Prevalence and intensity of *Schistosoma haematobium* urinary schistosomiasis in the Port St Johns district

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A urinary schistosomiasis survey undertaken in the Port St Johns district of the former Transkei showed the parasite to be endemic and noted an increase in overall infection rates in the region compared with previous studies. There was a general stability in infection over the sampling period 1987 - 1989. Prevalence rates were low to moderate with an overall prevalence of 42%. These ranged from approximately 10% in the low-prevalence settlement to 89.9% in the settlement with the highest prevalence. Infection rates were found to decrease nearer the coast, and settlements closest to the sea had the lowest prevalence rates. The intensity of infection was low, with the majority of patients having fewer than 200 eggs per 10 ml urine. Very few sufferers were treated with Ambilhar at clinics and hospitals.

S Afr Med J 1996; **86:** 76-80.

The former Transkei lies near the southern limit of the area of distribution of *Schistosoma haematobium* in Africa. The recently available database on schistosomiasis in this region consists of surveys carried out by researchers on their way through Transkei.[1,2] Inadequate explanation to villagers of the purpose of schistosomiasis surveys in the past resulted in poor co-operation between researchers and subjects. Nevertheless, Pitchford and Geldenhuys[1] made a number of anecdotal observations on the situation here which suggested that it might differ from that elsewhere in South Africa in that: (*i*) the disease appeared to be confined to low-lying watercourses; (*ii*) it became less common close to the coast; (*iii*) few host snails (*Bulinus africanus*) were present, perhaps as a consequence of the effects of the floods; and (*iv*) a prediction that although *S. mansoni* was not found in Transkei, its introduction would be facilitated if human living patterns changed. The government policy during the 1960s did just this by encouraging the aggregation of houses into settlements.

More recent surveys in different parts of Transkei[2,3] have reported that infection rates are generally low to moderate here, and range from 2% to 38%. Given the limited knowledge of urinary schistosomiasis in Transkei, and because sound epidemiological data on the status of the disease in a particular area are necessary for the design of a control programme that will succeed in the long term,[4] an epidemiological study was undertaken in the Port St Johns district to look for a link between the moderate prevalence levels, water-contact patterns and certain socio-economic variables at the community level. This paper therefore reports on the prevalence and intensity of *S. haematobium* infection rates in both schoolchildren and adults of the Port St Johns district.

The study area

The Port St Johns district lies on the coastal plain of Transkei between 31° 30' and 31° 45'S and 29° 15' and 29° 30'E. The annual rainfall is between 750 mm and 1 400 mm with most falling during summer (October to March). In summer (January) the mean daily maximum temperature is 28.0°C and the minimum 23.2°C and in winter (July), 17.0°C and 8.0°C.[5]

A steep coastal escarpment has been deeply incised by perennial rivers, resulting in an irregular topography with numerous valleys and hills. The natural vegetation of the plain belongs mostly to veld type 1 of Acocks,[6] coastal forest and thornveld, with type 23, valley bushveld, in the river valleys.

The average population density is 96 people per km^2,[7] and their wattle and daub homesteads are usually built on steep slopes, close to rivers where possible. Corrugated iron roofs are a symbol of status. These rural areas have no treated, piped water so that natural bodies of water, wells and small dams are the only sources of water supply. Only 12.8% of households had sanitary facilities or pit latrines and most used the bush for the disposal of excreta.[8] The people have an ambivalent attitude towards education, with various farming techniques often taking precedence over learning. Agriculture is the main activity and 'a way of life rather than an enterprise for economic gain'.[9]

Materials and methods

A urinary schistosomiasis survey was conducted among schoolchildren in eight schools in the Port St Johns district (Fig. 1) at 6-monthly intervals from May 1987 to May 1989. For this purpose, pupils in each school were divided into five age groups, viz: 5 - 7; 8 - 10; 11 - 13; 14 - 16 and > 17 years. One urine sample was also collected from adults (> 17 years), in March 1988. All samples were collected in numbered 250 ml plastic specimen bottles with tightly fitting lids. The names of all individuals who gave samples were recorded. These were brought to the laboratory where they were processed by means of a helminth filter method.[10]

Statistical method

The intensity of infection is given as the geometric mean egg count per 10 ml urine. Student's *t*-test was used to identify

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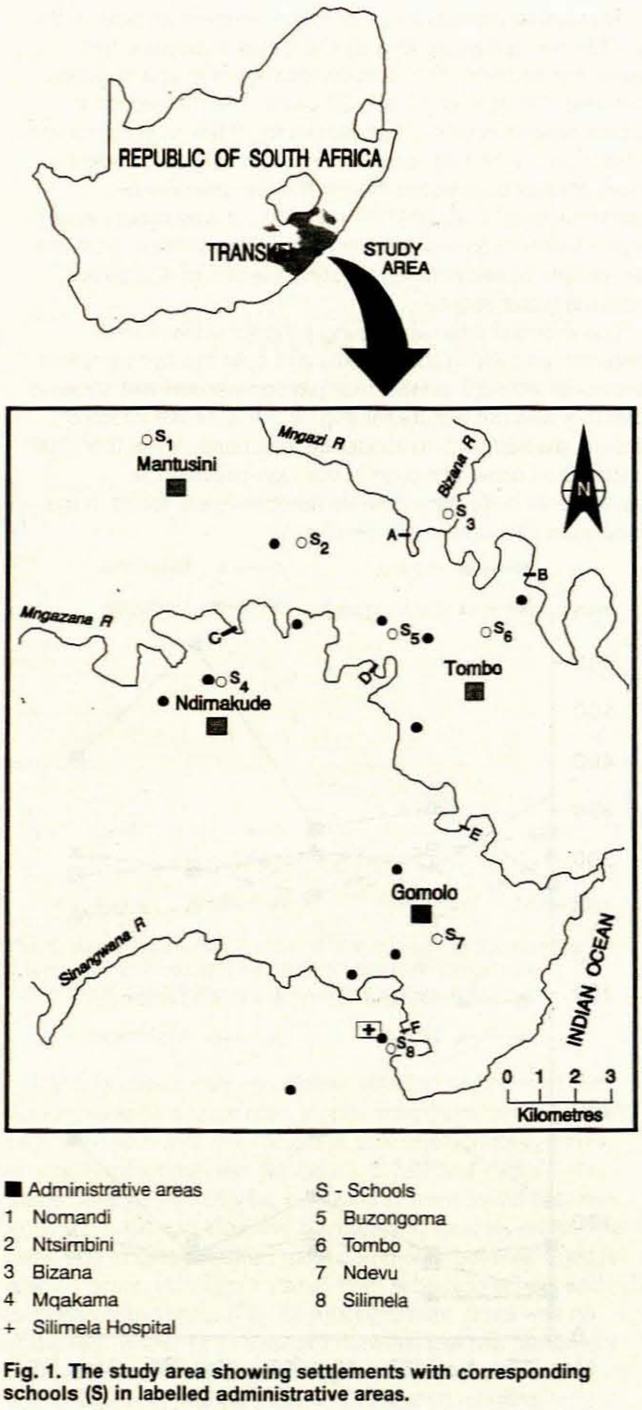

■ Administrative areas
1 Nomandi
2 Ntsimbini
3 Bizana
4 Mqakama
+ Silimela Hospital

S - Schools
5 Buzongoma
6 Tombo
7 Ndevu
8 Silimela

Fig. 1. The study area showing settlements with corresponding schools (S) in labelled administrative areas.

statistical differences in egg output between males and females. Chi-square tests were used to test for significant differences between male and female and school prevalences. A Spearman rank correlation test was used to test whether a relationship existed between the prevalence and the intensity of infection in a community. Tukey's HSD multiple comparison test[11] was used to check for significant differences within and between the schools and the sampling sessions. The frequency/intensity analysis was based on the categories for *S. haematobium* egg output used by Schutte *et al.*[12]

Results

During the sampling period, the prevalence of infection in schoolchildren ranged from 10.9% to 89.9% in the lowest and most highly infected areas respectively, giving an overall rate of 42%. Infection rates decreased with increasing proximity to the sea. Four schools that were further inland had constantly high prevalence rates and were collectively termed 'high-prevalence settlement' schools. These were Nomandi, Mqakama, Buzongoma and Bizana, and had a mean infection rate of 67% (Table I). This contrasted with the 'low-prevalence settlement' schools closer to the sea: Ntsimbini, Tombo, Ndevu and Silimela, which had a mean prevalence rate of 27% (Table II) (Fig. 2).

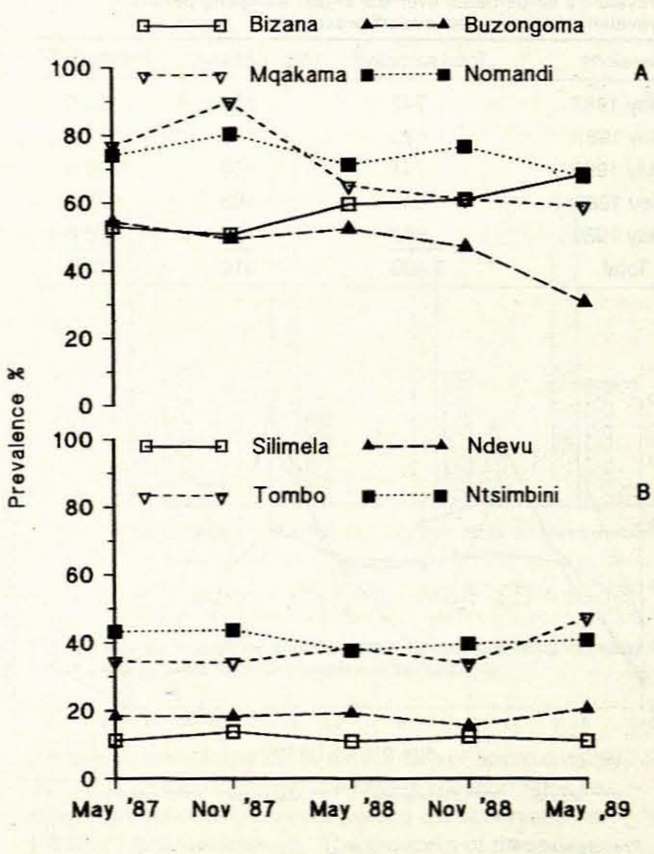

Fig. 2. Combined prevalence of *S. haematobium* in children from all schools during the study period: (A) high-prevalence settlements; (B) low-prevalence settlements.

Differences between boys and girls in respect of infections were apparent in both the high- and the low-prevalence settlements. In the high-prevalence settlements, girls were significantly more frequently infected than boys in May 1987 and November 1988 ($\chi^2 = 5.0406$ and 9.3056; $P < 0.05$ respectively) and also when the data from all five samples were pooled ($\chi^2 = 8.2067$; $P < 0.05$). The reverse was true in the low-prevalence settlements in all sampling sessions except the first ($\chi^2 = 5.1165$, 15.9715, 14.1118 and 24.822; $P < 0.05$) and again when the data for all four sampling sessions were pooled ($\chi^2 = 54.1058$; $P < 0.05$). In neither settlement group were infection rates in adult men and women (> 17 years) different ($\chi^2 = 0.0486$ and 0.0195 respectively; $P > 0.05$).

Table I. Total number of children sampled from the high-prevalence settlements over the 2-year sampling period — prevalence/session and overall prevalence

Session	Total sampled	No. positive	Prevalence
May 1987	446	298	66.8
Nov 1987	371	262	70.6
May 1988	411	322	78.3
Nov 1988	358	226	63.1
May 1989	479	274	57.2
Total	2 065	1 382	66.9

Table II. Total number of children sampled from the low-prevalence settlements over the 2-year sampling period — prevalence/session and overall prevalence.

Sessions	Total sampled	No. positive	Prevalence
May 1987	742	200	27.0
Nov 1987	620	170	27.4
May 1988	741	195	26.3
Nov 1988	645	163	25.3
May 1989	652	188	28.8
Total	3 400	916	26.9

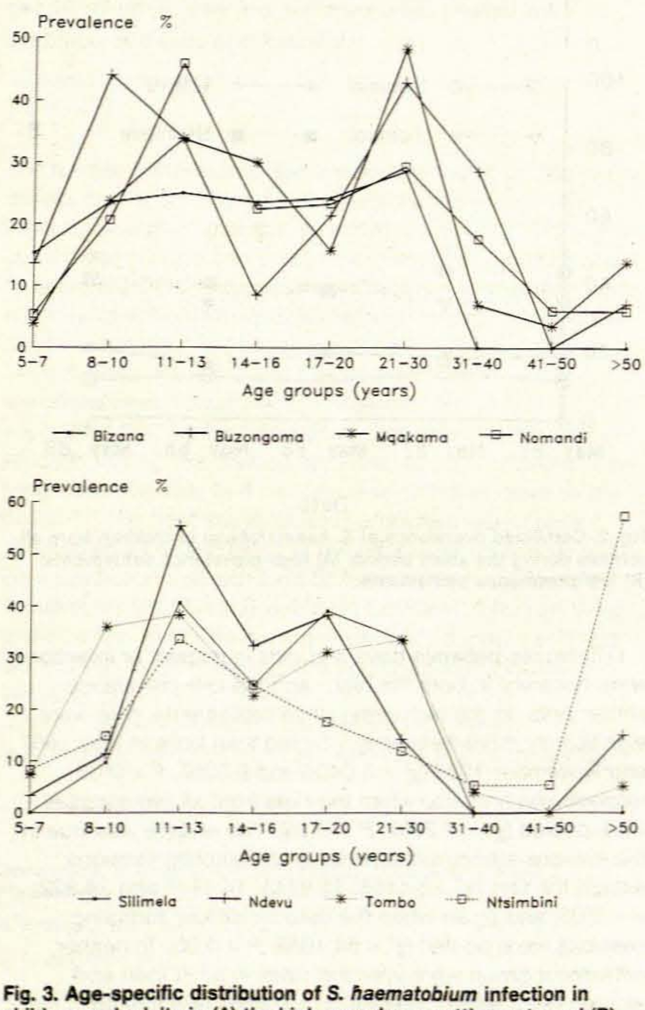

Fig. 3. Age-specific distribution of *S. haematobium* infection in children and adults in (A) the high-prevalence settlements and (B) the low-prevalence settlements.

The overall prevalence of infection reached its peak in the 8 - 13-year age group (Fig. 3) but it was noticeable that in six of the settlements, infection rose again in young adults between the ages of 17 and 30 years. The prevalence in adults ranged from 4.2% at Ndevu to 29.6% at Buzongoma with those in the high-prevalence settlements significantly more frequently infected than in the low-prevalence settlements ($\chi^2 = 36.6031$; $P < 0.0001$). It was observed also that infection was more common in schoolchildren from the same area of settlement, reflecting the use of a common, infested water source.

The infection intensity among schoolchildren varied between and within the schools and over the five sampling sessions, although a HSD multiple comparison test showed that this was not significant (Fig. 4). Most of the infected individuals had light-to-moderate infections, fewer than 200 eggs/10 ml urine, although in the high-prevalence settlements quite considerable numbers were found in the moderate and severe groups (Fig. 5).

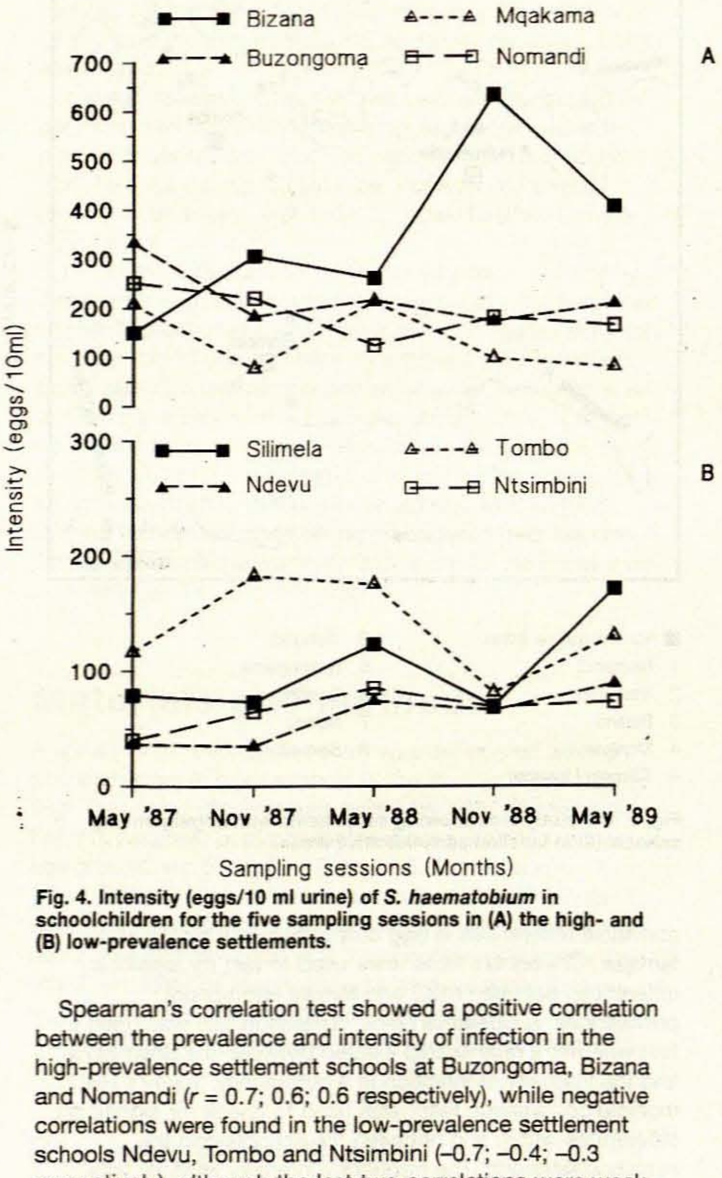

Fig. 4. Intensity (eggs/10 ml urine) of *S. haematobium* in schoolchildren for the five sampling sessions in (A) the high- and (B) low-prevalence settlements.

Spearman's correlation test showed a positive correlation between the prevalence and intensity of infection in the high-prevalence settlement schools at Buzongoma, Bizana and Nomandi ($r = 0.7$; 0.6; 0.6 respectively), while negative correlations were found in the low-prevalence settlement schools Ndevu, Tombo and Ntsimbini (–0.7; –0.4; –0.3 respectively), although the last two correlations were weak. No significant correlations were found at Mqakama and Silimela.

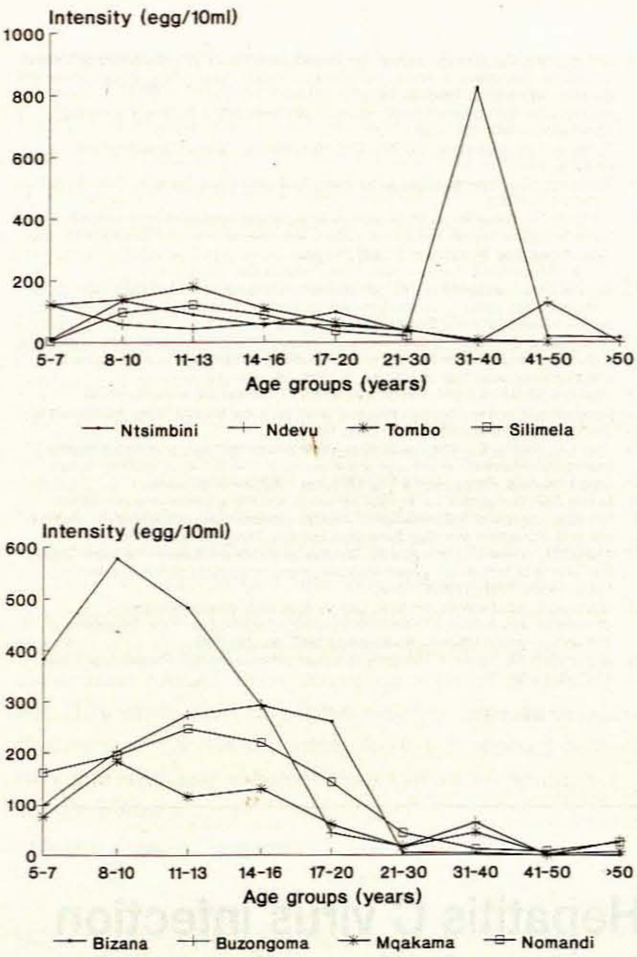

Fig. 5. Age-specific distribution of the intensity of *S. haematobium* infection in children and adults in (A) the high-prevalence settlements and (B) the low-prevalence settlements.

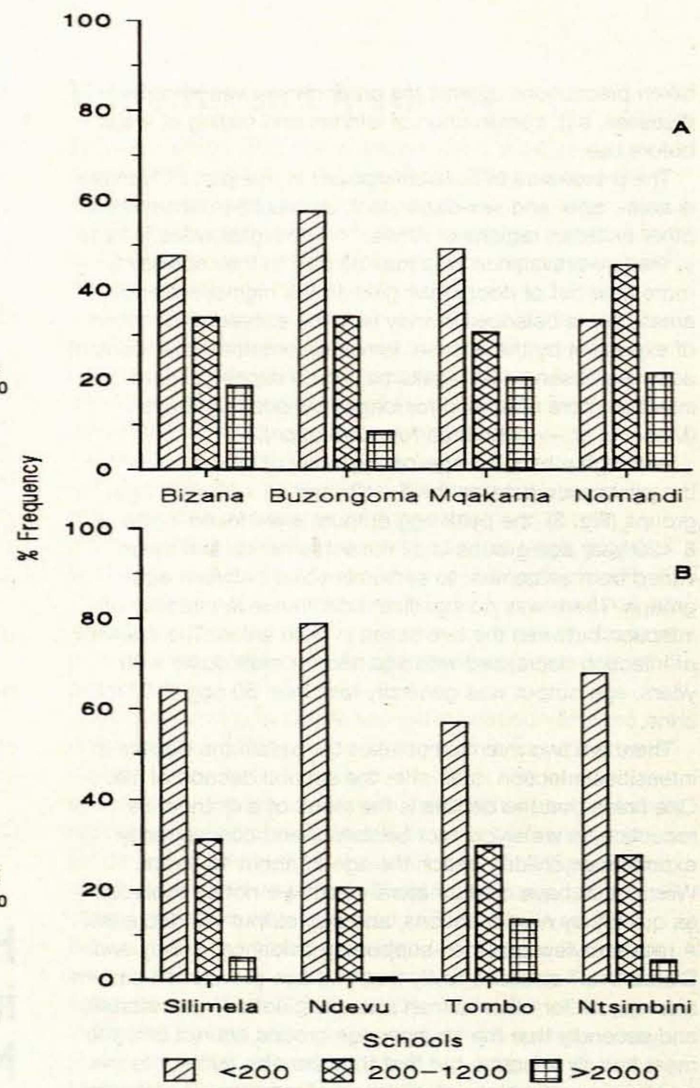

Fig. 6. Relative frequency distribution of *S. haematobium* intensity in the (A) high- and (B) low-prevalence settlements.

Although boys were more often infected than girls in the low-prevalence settlements, significant differences in intensity between the sexes were found at only one school in either group, Buzongoma and Tombo (t = 3.788 and 4.255 respectively; $P < 0.05$). No correlations were found between infection rates and intensity in males and females either. The peak egg output occurred most commonly between ages 8 and 20 years, although it varied from school to school and between settlements (Fig. 6). Among adults, there was no statistical difference in intensity between the two settlement groups (t-test, $P > 0.05$) and egg output in subjects > 30 years was uniformly very low, < 50 eggs/10 ml urine.

Discussion

Urinary schistosomiasis is endemic to Transkei but is not recognised as a public health problem. Most people are aware of the disease but very few sufferers bother to treat it, even those with heavier infections, since they do not regard the symptoms, notably haematuria, as unusual. Few individuals were found to have been treated with Ambilhar at hospitals and clinics.

The prevalence data from the eight settlements investigated form a continuum from a maximum of 70 - 90% (Mqakama and Nomandi) to a minimum of approximately 10% (Silimela). Those with the lowest infection rates lie closest to the coast, thus supporting the observation of Pitchford and Geldenhuys.[1] The grouping of these settlements into those with high and low prevalences is obviously artificial, but does provide a convenient basis from which to conduct an epidemiological analysis.

A feature of the prevalence data is their general stability over the 2-year sampling period. The reduction in infection rates at Buzongoma and Mqakama (Fig. 2) may reflect the influence of the severe 1987/88 floods on *Bulinus africanus* populations in the Mngazana river. Three of the low-prevalence schools, Tombo, Ndevu and Silimela, were sampled 5 years earlier by Schutte (1983, unpublished data) who used the same technique and found higher prevalences at the time (67%, 23% and 36% respectively). In two cases, Tombo and Silimela, prevalences were significantly higher (χ = 50.042 and 114.578; $P < 0.0001$). These reductions in prevalence may be the result of the health education campaign run by the community health staff of Silimela Hospital during the cholera and typhoid epidemic of 1983. Tshibangu[8] noted that as a result of these campaigns, approximately 12.8% of the population in his survey had taken precautions against the predominant waterborne diseases, e.g. construction of latrines and boiling of water before use.

The prevalence of *S. haematobium* in this part of Transkei is area-, age- and sex-dependent, as has been observed in other endemic regions of Africa.[12-15] The higher rates in boys in the low-prevalence area may be due to their spending more time out of doors than girls. In the high-prevalence areas, this is balanced or may even be exceeded (in terms of exposure) by the intense, female-orientated water-contact activities observed at Mqakama, which expose girls to infection more often and for longer periods than boys (Mqoqi *et al.* — submitted for publication).

Although a bimodal age-prevalence curve was evident in the prevalence data on the 8 - 13- and 21 - 30-year age groups (Fig. 3), the peak egg outputs were found in the 8 - 20-year age groups in all the settlements, and these varied from settlement to settlement and between age groups. There was no significant difference in intensity of infection between the two sexes in both areas. The intensity of infection decreased with age and for individuals > 30 years, egg output was generally less than 50 eggs/10^{-1} ml urine.

There are two main hypotheses to explain the decline in intensities/infection rates after the second decade of life. One holds that the decline is the result of a change, i.e. reduction, in water-contact behaviour and consequently exposure as children reach the age of about 15 years. Worms that have died a natural death will not be replaced as quickly by new infections, and egg output will decrease. A recent review provided supporting evidence: Bundy and Blumenthal[16] stressed firstly that this age-prevalence pattern also occurs for other human parasites, notably nematodes, and secondly that the younger age groups are not only the most heavily infected, but that they are also subject to the most exposure with least evidence of resistance to infection or reinfection. This implies that naturally acquired immunity has little relevance to the prevention of the disease. Adults show at least partial immunity but also experience less exposure which, the authors conclude, is the major determinant of helminth parasite burdens.

The alternative hypothesis is that the decline in prevalence is largely due to acquired immunity which only develops during the second decade of life.[17-19] In the light of this debate, a water-contact survey was done at one of the high- and low-prevalence settlements to relate the prevalence and the intensity of *S. haematobium* infection to exposure to infested water.

We acknowledge the co-operation of the pupils and the staff of the schools and the residents of the settlements investigated. We also acknowledge the assistance in the field of Mr D. Mafu and the staff of the Department of Zoology, University of Transkei, and both the University of Transkei and South African Medical Research Council for financial support.

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Accepted 2 Mar 1995.

Hepatitis C virus infection in chronic liver disease in Natal

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The aim of this cross-sectional seroprevalence study was to determine the prevalence of antibodies to hepatitis C virus (HCV) (anti-HCV) in patients with cirrhosis, hepatocellular carcinoma (HCC) and chronic active hepatitis (CAH) attending a referral hospital in a hepatitis B virus (HBV)-endemic area in South Africa. One hundred and ten patients with suspected cirrhosis, 44 with suspected HCC and 6 with chronic hepatitis were initially included. The diagnoses were confirmed in 77 patients with cirrhosis (histologically or macroscopically at

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