STUDIES IN THE EPIDEMIOLOGY OF TINEA PEDIS

I. TINEA PEDIS IN SCHOOL CHILDREN

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Although there are numerous reports of the incidence and epidemiology of tinea pedis in skin clinics, closed communities, and industrial groups, the natural history of this disease in the general population has received very little study.

The difficulty of examining a representative cross-section of adults is obvious, apart from the prohibitive amount of time which would be involved in visiting sufficient families in their own homes. Also, in adults, the past lives of individuals would be so varied that any results obtained would be very difficult to assess.

Investigation of recruits for the Forces or of first-year university students has a number of limitations, the greatest being that the subjects are drawn from widely scattered geographic areas, so that results would show the incidence rather than the epidemiology of the disease.

A cross-section of the children resident in any one district can, however, be obtained by carrying out surveys in comprehensive and bilateral schools and, to a less extent, in secondary modern schools. The study of day-school children has the further advantage that they have usually lived exclusively within their families and in the district in which the school is situated; also, the difference in the way of life of the sexes is far less marked than in adults.

Examination of school children might therefore throw a useful light on the epidemiology of tinea pedis. We can find no record of any such survey in the United Kingdom. In Europe large-scale investigations have been carried out by Lomholt (1938) in Sweden, and by Wilde (1951) and Polemann (1955) in Germany, but their conclusions were based almost exclusively on clinical evidence. Amrein (1953), in Switzerland, examined 707 children and confirmed his clinical diagnosis by microscopical examination of scrapings, but he made no cultures and did not differentiate between the incidence in boys and girls. Bocobo and Garcia (1950), using laboratory diagnostic tests, examined 203 Philippine students between 11 and 22 years old, but did not correlate incidence with age. In America, Andrews and Birkman (1931) and Wallace and Moorman (1943) examined 520 and 60 children respectively, but in neither investigation were conditions comparable with those in schools in this country.

The present investigation sets out to study aspects of the natural history of tinea pedis through the medium of Bristol's school children, to obtain some factual information on a number of epidemiological problems about which there is at present much guesswork, and to open up lines for more detailed work later.

The Subjects

Approximately 300 children were examined in each of six secondary modern boys' schools (schools 1–6), six secondary modern girls' schools (schools 7–12), and four junior boys' schools (schools 13–16). Small numbers of children of grammar-school standard were seen in four of the modern schools. Pupils in junior schools were aged 7–10 years, those in senior schools 11–14 years. Teachers were asked to produce about 80 children from each year with no attempt at statistically random sampling. However, they normally produced a whole class at a time.

The schools were selected from among those using three Corporation swimming-baths in widely separated parts of Bristol, two senior boys' schools and two senior girls' schools to each bath, and two junior boys' schools in each of two of the districts (Table I). Bath A was situated in district A and attended by schools 1, 2, 7, 8, 13, and 14; bath B was in district B and attended by schools 3, 4, 9, and 10; and bath C was in district C and used by schools 5, 6, 11, and 12. Schools 15 and 16, while situated in district B and passing many of their pupils to schools 3 and 4, did not attend the same swimming-bath as the latter schools. Bath B was closed in winter, and schools 4 and 10 used an alternative one during this time.

TABLE I.—*Showing Location of Schools in Relation to Districts and Swimming-baths*

District	Bath	Schools Using Bath		
		Senior Boys	Senior Girls	Junior Boys
A	A	1 and 2	7 and 8	13 and 14
B	B*	3 ,, 4	9 ,, 10	(15 ,, 16†)
C	C	5 ,, 6	11 ,, 12	

* Bath B is closed in winter, when schools 4 and 10 use an alternative one.
† Schools 15 and 16, though situated in District B, and passing many of their pupils to schools 3 and 4, did not use the same swimming-bath as the latter.

Methods

The survey was carried out in the winter and spring of 1956–7. The organization of the school visits and the screening of the children's feet were carried out exclusively by one of us (M. D. G.). The other (M. P. E.) was responsible for the laboratory work and also took most of the scrapings. Relevant personal details were taken down from the children by a clerical assistant.

The children's feet were classified according to their condition and the type of lesion into Holmes and Gentles's (1956) first five groups. Where the only blemish was plantar warts, blisters, or other injury, feet were taken as "normal" for our purposes. The distinction between a normal foot and one with a very slight lesion was in practice extremely difficult to make, especially in the smaller children, and a certain variation in judgment was inevitable.

As the time available, both to the schools and to ourselves, was limited, scrapings were taken as a routine only from children with lesions.

Feet were not cleaned before being scraped and no record of diseased toenails was made. A few children were under treatment for tinea pedis, diagnosed on purely clinical grounds. It was impossible to determine whether failure to recover dermatophytes from some of these was due to faulty diagnosis in the first place or to destruction of the fungi by treatment.

Scrapings were taken from both feet, from different lesions, and from different parts of large lesions, on to a piece of clean paper. From the smaller lesions, and especially from the younger children, it was often impossible to obtain enough material for both culture

and microscopical examination. In view of the experience of Gentles and Dawson (1956), who were also investigating skin lesions only, cultural procedures were given priority, and microscopical examination of scrapings in 15% potassium hydroxide was made only when there was enough surplus material—that is, for 64% of the senior children with lesions and 58% of the junior. Strauss and Kligman (1957) found examination in potassium hydroxide superior to culture ; but a large proportion of their specimens were toenails, from which we too, in other work, have found cultures difficult to obtain.

Cultures were made on glucose–peptone agar with added penicillin and streptomycin. Where possible, from 12 to 20 inoculations were made from each subject. Little trouble was experienced from saprophytic bacteria or fungi.

Results

Two limitations of our method affect all our results. The first concerns specimens that were too small to allow for microscopical examination. Of 617 of these, 38 (6.2%) were mycologically positive, while 138 (13.2%) of 1,048 scrapings which were examined microscopically were positive. Of the latter, 13 would have been missed without the aid of microscopical examination. Supposing that the same proportion of positives among the small specimens had been overlooked for this reason, the proportion of positives in the group would have been raised only from 6.2% to 7.5%. Statistically the probability of such a difference happening by chance is less than 1 in 1,000 ; therefore it is highly likely that there is a real difference in the infection rate of large and small lesions.

The effect of the omission of routine examination of normal feet must also be considered. This would result in our overlooking the lesion-free carriers reported by other workers. Also, if the number of carriers in the child population were uniform we would miss proportionally more infections in schools where more children had normal feet. To gauge the magnitude of this error we took scrapings at the end of the survey from the interdigital spaces of the feet of two groups, each of about 100 normal children, in schools with high and low incidences respectively as based on our findings in children with lesions (Table II).

TABLE II.—*Percentage of Symptomless Carriers*

Amount of Infection in Children with Lesions	Total Screened	Children with No Lesions			Symptomless Carriers
		Total in School	Total Mycologically Examined	No. Infected	
8·9%	628	343	109	3	1·5%
2·2%	365	253	83	0	0·0%

In schools with a high incidence 1.5% of carriers were found, and in those with a low incidence no cases were found in the 83 children examined. The difference is not statistically significant. The number of carriers disclosed by this sample is not high enough to distort our results significantly, and the tendency shown for the occurrence of more lesion-free carriers in populations with a high incidence of infection would emphasize our findings rather than minimize them. It seems probable that these carriers usually represent incipient or almost resolved infections, a proportion of which one would expect to find in any infected population, especially where the disease rate is high (Strauss and Kligman, 1957).

Relationship of Lesions and Infection to District, School, and Sex (Table III). — Of 4,794 children screened, 1,664 (34.7%) had lesions and 176 (3.6%) were infected with tinea pedis. The incidence of lesions in senior boys (40.3%), was significantly higher than in junior boys (33.2%) or senior girls (30.4%). The incidence of infection among senior boys (6.6%) was significantly higher than that in the other two groups—2.2% and 1.6% respectively. There was, however, a wide variation in infection among those with lesions, the incidence of infected lesions varying from 5.4% in senior girls to 16.5% in senior boys, and from 0.0% in schools 11 and 16 to 22.6% in school 2. The incidence of lesions varied greatly from school to school and was not related to district. But the incidence of infection in both senior (8.9%) and junior (3.1%) boys' schools in district A was significantly higher than in similar schools in the other districts, which averaged 5.5% and 0.5% respectively. There was no significant difference in infection between schools of the same type in any one district. Among girls the incidence of infection was too low for any significance of the effect of district to be calculable.

TABLE III.—*Incidence of Lesions and of Infection According to District, School, and Sex*

	District	School	No. of Children Screened	With Lesions		Infected		% of those with Lesions Infected
				No.	%	No.	%	
Senior boys	A	1	292	152	52	26	8·9	17·1
		2	336	133	40	30	8·9	22·6
	B	3	306	110	36	18	5·9	16·4
		4	284	123	43	18	6·3	14·6
	C	5	336	122	36	15	4·5	12·3
		6	285	101	35	15	5·3	14·9
		Total	1,839	741	40·3	122	6·6	16·5
Senior girls	A	7	414	111	27	8	1·9	7·2
		8	365	112	31	8	2·2	7·1
	B	9	315	70	22	2	0·6	2·9
		10	448	143	32	7	1·6	4·9
	C	11	225	73	32	0	0·0	0·0
		12	294	117	40	9	3·1	7·7
		Total	2,061	626	30·4	34	1·6	5·4
Junior boys	A	13	310	99	32	13	4·2	13·1
		14	234	93	40	5	2·1	5·4
	B	15	214	67	31	2	0·9	3·0
		16	136	38	28	0	0·0	0·0
		Total	894	297	33·2	20	2·2	6·7
All children			4,794	1,664	34·7	176	3·6	11·6

Effect of Age on Incidence of Lesions.—Fig. 1 shows that the incidence of lesions increased with age in both

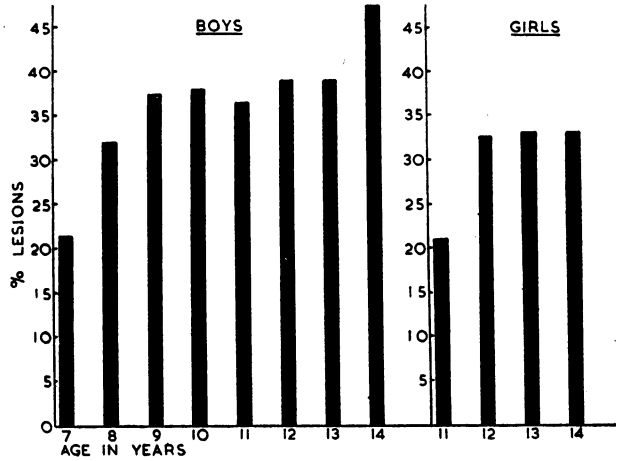

FIG. 1.—Incidence of lesions in boys aged 7 to 14 years and in girls aged 11 to 14.

sexes, but was always less in girls than in boys of the same age. In boys there were sudden significant ($p<0.02$) increases between the ages of 7 and 8, and of 13 and 14; and in girls between 11 and 12 there was also a highly significant increase: none of these could be explained by any change in personal or social conditions at these ages.

Effect of Age on Incidence of Infection.—Fig. 2 shows that boys as young as 7 years can become infected and that the total incidence rose from 0.6% at this age

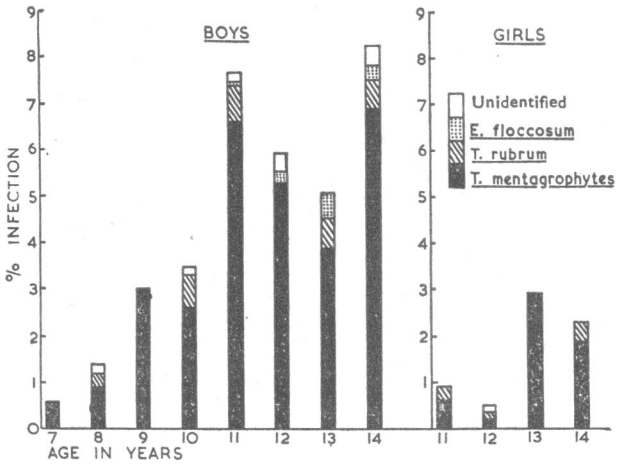

FIG. 2.—Incidence of infection with dermatophyte species in boys aged 7 to 14 years and in girls aged 11 to 14.

to 7.7% at 11 years, the age of transfer to the senior school. There was a marked increase in *Trichophyton mentagrophytes* infection between the ages of 8 and 9. After age 11 the incidence of infection dropped, to rise again to 8.3% at 14. The high incidence at ages 11 and 14 might be attributed to "epidemic years," but this idea requires further investigation. Puberty did not appear to affect the incidence of infection, which was already high at 11 years. Incidence was very low in all senior girls, but a statistically significant increase did occur between girls under 13 and those over 13.

Effect of Cleanliness and Social Status.—Visits to schools were made on the same day of each week and without warning the children beforehand. It is therefore probable that we saw our subjects, with some constancy, in their normal state of cleanliness. During screening, all children with foot lesions and 979 of those without were classified as clean, fair, or dirty, judgment being based on ingrained rather than superficial dirt and on the condition of the toenails. No statistical association, as indicated by the χ^2 test, was found between cleanliness and either lesions or infection. Most schools drew their pupils from socially mixed areas, but in the three which served almost exclusively a poorer type of family (3, 9, and 16) the incidence of tinea pedis was of the same order as that in similar schools in the same district serving socially mixed areas.

Association of Infection with Type of Lesion.—90% of lesions fell into Holmes and Gentles's (1956) group II (peeling and/or maceration). Most of the remainder were classed in group III (erythema or fissures), and group V (vesicles) was hardly ever seen. These figures differ radically from those for miners, and are such that it is statistically impossible to correlate infection with any particular type of lesion.

Infection and Use of Swimming-baths and School Showers.—In the senior schools, for both sexes (with the exception of school 9 with 44% bathers), 67 to 96% of children attended school swimming-classes. There was no significant correlation for boys between infection and attendance at these classes. For girls, infection was significantly higher among non-bathers, indicating the preponderance of some other source of infection for them. Though the difference in the proportion of boys and girls attending swimming-classes is too slight to account for the different incidence of tinea pedis in the sexes, records kept at the swimming-baths show that there are three times as many total admittances of boys as of girls. This implies a much more frequent use of baths by boys out of school hours. Senior schools in districts A and C (excepting school 7) possessed showers; schools in district B had none. But no correlation was found between infection and the use of school showers by individual children, or between incidence in any school and the presence or absence of showers. However, senior boys' schools 1 and 2, with 8.9% infection each, were the only ones where swimming-classes were held all the year round throughout the school, and which also possessed showers. Schools 3–6, with infection rates of from 4.5% to 6.3%, either lacked showers (3 and 4), went to swimming-baths only in the summer (3), or went in the lower forms only (5 and 6). There was no similar relationship in girls' schools. An investigation into the occurrence of dermatophytes on the floors of swimming-baths is reported in this issue (English and Gibson, 1959). It may be mentioned here that *T. mentagrophytes* was isolated from the floors of all the baths.

Footwear.—"Daps" (canvas shoes with rubber soles) are issued to all children for physical education classes. At the end of the school year they are collected, sterilized by exposure to formalin vapour, and stored for reissue to different children the following year. Laboratory tests indicated that this routine sterilization was probably adequate, and we do not consider that the reissue of daps is a serious source of infection. Exchange of shoes among children is, however, inevitable, and doubtless accounts for some cases of tinea pedis. Certain physical education classes in some schools are taken with bare feet, and must also provide a risk of infection.

Mycology

Table IV shows that *T. mentagrophytes*, the *interdigitale* type of which was consistently isolated, was responsible for the overwhelming majority of cases of tinea pedis in Bristol school children (84.4%). This was true for all schools, districts, and ages, and for both sexes. The fungus was found eight times more often

TABLE IV.—*Incidence of Species of Dermatophytes, Including Those Found in the Sample of Lesion-free Children*

Type of School	Total Children Screened	Cases of *T. mentagrophytes*		Cases of *T. rubrum*		Cases of *E. floccosum*		Cases Microscopically Positive Only	
		No.	%	No.	%	No.	%	No.	%
Junior boys	894	17	1·9	1	0·1	0	0	2	0·2
Senior ,,	1,839	106*	5·8	8	0·4	7*	0·4	5	0·3
,, girls	2,061	29	1·4	4	0·2	0	0	1	0·05
All ..	4,794	152	84·4	13	7·2	7	3·9	8	4·4

* Including one combined infection of *T. mentagrophytes* and *E. floccosum*. This occurred in school 2, with a high total infection rate and four out of the six other *E. floccosum* infections.

than *T. rubrum* and *E. floccosum* together. This is in marked contrast to figures from skin clinics both in England and abroad, where the proportion of *T. rubrum* infections is much higher. For instance, in the dermatological clinic of the Bristol General Hospital, from 1954 to 1957, *T. mentagrophytes* and *T. rubrum* have each been responsible for 57 cases of tinea pedis. The discrepancy arises because the chronic and disfiguring nature of *T. rubrum* infections leads to the reference of a high proportion of them for specialist advice.

T. rubrum was found twice as often as *E. floccosum* and occurred in most schools, at all ages, and in both sexes. *E. floccosum* was found only in senior boys, and its incidence in this group was equal to that of *T. rubrum*. The proportion of boys to girls among those aged 11–14 years with *T. mentagrophytes* infection was 4:1; for *T. rubrum* the proportion in the sexes was 2:1.

Discussion and Conclusions

Despite limitations of method, the results of this survey clarify a little our picture of the epidemiology of tinea pedis. In the first place the choice of day-school children as subjects limited the size of the problem and has resulted in the focusing of attention on certain factors influencing the disease while eliminating a number of others previously believed to do so.

The striking difference we have found between the incidence of lesions and of true tinea pedis confirms the results of Holmes and Gentles (1956) and other workers, and lays emphasis on the necessity of laboratory examination for the accurate diagnosis of the disease. For example, Wilde (1951) and Polemann (1955), working with German children and using clinical diagnosis only, obtained figures for "infection" which are of the same order as ours for lesions; while Amrein (1953), using microscopical examination of scrapings, obtained an average infection rate of 4.1% for Swiss urban children, which compares closely with our average of 3.7%.

The following epidemiological discussion refers to *T. mentagrophytes* only, as this fungus has been shown to be of dominant importance in Bristol children.

Two points need elucidation. First, what factors in, or habits of, the individual predispose him to infection? This question includes the problem of the different incidence in the sexes. Age in itself in young people is probably not a factor. The increase of incidence with age is most likely simply a reflection of the increased opportunity for infection (Wilde, 1951).

There have been varying opinions on the effect of hygiene. Polemann (1955) and Andrews and Birkman (1931) claim that washing encourages the fungus, while Wallace and Moorman (1943) and Bocobo and Garcia (1950) consider that it thrives in dirt. These observations were either mere opinions or were based on small numbers of cases. The rating of cleanliness must be subjective and inexact, but our results are based on sufficient numbers to suggest that there is in fact no relationship between cleanliness and liability to be infected.

Neither does the incidence of infection in boys lend credence to the common belief that tinea pedis is a rare disease before puberty. Nor is the incidence materially affected by social status. If the presence of lesions of undetermined aetiology predisposes the feet to infection, the higher incidence of such lesions in boys might account for their higher infection rate. But the fact that the percentage of *infected* lesions differs widely in different schools seems to dispose of this as a major factor affecting incidence.

Tritsmans and Vanbreuseghem (1955) have shown that there is a positive correlation between tinea pedis and the frequency of use of swimming-baths. Though we found no relationship between incidence of the disease and attendance at school swimming-classes, there is evidence that boys swim more frequently than girls out of school hours, and that boys' schools where the curriculum includes swimming summer and winter throughout the school career (schools 1, 2, and 4) have a higher infection rate than those whose pupils swim less continuously. These observations, and any differences in the normal footwear of boys and girls, obviously require detailed investigation.

It still remains possible that some unknown physiological factor is responsible for the different incidence in the sexes.

The second point needing an explanation is—where does the main source of infection lie and how is the disease spread?

Children are exposed to three main sources of infection—the family, the school, and the swimming-bath. Previous work (English, 1957) has shown that they run a serious risk of contracting *T. rubrum* infection should it be present in the family: a similar survey is being carried out for *T. mentagrophytes*.

In school there is a theoretical risk from a number of sources. The practice of reissuing sterilized daps can probably not be incriminated, though bare-foot gymnastics and the borrowing of footwear must spread infection. But the former occurs in all schools and the latter is not a common practice, so that neither would account for different incidences in different districts.

In view of the findings of Holmes and Gentles (1956), school showers must certainly be involved, and further investigation into their use is necessary, but as each child uses them approximately only twice weekly the risk cannot be compared with that in pithead baths used daily by the miners. Though there is some indication that, combined with frequent swimming, they tend to increase infection, they do not appear to be a major risk in schools, as we have been unable to correlate the use of them with a high incidence of tinea pedis.

There is, however, a strongly positive correlation between geographic area and tinea pedis in boys' schools, for which the local swimming-bath and the frequency of its use by schools in the district are the only probable explanation. This, together with frequent use of the baths out of school hours by boys, and the results of investigations in the baths themselves (English and Gibson, 1959), incline us, pending further information, to the opinion of Amrein (1953) that the swimming-bath is an important focus of fungal infection of the feet in school children.

Summary

1,839 boys and 2,061 girls, aged 11–14, from 12 secondary modern schools, and 894 boys, aged 7–10, in four junior schools, all situated in three different districts of Bristol, were examined for tinea pedis.

Of the senior boys 40.3% had lesions and 6.6% had tinea pedis; 30.4% of senior girls had lesions and 1.6% tinea pedis; 33.2% of junior boys had lesions and 2.2% were infected.

In the girls the incidence was too low to allow correlation of results with relevant environmental factors.

In the boys the incidence of tinea pedis increased gradually to age 11 and then fluctuated irregularly.

No correlation was found between infection rate and cleanliness, the presence of non-mycotic lesions, social class, or the use of school showers.

There was a marked correlation between infection and the district in which the schools were situated. Senior and junior boys' schools in district A had 8.9% and 3.1% infection respectively: similar schools in districts B and C together had 5.5% and 0.4% infection respectively. It is concluded the local swimming-baths and the frequency with which they are used are the probable cause of this.

Of the 179 infections, 84.4% were caused by *Trichophyton mentagrophytes*, 7.2% by *T. rubrum*, 3.9% by *Epidermophyton floccosum*, and 4.4% were identified by microscopical examination only.

We acknowledge the kindness of the head teachers and staffs of the schools, without whose co-operation this investigation would have been impossible. We are indebted to Miss E. H. L. Duncan, of the Central Health Clinic, Bristol, for guidance and practical help in the statistics. Our thanks are also due to Dr. R. P. Warin and Dr. C. D. Evans, of Bristol Royal Hospital, and to Dr. R. C. Wofinden, medical officer of health, Bristol, for their advice and encouragement.

ADDENDUM.—Since writing this paper our attention has been drawn to Scheffler's (1958) investigation of tinea pedis in 2,622 German school children. Though differing from ours in the wider age range of the children and in slightly more restricted criteria for selection of those for scraping, the results should be roughly comparable. In fact, Scheffler's total incidence of infection of 3.4%, as determined by microscopical examination, is remarkably similar to ours, but the incidence in the sexes, determined microscopically, differs in being almost equal in boys and girls. However, the dominant fungus among Scheffler's subjects is *T. rubrum* (79% of 67 cultures obtained); and indications in our survey and in the investigation of this fungus in families (English, 1957) are that the incidence of *T. rubrum* in females far more nearly approaches that in males than is the case for *T. mentagrophytes*. Scheffler's results support this observation. Unfortunately Scheffler does not give the incidence of the fungus species in the sexes; nor does he relate his mycological findings to age.

REFERENCES

Amrein, H. P (1953). *Praxis*, **42**, 197.
Andrews, G. C., and Birkman, F. W. (1931). *N.Y. St. J. Med.*, **31**, 1029.
Bocobo, F. C., and Garcia, D. (1950). *J. Philipp. med. Ass.*, **26**, 169.
English, Mary P. (1957). *Brit. med. J.*, **1**, 744.
—— and Gibson, Mary D. (1959). Ibid., **1**, 1446.
Gentles, J. C., and Dawson, Christine O. (1956). *Trans. Brit. mycol. Soc.*, **39**, 465.
Holmes, J. G., and Gentles, J. C. (1956). *Lancet*, **2**, 62.
Lomholt, S. (1938). *Med. Klin.*, **34**, 118.
Polemann, G. (1955). *Arch. klin. exp. Derm.*, **201**, 24.
Scheffler, H. S. F. (1958). *Mykosen*, **1**, 102.
Strauss, J. S., and Kligman, A. M. (1957). *A.M.A. Arch. Derm.*, **76**, 70.
Tritsmans, E., and Vanbreuseghem, R. (1955). *Belg. T. Geneesk.*, **11**, 625.
Wallace, G. I., and Moorman, H. E. (1943). *Arch. Derm. Syph. (Chicago)*, **47**, 816.
Wilde, H. (1951). *Z. Haut- u. Geschl.-Kr.*, **10**, 99.

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II. DERMATOPHYTES ON THE FLOORS OF SWIMMING-BATHS

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The results of a recent investigation into the epidemiology of tinea pedis in Bristol school children (English and Gibson, 1959) suggested that the public swimming-baths were an important source of transmission of this infection.

Amrein (1953) found that school children in Zurich, with access to public swimming-baths, showed nearly the same percentage of infection as was found in the Bristol children, but that those from remote mountain villages with no public bathing facilities had no infection with tinea pedis. Amrein did not report any attempt to isolate dermatophytes from the floors of the baths.

Tritsmans and Vanbreuseghem (1955), in Belgium, showed that 30% of persons whose main recreation was swimming in public baths had tinea pedis, compared with 4.5% of gymnasts and 3.5% of a control group. They failed, however, to grow dermatophytes from material scraped from the floors of the swimming-baths used by their subjects. Attempts to isolate these fungi from the floors of shower-baths in the United States by similar sampling methods (Ajello and Getz, 1954; and other workers) have had disappointing results.

However, Gentles (1956) has developed a direct sampling technique, which he used with considerable success on the floors of pithead baths, and this method has been adopted for the examination of three swimming-baths in Bristol.

The swimming-baths investigated were baths A, B, and C, used by the school children examined in our survey of tinea pedis (English and Gibson, 1959).

Baths A and C were so laid out that the accommodation for changing opened on to passages from which the only access to the pool itself was through footbaths filled with chlorinated water. In bath B the cubicles opened straight on to the side of the pool. Sampling of the changing accommodation included showers, lavatories, passages, and wooden slats, where they existed, as well as the floors of the cubicles. Floors were made from smooth tiles patterned with grooves, with a strip of concrete 1 ft. (30 cm.) wide surrounding the pool.

All baths were cleaned twice daily with brooms and a solution of "chloros." In addition, baths B and C were sluiced down with buckets of water frequently during the day. Bath A was not sluiced.

Procedure and Methods

Sampling was carried out during those parts of the school term falling in the period July to October, 1957. Samples were taken at 9 a.m., before the admission of bathers, and at approximately 4 p.m., up to which time the great majority of bathers were organized school