be of value in managing patients with severe postvagotomy diarrhoea who have not responded to other measures.

We thank Bristol Laboratories for assistance in performing this study.

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Prevalence of intestinal parasitic infestation, salmonellosis, brucellosis, tuberculosis, and hepatitis B among immigrant children in Glasgow

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Summary

Two hundred Asian and 100 each of African, Chinese, and Scottish children were screened for intestinal parasitic infestations, salmonellosis, brucellosis, hepatitis B antigen (HBsAg), and tuberculosis. There was a fairly high incidence of *Giardia lamblia* among Asian and Scottish children and of *Trichuris trichiura* among the Chinese. Hookworm ova were seen only in African children. There were no chronic carriers of *Salmonella* or *Brucella*, and no one was suffering from salmonellosis or brucellosis. Tuberculin sensitivity was found in only 4% of immigrant and 1% of Scottish children: the difference was small and neither figure suggests a continuing high incidence of tuberculosis in Glasgow. Only seven immigrant children were found to be HBsAg carriers. Among the families of these carriers there was a high incidence (84%) of HBsAg or antibody (HBsAb).

The survey shows that immigrant children in Glasgow do not constitute a health hazard to the indigenous population. Moreover, severe overcrowding is not a prominent feature among the immigrant families in Glasgow but is greatest among the local Scots.

Introduction

Large-scale immigration into the United Kingdom has brought with it the problem of imported infections.¹⁻⁶ To assess whether immigrant children from tropical and subtropical countries have transmissible infections and infestations that might constitute a health hazard to native Scottish children we designed a survey

to compare health and nutrition in Asian, African, and Chinese children with those in Scottish children of similar social background.⁷ We report here our preliminary findings on the prevalence of intestinal parasitic infestations, salmonellosis, brucellosis, hepatitis B antigen (HBsAg), and tuberculosis among children who were examined in 1974. The Asians were all from the Indian subcontinent, the Africans from various parts of Africa, and the Chinese from Hong Kong. The term Scottish means local White children.

Patients and methods

There are about 12 000 Asians, 1100 Africans, and 3000 Chinese in Glasgow. The immigrant community is mainly concentrated within two major areas on either side of the River Clyde. The children studied came from two schools north of the Clyde. Preschool siblings in the same families were also asked to attend. Forms explaining the purpose of the survey with translations into Urdu, Punjabi, Hindi, and Chinese were given to the parents of each family. The children of parents who agreed to participate were studied at a special clinic held by one of us (KMG) at the Royal Hospital for Sick Children, Glasgow.

Five hundred children (200 Asians and 100 Africans, 100 Chinese, and 100 Scots) from 172 families were studied (table I). The children were aged 6 months to 16 years. Two hundred and eighty-eight of the immigrants were born in the United Kingdom. Almost half the children (217; 102 Asians, 12 Africans, 38 Chinese, and 65 Scots) came from homes with more than two people per room. Sanitation in most of these homes was relatively good, however, and almost all had inside lavatories.

Examination of faeces—A total of 1015 stool specimens from 457 children were examined.⁸ One, two, or three specimens of faeces were submitted by 30%, 34%, and 36% of children respectively. Faeces emulsified in (a) saline and (b) Lugol's iodine were examined microscopically for vegetative parasites, ova, and cysts. Other specimens were similarly examined for ova after zinc sulphate and formol ether concentration. Specimens were cultured by direct plating on MacConkey and deoxycholate citrate (DCA) plates and by inoculation of Selenite F and tetrathionate enrichment broths, which were subcultured on MacConkey and DCA plates after overnight incubation at 37°C. MacConkey plates were examined for enteropathogenic *Escherichia coli* serotypes by screening lactose-fermenting colonies with polyvalent antisera (Wellcome), and positive colonies were taken to titre with specific antisera. Non-lactose-fermenting colonies on MacConkey and DCA plates were subcultured on urea and nutrient-agar slopes. Urea-negative colonies were then screened for salmonellae and shigellae using polyvalent antisera (Wellcome). Agglutinating

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colonies were examined biochemically (using the API system) and simultaneously taken to titre in tube dilution tests with specific antisera.

Widal agglutinations—Using automatic pipettes doubling dilutions of 411 sera (from 154 Asians, 81 Africans, 83 Chinese, and 93 Scots) in saline from 1/20 to 1/320 were examined for salmonella antibodies by titration against stained H and O suspensions of *Salmonella typhi* and *Salmonella paratyphi* B. Non-specific salmonella antibodies were sought using a suspension containing H factors 1, 2, and 5. Sera for H agglutination were incubated in 1-ml amounts in 75 × 9.5-mm tubes at 50°C for 18 hours and sera for O agglutination were incubated in 1-ml amounts in 75 × 12.5-mm tubes at 37°C for 18 hours. All serological titres were expressed as reciprocals of serum dilutions.

Brucella antibodies—The direct agglutination test was identical to the Widal O agglutination test but used stained suspensions of *Brucella abortus* and *Brucella melitensis* (Wellcome). For the Coombs test the incubated mixtures were washed four times and reconstituted in saline. One drop of Coombs reagent (antihuman globulin) at optimum dilution was added before further incubation at 37°C for 18 hours.

HBsAg and HBsAb tests—Sera from 351 children were tested for the presence of HBsAg by solid-phase radioimmunoassay (Ausria II,

Abbott Laboratories, Chicago). Positive reactions were confirmed by neutralisation with specific antibody (HBsAb) and subtyped by neutralising with monospecific anti-d and anti-y antibody and comparing the amount of antibody remaining after neutralisation. Residual antibody was measured by solid-phase radioimmunoassay (Ausab, Abbott Laboratories, Chicago), which was also used to test sera from family groups for the presence of HBsAb.

Tuberculin Tine test—All 500 children underwent human tuberculin Tine testing to determine the prevalence of tuberculin sensitivity in the immigrant and native communities. The Tine test was used instead of the more precise Mantoux test because of its practical advantages.

Results

Intestinal parasites—The faeces of 69 children (29 Asians, 10 Africans, 17 Chinese, and 13 Scots) were found to have pathogenic intestinal parasites or bacterial pathogens (table II). Their ages varied from 6 months to 15 years. Fourteen children belonged to social class II, 46 to social class III, 8 to social class IV, and only one to social class V. Thirty-two children with intestinal parasites lived in overcrowded

TABLE I—Social information on 500 children

Ethnic group	No of children	No of families	Sex (M:F)	Mean age (and range) (years)	Country of birth		English speaking parents						Social class					No of persons per room			
					UK	Own country	Mother			Father			I	II	III	IV	V	0-2	1-4	-6	-8
							Yes	Poor	No	Yes	Poor	No									
Asian	200	53	118:82	6½ (6m-16)	162	38	16	31	6	47	6			5	130	51	14	98	98	4	
African	100	40	53:47	7½ (6m-16)	75	25	40			40			21	31	48			88	12		
Chinese	100	42	45:55	7½ (6m-16)	51	49	3	18	21	14	18	10		29	71			62	35	3	
Scottish	100	37	42:58	7½ (6m-16)	100		37			37				18	67	15		35	27	27	11
Total	500	172	258:242	7½ (6m-16)	388	112	96	49	27	138	24	10	21	83	316	66	14	283	172	34	11

TABLE II—Results of stool examination of 457 children. Results and numbers percentages of children

Ethnic group	No of children	No of stools tested	No of positive stools	No of children	Giardia	Ascaris	Hook-worm	Thread-worm	Trichuris	Shigella sonnei	Enteropathogenic E coli	Non-pathogenic parasites	Mixed infections
Asian	196	455	67	29	20 (10.2)	2 (1.02)		2 (1.02)	1 (0.51)	2 (1.02)	2 (1.02) (055 B5 0114 K90)	4 (<i>Hymenolepis nana</i> , 5 (<i>Entamoeba coli</i>), 2 (<i>Iodamoeba butschlii</i>))	2 (<i>Hymenolepis nana</i>), 1 (<i>Entamoeba coli</i>), 1 (<i>Giardia</i>), 1 (<i>Entamoeba coli</i>), 1 (<i>Ascaris</i> , <i>Trichuris</i>)
African	88	164	19	10	1 (1.1)	2 (2.3)	5 (5.7)		2 (2.3)			4 (<i>Entamoeba coli</i>)	2 (<i>Hookworm</i> , <i>Trichuris</i>)
Chinese	90	200	28	17	1 (1.1)	3 (3.3)			13 (14.4)				1 (<i>Giardia</i> , <i>Trichuris</i>)
Scottish	83	196	26	13	11 (13.3)				1 (1.2)		1 (1.2) 0124 B17	3 (<i>Entamoeba coli</i>)	None
Total	457	1015	140	69	33 (7.2)	7 (1.5)	5 (1.1)	2 (0.43)	17 (3.7)	2 (0.43)	3 (0.65)	18 (3.9)	7 (1.5)

TABLE III—Widal agglutination and Brucella antibodies in 411 children

Ethnic group	No tested	Reciprocal of titre	Salmonella typhi		Salmonella paratyphi		Non-specific Salmonella H (1, 2, 5)	Brucella abortus		Brucella melitensis	
			H	O	H	O		Direct agglutination	Coombs test	Direct agglutination	Coombs test
Asian	154	20 40 80 160	3 2	9 3 9	1	8 3	1 1		1 1		1 1
African	81	20 40 80 160	3 1	6 5 5	1 5 4	6	2 1 1	6 1	5 3 3	1	3 1 1
Chinese	83	20 40 80 160	5 3 1	2 6 7 9 2	2 3	10 3	4 4 2 1 1	1 4	3 1 3	2 1	5 1
Scottish	93	20 40 80 160			1						
Total	411		18	63	17	30	18	12	20	4	13

TABLE IV—Results of HBsAg screening of 351 children

Ethnic group	No tested	No (%) positive for HBsAg	Age (years) and sex	Subtype	Place of birth	Family studies			
						Parents and sibs	Antigen (RIA)	Antibody (RIA)	Subtype
Asian	147	2 (1.4)	8 F 6 M	ay ay	UK UK	Mother Father Sister	+	—	ay ay
African	34	1 (2.9)	15 F	ay	Nigeria	Mother Father Brother Sister	— — + —	— + — +	ay
Chinese	78	4 (5.12)	14 F 13 M 13 F	ad ad ad	Hong Kong Hong Kong Hong Kong	Mother Father Mother Father	+ — — —	— + + +	ad
Scottish	92	0 (0)	14 F	ad	Hong Kong	Mother Brother	— —	— —	ad
Total	351	7							

TABLE V—Results of tuberculin Tine test on 500 children

Ethnic group	No tested	BCG vaccination		Tine test		Primary tuberculosis
		Yes	No	Negative	Positive	
Asian	200	198	2	198	2	1%
African	100	96	4	100	0	0%
Chinese	100	80	20	97	3	3%
Scottish	100	96	4	99	1	1%
Total	500	470	30	494	6	5%

households. Of the 56 immigrant children 30 were born in the United Kingdom and 26 abroad. Cysts of *Giardia lamblia* were found in 33 children, ova of *Trichuris trichiura* in 17, ova of roundworm (*Ascaris lumbricoides*) in seven, ova of hookworm in five Africans, and ova of threadworms in two Asians. All five African children with hookworm ova in their faeces were born in Nigeria. No child with positive stools had any symptoms. All 33 children with giardial cysts in their faeces were born in the United Kingdom. Only two Asian children—that is 0.4% of the children surveyed—were carriers of *Shigella sonnei*, and two more Asians and one Scottish child yielded specific enteropathogenic *Escherichia coli* on culture (*E. coli* 055 B5, 0114 K90, 0124 B17). Eighteen children (3.9%) had non-pathogenic parasites: *Hymenolepis nana* in four, *Entamoeba coli* in 12, and *Iodamoeba buetschlii* in two. Polyparasitism was not as common as expected, more than one kind of parasite being found in only seven of the 140 infested stools. Thirty-eight per cent of the children had significant eosinophilia (over $0.4 \times 10^9/l$), and 53% of these were found to have intestinal parasitic infestation.

Widal agglutinations—One hundred and forty-six sera (from 40 Asians, 47 Africans, 57 Chinese, and 2 Scots) reacted positively (with a titre of ≥ 20) in the standard Widal agglutination test for *Salmonella typhi*, *Salmonella paratyphi* B, and non-specific *Salmonella* (table III). Cultures of faeces were negative for salmonella organisms. None of these children had been immunised with TAB vaccine.

Brucella antibodies—Twenty sera (from 2 Asians, 11 Africans, and 7 Chinese) reacted positively (with a titre ≥ 20) in the standard Coombs test for *Brucella abortus* and 12 (1 Asian, 5 Africans, and 6 Chinese) for *Brucella melitensis* (table III). Of the immigrant children whose sera reacted positively either in the Widal agglutination test or in the standard Coombs test for *Brucella abortus* or *melitensis*, or both, 40% were born in the United Kingdom.

HBsAg and HBsAb—Seven immigrant children were positive for HBsAg (table IV). Both Asians were from the same family, as were two of the Chinese children. All seven children were healthy carriers, and there was no clinical or biochemical evidence of hepatic disease. Three children came from families of social class II and three from families in class III. Two of the Chinese children from the same family were found to have *Trichuris* ova in their faeces. On subtyping the two Asian children and one African were subtype ay and all four Chinese were ad. Within the families where two children were carriers the subtypes were identical. All available family members living in the same household as the index carriers were tested for antigen and antibody. Of 13 tested 11 (85%) were positive for either antigen or antibody. In three families both mother and child (or children) were antigen carriers. In the other two families the child was an antigen carrier and the parents were positive for antibody. None of the parents with antibodies or antigens gave a history of viral hepatitis or jaundice,

contact with a known case of hepatitis, blood transfusion, or drug addiction.

Tuberculin Tine test—Of the 500 children who were tested only six showed a strongly positive reaction (table V). Three were born in the UK and three abroad. Only two of the six had had BCG vaccination and there was a family history of tuberculosis only in the Scottish child. Those born abroad had been in the UK for the past three years.

Discussion

Intestinal parasitism is clearly prevalent in immigrant as well as in native Scottish children. It was present in 18% of Asians, 16% of Africans, 19% of Chinese, and 19% of Scots. *Giardia lamblia* was highly prevalent among Asian (19.2%) and Scottish (16.2%) children, while *Trichuris trichiura* was prevalent among the Chinese (14.4%). Hookworm ova were seen only in Africans (5.7%). All children with parasitic infestation were asymptomatic. About 80% of the children with intestinal parasites belonged to low-income groups. The frequency and the type of parasites seen in immigrant children do not suggest that they are a health hazard either to themselves or to the local Scottish children. Therefore it is doubtful whether preschool stool screening of immigrant children, as suggested by Thompson *et al.*,¹ is justified. Nevertheless, all children with positive stools were treated with an appropriate antiparasitic drug to reduce the reservoir of infection.

The low level of Widal agglutination titres to both H and O antigens in immigrant children was probably due to a previous infection, as these children came from areas where enteric fever is endemic. The level of H agglutinins in normal serum varies to a greater extent in different parts of the world than the level of O agglutinins.⁹ In countries in which enteric fever is prevalent appreciable H titres may be found in the absence of overt infection. As these children were symptom-free and the faecal specimens were repeatedly negative for salmonella organisms it seems that they were neither chronic carriers nor suffering from an active infection.

Only immigrant children, mainly from farming villages, who were known to have drunk raw milk showed serological evidence of *Brucella abortus* or *Brucella melitensis* antibodies. The low titres indicated that these children were not suffering from active brucellosis but had probably suffered from infection in the past. Poole¹⁰ reported that sometimes high titres are found in healthy members of the rural community.

In the adult Scottish population screening of blood donors indicates that 0.1% are asymptomatic carriers of HBsAg.¹¹ No data are available on the number of carriers among children but it is unlikely to be significantly higher, and our own findings on an admittedly small number of children would support this view. The significantly higher prevalence among the immigrant children probably reflects the higher prevalence rates of HBsAg carriage in the adult population in their families' countries of origin.¹²

There is no simple certain way of knowing whether the blood of an HBsAg carrier is infectious. The available evidence suggests that carriers in the health care professions are not sources of infection to their patients.^{13 14} It is unlikely therefore that these children are a source of infection to their classmates, but the lack of data on hepatitis in children indicates caution and a need for further studies.

Although we studied only a few families our results show that HBsAg can spread within the family. They also show how a reservoir of hepatitis B infection can be maintained from one generation to the next,^{15 16} even though, as is the case in Scotland the prevalence of HBsAg carriage and acute hepatitis B infection within the community may be comparatively low. The higher prevalence of HBsAg in immigrant children, and, by implication, in the immigrant community, suggests that the reservoir is being maintained at a higher level than was the case before mass immigration.

The low prevalence of tuberculin sensitivity in immigrant children in this survey (1.25%) probably indicates a decline in tuberculosis in this group. This is possibly due to the fact that 72% of the immigrant children in this survey were born in the United Kingdom and 94% had had BCG vaccination irrespective of the country of origin. The notification rate among immigrant children in Glasgow is lower than that in the native-born group. From 1971 there were 98 notifications of both pulmonary and non-pulmonary tuberculosis in children. Only 12 cases were in immigrants.¹⁷ The policy of taking chest radiographs of immigrants from countries where tuberculosis is prevalent at the port of entry and of giving BCG vaccination to children in their country of origin and in the United Kingdom has promoted this decline. Springett⁵ reported that if exposure to tuberculosis before migration were an important factor in determining clinical infection after migration then it would be reasonable to expect that notification rates would be at their highest shortly after arrival and would decline with length of stay in this country. If this trend continues the immigrant children will soon be out of the high-risk group.

Immigrant children clearly do not constitute a major health hazard to the indigenous population. This is reassuring,

especially as some members of all the Chinese and many of the Asian families in this survey worked as food handlers in restaurants or in grocery shops. We suggest, however, that a similar survey of children from various racial groups should be carried out in other parts of the United Kingdom so that the results could be compared.

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Somatomedin in growth disorders and chronic renal insufficiency in children

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Summary

Somatomedin activity was measured using an embryonic chick cartilage assay in 33 normal and short normal children, 23 children with pituitary growth hormone (GH) deficiency, 14 children with sexual precocity, and

13 children with chronic renal insufficiency. In normal children somatomedin activity correlated well with chronological age: low values in early childhood rose to higher than adult levels at puberty. Children with GH deficiency had significantly lower activities and those with sexual precocity significantly higher activities than normal children. In all three groups somatomedin activity correlated well with bone age. In children with chronic renal insufficiency there was a significant correlation between decreasing somatomedin activity and both a reduced growth velocity and a falling glomerular filtration rate. Somatomedin activity and growth velocity were within normal limits in children with glomerular filtration rates above 30 ml/min/1.73 m².

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Introduction

Salmon and Daughaday^{1 2} showed that growth hormone (GH) promoted skeletal growth by inducing a serum factor that