STUDIES IN THE EPIDEMIOLOGY OF TINEA PEDIS

V. SOME DAY-SCHOOLS REVISITED

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Second visits have seldom been made to communities which have once been surveyed for tinea pedis, though Gentles and Holmes (1957) visited one of their collieries a number of times. Consequently, there is little information on changes in incidence over a period, either in the community as a whole or in individuals, and the resulting epidemiological picture is a somewhat static one.

Our first survey in Bristol day-schools (English and Gibson, 1959a) gave an estimate of the level of infection in the city's school children before attention had been drawn to it. That survey, and our second visit to the same schools (English *et al.*, 1960) to investigate the children's footwear and use of swimming-baths, could be expected to attract the attention of both teachers and pupils to the condition. Also, much of the reservoir of infection should have been removed if most of the cases found at these two surveys had been successfully treated. The improvement in the cleansing of swimming-bath A which followed our visit to it (English and Gibson, 1959b) should, too, have lowered the incidence of tinea pedis in schools which used it. We have therefore revisited certain of the schools to discover whether, in fact, any changes in incidence had occurred.

The Subjects

The survey was carried out during the autumn of 1958 and the spring of 1959, approximately two years after the first survey, and at similar seasons. Senior boys' schools 1, 2, 3, 4, and 6, and senior girls' school 8 (English and Gibson, 1959a) serving children aged approximately 11 to 14 were revisited.

Schools 2, 3, and 4 were comparatively small and almost all the third- and fourth-year children in them at this survey had been seen at the first, when in their first and second years respectively. In schools 1, 6, and 9, which were larger, only a proportion of the children were seen at either survey, so that about 25% of third- and fourth-year pupils at the present survey had not

been seen in their first and second years at the first, though they had been in school at the time. Children in their first and second years at the present survey were all newcomers to their schools since our first visit.

The possibility of error in the results is introduced by the fact that 3.6% of boys with lesions from whom no fungus was isolated were being treated for clinically diagnosed tinea pedis at the time of our visit. But the experience of ourselves and of many other workers, with clinical diagnosis without laboratory confirmation, suggests that most of these boys were not, in fact suffering from a fungal infection.

Methods

These were identical with those used at the first survey (English and Gibson, 1959a). Scrapings were taken only from children with lesions; cultures were made from all scrapings, and microscopical examination was also carried out where there was enough material.

Correction of Report on First Survey.—Our results were there given in terms of "age in years" of the children. This was inaccurate: they should have been in terms of "year in school." Children remain in senior schools for four years, but are moved up each year as soon after their birthdays as is convenient, not on them. Hence, for example, first-year children, though mostly 11 years old, will include some recent 12-year-olds. This in no way invalidates the results of the first survey, but might affect any comparison with one truly based on age in years. The appropriate correction in terminology has been made in the present article.

Infection

Incidence in Boys

Table I shows that the total incidence of infection in boys fell from 7.1% at the first survey to 5.5% at the present one, but the difference was not statistically significant. In first- and second-year boys taken alone, however, there was a significant ($P<0.01$) fall in incidence from 6.7% to 3.7%. The only significant ($P<0.05$) change in an individual school was a fall from 8.9% to 4.5% in school 1. In the first survey there was no significant difference between the incidence in any two schools using the same swimming-baths: in the present survey the difference both between schools 1 and 2 and between schools 3 and 4 was statistically significant ($P<0.05$).

The second survey showed a relationship between infection and the degree of exposure entailed by the use of swimming-baths in the boys' own time. In the present survey the children were not questioned about spare-time bathing, but a further analysis of the figures from the second survey are of interest. In schools 1 and

TABLE I.—Incidence of Tinea pedis in Senior Schools Compared with that at the First Survey

	District	School	First- and Second-Year Children (11–12 Years Old Approx.)				Third- and Fourth-Year Children (13–14 Years Old Approx.)				All Children			
			Total	Infected	% Infected	% Infected 1st Survey	Total	Infected	% Infected	% Infected 1st Survey	Total	Infected	% Infected	% Infected 1st Survey
Senior boys	A	1	160	6	3.7	8.9	131	7	5.3	8.9	291	13	4.5	8.9
		2	119	6	5.0	8.0	149	19	12.8	10.2	268	25	9.3	8.9
	B	3	169	7	4.1	7.7	143	2	1.4	3.9	312	9	2.9	5.9
		4	153	4	2.6	6.0	123	18	14.6	6.7	276	22	8.0	6.3
	C	6	160	5	3.1	3.2	149	6	4.0	7.7	309	11	3.6	5.3
		All	761	28	3.7	6.7	695	52	7.5	7.5	1,456	80	5.5	7.1
Senior girls	A	8	140	0	0.0	0.6	166	6	3.6	3.6	306	6	2.0	2.2

3, with a large fall in the infection rate between the first and third surveys, the second survey showed that 15% and 17% of boys respectively had begun to bathe by the time they were 7. But in schools 2 and 4, where the change in the infection rate had been slight, 25% and 33% respectively of the boys were going to the baths at that early age. That is, in schools with the least improvement more boys had been going to the baths from an early age. On the other hand, there was no association between the frequency with which boys went swimming and change of infection in the schools.

In district A, where there had been an improvement in the hygiene of the swimming-bath after our first survey, 35% of the boys in school 1, which showed a significant drop in infection, did not begin to bathe until they were 12 or over, and would not, therefore, have been to the baths until they were adequately cleaned. But this was true for only 18% in school 2, where the level of infection was still high.

Persistence of Infection.—Out of all the schools, 28 boys who were infected at the first survey were scraped at both subsequent ones. Of these, four were infected on all three occasions; four were clear at the second survey but reinfected at the third, two with the same fungus and two with different ones; and 20 were clear at the second and third, or at the third survey. A further 25 boys who were infected at the first survey and clear at the second were not scraped at the third because they had no lesions then: the chances that these boys were indeed still free from infection are high (English and Gibson, 1959a). Even taking into account the fact that about 25% of the boys seen in their third and fourth years in schools 1 and 6 at the present survey had not been seen at the first, it is obvious that most of the infections found in older boys this time were new ones: persistent infections were not a serious problem in individuals, though epidemiologically they may well be important.

The relationship of age to infection is not considered here, as it would undoubtedly be affected by the treatment of cases found at previous visits.

Symptoms.—All boys with lesions were asked whether they noticed itching or burning of their feet. Table II shows that, though symptoms were not confined to children with infections, there was a statistically positive ($P < 0.01$) association between symptoms and infection. This was not nearly so marked as in the survey of Marples and Bailey (1957), carried out on older subjects.

TABLE II.—Association of Symptoms With Infection in Boys With Lesions

	No. of Boys Infected	% Infected	No. of Boys Clear	% Clear
Boys with symptoms ..	21	26.3	71	14.3
Boys without symptoms ..	59	73.6	426	85.7
Total ..	80		497	

Infection in Girls

In the first survey infection in six girls' schools averaged only 1.6%; in the present one it was still low—2.2% (Table I)—in the one girls' school examined. This school stood in the same grounds and served the same families as school 2, the most highly infected boys' school at both surveys. We consider this reasonable evidence of a consistently low incidence of tinea pedis in senior girls' schools in the city.

Lesions

Table III shows that both the incidence and the age distribution of lesions in boys were almost the same as at the first survey. There was again no relationship between the incidence of lesions and of infection in any one school. Lesions in the single girls' school rose from 30.7% to 48.2%, an increase for which we could find no explanation.

TABLE III.—Incidence of Lesions in Boys Compared With First Survey

Age-Group	Total Boys	Incidence of Lesions		% With Lesions at First Survey
		No. of Boys with Lesions	% With Lesions	
1st year ..	412	138	33.5	37.5
2nd ..	349	135	38.7	37.6
3rd ..	337	132	39.2	42.1
4th ..	358	172	47.0	47.8
All ..	1,456	577	39.7	41.3

Mycology

Table IV shows the relative frequency of the occurrence of the dermatophyte species in the 86 mycologically positive cases. The distribution was very similar to that found at the first survey, the great majority of infections, including all those in the girls' school, being attributable to the *interdigitale* type of *Trichophyton mentagrophytes*. All the isolations of *Epidermophyton floccosum* were made in school 2, whence came five out of the seven obtained at the first survey.

TABLE IV.—Incidence of Dermatophyte Species Compared With First Survey

Fungus	Present Survey		First Survey
	No. of Cases	% of Total Cases	% of Total Cases
<i>T. mentagrophytes</i> ..	74*	85.8	83.5
<i>T. rubrum</i> ..	4	4.7	7.0
<i>E. floccosum</i> ..	6*	5.9	6.1
Microscopically positive only ..	5	5.9	4.4

* Three combined infections—*T. mentagrophytes* and *E. floccosum*.

Discussion

The marked reduction in incidence of tinea pedis in first- and second-year boys is difficult to account for, especially as the high incidence among older boys was not, in general, attributable to persistent old infections but to new ones. The improved hygiene in bath A might offer the explanation for schools 1 and 2, but would not cover schools 3 and 4, whose swimming-bath (B) had always been adequately cleaned. Further observations on the same group of schools might disclose other reasons for periodic fluctuations in incidence in an age-group.

Schools 1 and 2 both had the benefit of the improved hygiene at bath A, but this was reflected by a lowered infection rate only in school 1. One reason for this might be that, as well as the three surveys carried out in all the schools, school 1 had also been the subject of a number of preliminary surveys during which our methods were worked out. In consequence, it had become very conscious of the disease, and among the boys "athlete's foot" was a social stigma, lesions being promptly reported and thoroughly treated. The head of school 2 told us he had been unable to raise any interest in the condition in his boys.

The low incidence of persistent infections is in agreement with our previous findings in children infected with *T. mentagrophytes* (English and Gibson, 1960), but apparently contrasts with the situation in miners (Gentles and Holmes, 1957). However, the overwhelming number of infections in the pit revisited by these authors were due to *T. rubrum*, a species notorious for persistence. Of the five cases that did recover, four belonged to the minority of men who had been suffering from a *T. mentagrophytes* infection. The miners' infections were probably also more severe and of longer standing than those of the majority of schoolboys.

The infrequency of persistent infections in schoolboys would seem to invalidate the difference in age at which swimming was begun as an explanation of the fall in incidence in school 1 but not in school 2. For if infections acquired while the baths were inadequately cleaned had been quickly cured, the risk of their being passed on would be small. The lax attitude of the boys of school 2 can probably again be invoked in explanation. It is likely that their infections, other than those found by us at the first two surveys, would be treated only after they had existed for some time and had become annoying or severe; meanwhile the disease would have been passed on to others.

Summary

A survey of tinea pedis has been carried out in six local authority senior day-schools in Bristol, five boys' schools and one girls' school, all of which were similarly surveyed two years previously.

In general, little change was noticed in the incidence of lesions, infections, or fungus species, despite the fact that previous visits should have resulted in greater awareness of the condition in both staff and pupils.

However, of the two boys' schools using a swimming-bath in which adequate cleaning had been begun only after the first survey, the incidence in one had dropped significantly from 8.9% to 4.5%, while that in the other had remained at a high level. This is attributed partly to the fact that 35% of boys of the first school had never been to the baths in their poorly cleaned state, compared with 17% in the second; and partly to the fact that "athlete's foot" had become a social stigma in the first school but not in the second.

Out of 53 boys infected at the first survey, 45 were clear at the present one. Persistent infections are not, therefore, a problem in individual boys, though epidemiologically they may well be important.

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COMPARISON OF POST-OPERATIVE PAIN AND STIFFNESS AFTER THE USE OF SUXAMETHONIUM AND SUXETHONIUM COMPOUNDS

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Muscular pain and stiffness after the use of short-acting relaxants of the depolarizing variety is a major problem after dental in-patient anaesthesia. A clinical trial has been undertaken to compare the incidence of muscular pain and stiffness after the use of suxamethonium and suxethonium compounds.

Technique

The main investigation was carried out on 100 in-patients. The operative procedures were of the standard in-patient variety—namely, routine oral surgery and plastic operations about the mouth.

Anaesthesia was induced routinely by the intravenous injection of sodium thiopentone in a dose of 150–300 mg. Intubation was facilitated by the use of a short-acting relaxant, after which anaesthesia was maintained by means of nitrous oxide, oxygen, and halothane. The two relaxants chosen for comparison were suxethonium bromide in a dose of 180 mg. and suxamethonium chloride, dose 50 mg.; the use of bromide salts in place of the chloride has been shown to be irrelevant to the incidence of stiffness (Leatherdale, 1959). Each of us used the relaxants alternately on his own lists; both drugs were in the form of the ready-prepared solution.

The patients were admitted for a three-day period. For the first 24 hours after the operation they were confined to bed, after which they were ambulant. The ward sister, who was unaware of the relaxant used, kept a detailed record of pain and stiffness, and on discharge the patients received a form, which subsequently allowed us to follow their symptoms until they abated. From these records the accompanying Table has been compiled.

Summary of Results

Main Trial (100 Patients)	Severe Stiffness or Pain	Mild Stiffness	Total Incidence of all Types of Stiffness
Suxamethonium series (50 patients) ..	13	25	38
Suxethonium .. (50 ..) ..	13	20	33
Total ..	26%	45%	71%
50 female patients	16	28	44 (88%)
50 male	10	16	26 (52%)
Series of Morris and Dunn (1957) ..	22%	50%	72%

Comment.—No significant difference existed in the incidence of pain and stiffness with the two compounds, and the overall incidence agrees well with figures given by Morris and Dunn (1957). Each series of 50 in the main trial comprised 23 male and 27 female patients, and by continuing recording after the initial 100 cases it