boys with high natural resistance. In Cunningham's words: "Higher percentages of children often ill have tonsils removed than children less often ill." On the other hand, wealthy families with a high standard of living include the highest percentages of tonsillectomized children, so that if good economic status of the family and careful nurture are advantages the tonsillectomized group have probably enjoyed

them. It might be argued that an operation which in an epidemic has brought the tonsillectomized group, with its more delicate constituents, practically to a level with the non-tonsillectomized group had, in fact, justified itself. This argument, however, appears to us to be weakened when so large a proportion of a school population is tonsillectomized. Thus, though one might conceive that when 5 per cent. were tonsillectomized this section would include most of the weaklings, yet when more than half the school is tonsillectomized it is obvious that no real selection can have taken place, and that one is almost as likely to find the strong and healthy in the tonsillectomized group as in the other.

TONSILLITIS

3. The question with regard to tonsillitis was also specially studied at three schools during epidemics of this disease. Their total boy population was 1,472, and of these 942 (62.8 per cent.) were tonsillectomized.

TABLE III.—Epidemic Tonsillitis at Three Boys' Boarding Schools

Boys	Total, 1,472	Tonsillectomized, 924		Non-tonsillectomized, 548	
		No.	Attack Rate (One Term)	No.	Attack Rate (One Term)
Patients with tonsillitis ...	281	162	17.5 per cent.	119	21.7 per cent.
Patients with febrile catarrh, nasopharyngitis, etc.	154	100	10.8 "	54	9.9 "
Total patients:	435	262	28.3 "	173	31.6 "

The slight advantage (as regards tonsillitis) here shown to the tonsillectomized is discounted by the natural reluctance to use the diagnosis "tonsillitis" for a patient without tonsils. Griffith and Glover¹⁷ have recently shown that cases of nasopharyngitis, febrile catarrh, etc., occurring during epidemics of tonsillitis are often shown in bed plans of dormitories to occur side by side with cases of tonsillitis, and are, in fact, often one of the clinical manifestations of the same haemolytic streptococcal infection as tonsillitis. Whilst the tonsillectomized boys enjoyed a slight superiority (17.5 per cent. to 21.7 per cent.) over the untensillectomized in tonsillitis, in the feverish catarrh and nasopharyngitis cases which accompanied the epidemics of tonsillitis the position was reversed, their attack rate being 10.8 per cent., compared with 9.9 per cent. of the untensillectomized. The percentage of tonsillectomized boys who remained well during these epidemic terms in the three schools was 67.1, and of the untensillectomized 64.6. None of these slight differences was significant. It does not, of course, follow that incidence during such tonsillitis epidemics gives any indication of the incidence of recurrent sore throat in the individual. We find no evidence that a high percentage of tonsillectomy in a school community tends to increase its herd immunity, but our experience does not include diphtheria.

MEASLES AND OTHER CONDITIONS

4. The incidence in measles was studied in three epidemics in three boys' schools. The total population was 1,469, and there were 369 boys (25 per cent.) not protected by previous attack. These susceptibles were made up of 251 tonsillectomized and 118 non-tonsillectomized boys. The attack rate upon the tonsillectomized susceptibles was 78.1 per cent., and on the non-tonsillectomized susceptibles 71.2 per cent. Owing to the large proportion (75 to 80 per cent.) of immunes at a public school, infection with measles is very irregular, and it is almost certain that the above difference has no significance; but at any rate there appears to be no protection afforded by tonsillectomy either from measles or, as we see in the next paragraph, from its common complications, otitis, mastoid disease, and pneumonia.

5. The cases of scarlet fever, rheumatism, otitis, pneumonia, and appendicitis which have occurred in seven terms (or two and one-third years) in the school population under review

have fortunately been very small, cases of scarlet fever, for example, in girls, being only twelve, and those of rheumatism in girls being only eighteen. These small numbers of cases render the girls' experience of little value except as regards appendicitis. The boys' experience is, however, sufficient to be of value, and is shown in Diagram 2 and Table IV.

DIAGRAM 2.—Boys—all schools. (Population about 10,500, about 9,500 being boarders.) The percentages of tonsillectomized boys amongst all boys, and boys with certain diseases, showing excess or defect above "expected" (that is, all boys).

TABLE IV

Disease	Boarding Schools Only. Population, 8,263			All Schools.* Population, 10,219		
	Number of Cases	Tonsillectomized		Number of Cases	Tonsillectomized	
		No.	Per cent.		No.	Per cent.
All boys—"Expected"	—	—	53.6	"Expected"	—	51.8
Scarlet fever...	99	49	49.5	130	60	46.2
Rheumatism...	75	43	57.3	116	60	51.7
Otitis ...	229	130	56.8	268	152	56.7
Mastoid disease	37	22	59.5	40	25	62.5
Pneumonia ...	129	77	59.7	151	82	54.3
Appendicitis...	141	93	66.0	159	107	67.3

The percentages of tonsillectomized boys amongst all boys (= "expected") and amongst those boys who contracted certain diseases during a period of seven terms (2½ years, 1930-2), showing excess or defect above "expected" (that is, if infection were equally distributed upon tonsillectomized and non-tonsillectomized boys).

The girls suffered nearly twice as much in proportion from appendicitis as the boys, and had 80 cases—sufficient to make the experience worth recording. Of these 80 patients, 38 (47.5 per cent.) were tonsillectomized, compared with an "expected" percentage of all girls of 45.8.

Summarizing all these school observations, our opinion is that statistically they give little support to the view that tonsillectomy influences the incidence of infection either favourably or unfavourably. The slightly diminished incidence in scarlet fever in tonsillectomized boys and in epidemic tonsillitis may possibly be consistent with some increase in Dick immunity (to which we shall refer later). In otitis and mastoid disease our records are consistent with those of Paton,¹² who says: "The removal of adenoids results in an increased incidence of otorrhoea"; and those of Bradley,²⁴ who states: "There is ample evidence that tonsillectomy has not protected against otitis media."

Information from other Sources

SORE THROATS AND COLDS

Let us compare our school experience with that of other observers, first as regards tonsillitis. Perhaps owing to their dealing with younger children, the results obtained by Kaiser,¹⁵ the Committee of the Board of Education,⁵ Selkirk and Mitchell,¹⁸ and Munroe and Volk¹⁹ were more favourable

to the tonsillectomized than ours. Wilson, Lingg, and Croxford,²⁰ in 413 children, of whom 247 were tonsillectomized, found that of the latter 40 per cent. still had recurrent sore throats, compared with 48 per cent. of the non-tonsillectomized. Most of us will, however, agree that in appropriate cases the end-results of tonsillectomy undertaken for repeated attacks of tonsillitis render the operation justifiable. To define the "appropriate case" is, of course, the difficulty; definite evidence of gross obstruction or unmistakable sepsis, or a clear history of more than three recurrent attacks of tonsillitis, or a definite tonsillar abscess, may be sufficient indication. Tonsillar abscess is rare in childhood, and, indeed, only occurs at all ages once in fifty cases of tonsillitis, or, in ages above 10, once in every twenty-three cases (Close²¹).

With regard to frequent colds, Kaiser found that tonsillectomy offers no sure protection against colds in the head, but effects some reduction in their incidence, especially in the earlier school years. Smiley,²² dealing with students of Yale University, said that the removal of nasal obstructions and diseased tonsils in more than half of those having four or more colds in a year did not result in a reduction, whilst Forsythe,²³ in 537 students of the University of Michigan, found that the tonsillectomized had 40 per cent. more acute respiratory infections than the non-tonsillectomized. In this country Bradley²⁴ has found that nasopharyngitis occurs irrespective of the presence or absence of the tonsil, and that the operation is of no appreciable value in the prevention of epidemic nasopharyngeal infections.

PULMONARY INFECTIONS AND OTITIS

In respect of chest infections in children, opinion has apparently changed in the last ten years. Coakley and Pratt²⁵ believed that complete tonsillectomy markedly reduced the incidence of respiratory infections. Kaiser, however, found that the figures for bronchitis during both his three-year and ten-year periods were twice as bad for the tonsillectomized children as for the non-tonsillectomized children; his figures for pneumonia were also definitely worse. These results seem significant, for his control children had exhibited equal indications for tonsillectomy as his tonsillectomized children before operation, thus eliminating any error due to the fact that the child who is often ill (particularly with respiratory infections) is more likely to be operated on. In both pneumonia and pleurisy, in Cunningham's figures, the tonsillectomized students have a slightly higher incidence than either the normal or the "pathologic" series.

As to otitis media, Kaiser thought this occurred somewhat less frequently in the children operated on, but Cunningham, like Paton and Bradley, considers that tonsillectomy is not an effective means of prophylaxis against otitis media.

TONSILLECTOMY AND RHEUMATIC CONDITIONS

The literature of the end-results of tonsillectomy with regard to acute rheumatism, chorea, and rheumatic carditis is so extensive that the briefest summary must suffice. There are several distinct questions:

1. Does tonsillectomy *before* rheumatic infection diminish the liability to primary rheumatic infection?
2. *After* the rheumatic infection has occurred, does it tend to prevent further attacks or recurrences?
3. Does it diminish the severity of attacks?
4. After infection, does it tend to reduce the liability to carditis?
5. Should it be done as a routine measure in any case where the diagnosis of rheumatic infection is established?

All have been answered differently by different observers. With regard to the first, Kaiser thought the tonsillectomized child not yet infected has a decidedly better chance to escape rheumatic infection over the same period of time than the child whose tonsils have not yet been removed. Campbell and Warner,²⁶ however, working with 1,010 children, found that complete enucleation of the tonsils is without effect in preventing the onset of rheumatism, the proportion of children who subsequently

* "All schools" consist of the boarding schools in the left-hand column, together with two large naval boarding schools and one large public day school.

developed rheumatism being the same as if the tonsils had not been enucleated. On the other hand, children with incomplete tonsillectomy before the onset of rheumatism show a much greater tendency (more than twice as great) to develop it, and they found that in 25 per cent. of the tonsillectomized the operation was incomplete.

As regards the second question, Kaiser found recurrences as frequently in the tonsillectomized rheumatic children as in those in whom the operation had not been performed, and is thus in agreement with Campbell and Warner, Vining, and many others. Those with the greatest clinical opportunities seem almost equally divided on this question of recurrences, and on the closely linked and even more vital question as to the prevention of carditis. In the time at our disposal it can only be said that no sufficient case has been made out for the removal of apparently healthy tonsils in a rheumatic or potentially rheumatic child simply as a measure of prophylaxis against acute rheumatism, and that the operation does not appear to have any great influence on the behaviour of rheumatism or on the occurrence of carditis or chorea. If, however, the tonsils are obviously diseased, they should be removed when possible, but not during or soon after an attack of rheumatism. By the recent brilliant work of Collis,²⁸ Sheldon,²⁹ and Schlesinger³⁰ in this country, and of Coburn³¹ in America, recurrences of acute rheumatism in children have been shown to be almost invariably associated with a *fresh* infection of the patient's throat with haemolytic streptococci, taking the form either of a tonsillitis or of a nasopharyngitis, usually a fortnight before the occurrence. Collis²⁸ tells us that "tonsillectomy makes little or no difference in determining whether a child will or will not relapse if he gets a haemolytic streptococcal throat infection, but if a relapse has occurred the presence of tonsils which have become seriously infected tends to prevent the rheumatic symptoms from clearing up, and has on several occasions seemed to lead to a fatal conclusion. In such fatal cases of acute rheumatism the tonsils are often found to be extremely septic, containing an almost pure culture of haemolytic streptococci, the patients having been too gravely ill to undergo tonsillectomy." Few will doubt the importance of ridding the rheumatic child of tonsils that are septic. It is, moreover, essential to protect the rheumatic child from reinfection from persons with sore throats or carriers of haemolytic streptococci, and here the end-results of a vicarious tonsillectomy may be excellent, of which Homer Swift³² gives an example:

"Several years ago we learned that the mother of one of our rheumatic children frequently had sore throats within a short time of the appearance of relapses in the child. Following the removal of badly diseased tonsils in the mother her sore throat ceased, and since then the child has been free from recurrences."

EFFECTS ON MALNUTRITION AND DIPHTHERIA IMMUNITY

The end-results of tonsillectomy upon *malnutrition* are as statistically baffling as those in any other condition. Paterson and Bray,³ apart from their rheumatic group, recorded alimentary and wasting indications in 174 (35 per cent.) of their 500 cases, and showed excellent results in continuous gain in weight and clearing up of constitutional symptoms in nearly all. Their rheumatic group gained proportionally the most weight. Vining,²⁷ however, found his "no operation" group had an average greater gain of weight than his "operation" group, and Kaiser, whilst recording striking individual cases of relation between malnutrition and disease of the tonsil, finds that this does not hold good when large groups are surveyed. He found that there were only a few more (about 10 per cent.), underweight children among the non-tonsillectomized than among his operated group. Cunningham, in her second paper on the tonsillar state in young women students of the University of California, found that "there is no argument in this field for removing pathologic tonsils."

As to the effect of tonsillectomy on immunity to diphtheria and the Schick reaction, which has recently been fully discussed by Dudley,³³ the opinion of observers is divided. One of the end-results of tonsillectomy certainly seems to be diminished liability to, and lessened severity of, clinical diphtheria, the only infectious disease in which this seems agreed, though some have thought the incidence and severity of scarlet fever was also lessened by it. It is possible that a slight and perhaps transitory increase of Dick immunity follows tonsillectomy due to infection of the operation site by haemolytic streptococci, an infection which not infrequently gives rise to rashes, and even true scarlet fever, after tonsillectomy. Tonsillectomy often effectively terminates the *carrier state* in chronic carriers of either diphtheria bacilli or haemolytic streptococci, though Dudley found there was no significant difference in the carrier rate for toxigenic diphtheria bacilli between tonsillectomized and other boys at Greenwich Hospital School.

Summary

1. The rising flood of tonsillectomy has been shown in the immense and rapid increase in the numbers of operations annually performed, and by the astonishing fact that more than half the most carefully nurtured children in this country are now subjected to it, whereas forty years ago none of their parents underwent the operation. Whilst the incidence of tonsillitis is at least as high amongst the poor as amongst the well-to-do, the children of the latter have an incidence of tonsillectomy at least four times as high.

2. A review of the literature suggests that, with the single exception of diphtheria, the incidence of the ordinary infectious diseases is unaffected by tonsillectomy; that while the incidence of recurrent sore throats is perhaps somewhat diminished, that of frequent colds is unaltered, or perhaps slightly increased. The incidence of otitis and mastoid disease is the same, or perhaps slightly increased upon the tonsillectomized, while their liability to bronchitis and pneumonia is also probably slightly increased.

3. The evidence with regard to the prophylactic and therapeutic end-results of tonsillectomy on acute rheumatism, chorea, and carditis is distressingly confusing. There is no sufficient case for the routine removal of apparently healthy tonsils in a rheumatic or potentially rheumatic child, simply as a measure of prophylaxis against acute rheumatism. Removal should only be undertaken if there is some definite indication.

4. Observations have been detailed on the relative incidence of nasopharyngeal infections upon the tonsillectomized and the non-tonsillectomized pupils of a school population numbering nearly 14,000. Most of these pupils were between the ages of 13½ and 18, and belonged to the well-to-do classes. Save for two, with a total of 1,100 pupils, all the schools were boarding schools. Rather more than half of this population was tonsillectomized. Some of the observations cover a period of seven terms, or two and one-third years, whilst others are confined to certain terms of epidemic prevalence.

5. These interim observations (so far as they have gone) give no statistical support to the theory that the removal of tonsils closes an entrance for infectious or respiratory diseases. Hardly any cases of diphtheria have occurred, so that the prophylactic value of the operation in this disease could not be assessed. In scarlet fever, otitis media, and mastoid disease no significant differences were observed. In the two latter diseases the slight differences observed were in favour of the non-tonsillectomized.

6. These observations, based on actual *attack rates* in a school population, generally support the conclusions arrived at by Cunningham from a study of the *histories* of a similar number of somewhat older students. She found that the tonsillectomized pupils gave a history of higher incidence of all illnesses, and suggests that the fact that children who are often ill are those most frequently tonsillectomized may be the explanation. Comparing the proportion of the amount of illness reported

before and after tonsillectomy in the same pupils, she suggests that the removal of tonsils had little influence in lessening the susceptibility to most infections.

7. We hold no brief for the retention of diseased or really obstructive tonsils or adenoids, nor do we wish to cast doubt upon the high value of the operation in cases in which there is sure evidence of toxic or obstructive damage. A review of the literature and the epidemiological observations made on a highly tonsillectomized child population suggest, however, that the excellent end-results of tonsillectomy in selected cases have been statistically overweighted by indifferent end-results in cases in which the operation has been performed without sufficient indications as a more or less routine prophylactic ritual. In our opinion, a large proportion of the tonsillectomies now done in children are unnecessary, entail some risk, and give little or no return.

In conclusion, we wish to thank the Medical Research Council and the Committee of Investigation into Epidemics in Schools for their kind permission to use their records for our observations, and Dr. E. A. Straker for much help.

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THE MENACE OF QUACKERY TO PHYSICAL MEDICINE *

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Cassell's Dictionary defines a quack as: "a boastful pretender to skill which he does not possess, especially medical skill," and shows that the word is derived from the cry of a duck. Since quackery in physical medicine is associated chiefly with claims for effects produced by apparatus rather than for the skill of the person using the apparatus, the definition needs some modification for the purpose of this discussion. A suitable definition would be: "One who boastfully pretends that apparatus has therapeutical effects which he knows it has not, or who is too ignorant or credulous to discover that it has not."

With this definition as a working basis it is clear that two types of quack must be recognized: the purposeful or "charlatan" quack and the "ignoramus" quack. Only an insignificant part, however, of the menace of quackery in physical medicine comes from the out-and-out charlatan quack, whether qualified or unqualified. The charlatan turns to physical and especially to electrical apparatus, because even to-day the general public understands very little about electrical currents, and he is therefore in a position to "put over" statements about the action and effect of his apparatus that are unlikely to be controverted. Moreover, apparatus with switches, wires, lights, or crackles suggests *per se* that something tangible is going to

be done, and has in consequence a strong element of initial suggestion. Further, the apparatus provides an excellent excuse for repeated visits and the consequent repetition of fees.

THE "IGNORAMUS QUACK"

The different types of ignoramus quackery can best be considered under the heads of: (1) The medically unqualified practitioner. (2) The manufacturer. (3) The medically qualified practitioner. Each of these classes presents a different kind of menace to the welfare of physical medicine.

1. *The Unqualified*.—I have placed the unqualified practitioner first, not because he constitutes the greatest menace, but because he constitutes the smallest and can be dismissed from our discussion in a few words. The unqualified practitioner is debarred by law from describing himself as a doctor of medicine, and has other legal disabilities and difficulties. Thus the great majority of those attending him are well aware that he is not a duly qualified medical man, and they seek his advice or treatment with their eyes open. He must therefore derive the majority of his clientele from the ranks of the superstitious, the over-credulous, or those who go as a last resource and a forlorn hope. With the increase of the interest and education of the public in electricity and physics—largely brought about by wireless—he is more easily seen through, and as the field of successful treatment by qualified men grows ever wider, the group of patients who fail to find relief along orthodox lines diminishes, and thus the quack's sources of supply steadily decrease. It can be laid down as a safe axiom that when medical diagnosis becomes accurate quackery walks out of the door. By accurate diagnosis I mean not only the correct naming of the disease, but a true understanding of the cause, as then the treat-

* Read in opening a discussion in the Section of Physical Medicine at the Centenary Meeting of the British Medical Association, London, 1932.