children with an inhaled foreign body, 80% have a good history of inhalation rather than swallowing, with 80% choking, and up to 20% becoming cyanosed.[2] On examination, the triad of cough, localised wheeze, and decreased air entry can be expected in 60% of patients.[3]

Radiographically, the commonest feature is obstructive overinflation of one or more lobes of the lungs (68%).[2] This is about five times more common than collapse (14%). Pathophysiologically, a foreign body in a bronchus may not obstruct it on inspiration, when the bronchial diameter increases, but may occlude it totally or partially on expiration, when the bronchial diameter decreases.[4] Thus an inspiratory chest *x* ray film will show air in both lungs, but an expiratory film will show that only the normal lung is deflating. Air trapping may be shown best by fluoroscopy (screening) during vigorous respiration or crying both in children aged from 1 to 3 years, in whom full expiratory films may be difficult because of poor cooperation, and in those cases with only minimal degrees of overinflation. Complete obstruction of a bronchus will lead to distal air absorption and collapse.

All inhaled foreign bodies need to be removed bronchoscopically. Various techniques and grasping forceps have been developed which achieve this more easily. Modern ventilating bronchoscopes allow removal to be performed with safety, though there is always a need for close cooperation between the surgeon and the anaesthetist.

Although the role of the expiratory chest *x* ray film is well known in the diagnosis of pneumothorax, its place in the diagnosis of inhaled foreign body needs to be re-emphasised, as appearances on a routine inspiratory chest *x* ray film may be normal.

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Contemporary Themes

Differences in rate of uptake of immunisation among ethnic groups

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Abstract

In the Bradford health district ethnic origin is associated with appreciable differences in morbidity and mortality. In view of these differences a study was undertaken to determine whether there were differences among the ethnic groups in utilisation of the National Health Service, as reflected in the rate of uptake of immunisation, which is offered to all children. Significant differences were found between the British group and some other ethnic groups—notably Pakistani, Indian, and half Negro groups. The rate of uptake of immunisation was nearer the optimum in the Indian group than in the British group. The most unsatisfactory rate of uptake of immunisation overall was found in the half Negro group.

No clear explanation of the differences has been shown, they are likely to be due to various factors in the National Health Service and in the community.

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Introduction

In the Bradford health district ethnic origin is associated with appreciable differences in both morbidity and mortality.[1] In 1980 the perinatal mortality was 29·2 per thousand in the Asian community in Bradford compared with 9·4 in the non-Asian community. This is important because 37·2% of the 1980 birth cohort in Bradford are of ethnic origins other than British (table I).

In view of the differences in morbidity and mortality we thought that it would be useful to know if there were also differences in the utilisation of the National Health Service in Bradford. We decided to examine rate of uptake of immunisation. The basic immunisations—diphtheria, pertussis, tetanus; poliomyelitis; and measles—are offered to all children known to be resident in the district. BCG is offered within the first six weeks of life to all children with ethnic origins in Asia because of the increased incidence of tuberculosis in these ethnic groups. As basic immunisations are offered to all children differences in the rate of uptake are likely to be due to differences in utilisation of the NHS.

The age at which a child is immunised is important and has been reviewed several times by the Joint Committee on Vaccination and Immunisation. The ability to generate a good immune response, which increases with the age of the child, must be balanced against the risks of contracting the infection while still unprotected by immunisation.[2-4] As the benefit of immunisation depends on the age at which it is given, we decided to compare not just total immunisations received by each ethnic group but also the ages at which children in the different ethnic groups received their immunisations.[5]

TABLE I—*Ethnic composition of the 1980 birth cohort of the Bradford health district*

	No	%
British	3545	62·9
Pakistani	1396	24·8
Indian	343	6·1
Half Asian	54	0·9
Half Negro	48	0·8
Bangladeshi	37	0·6
West Indian	35	0·6
Other Asian	26	0·5
European (including Eire)	24	0·4
Asian from Africa	9	0·2
African (excluding Asian)	6	0·1
Any other	114	2·0
Total No in cohort	5637	100

Method

An extensive search of the published reports failed to identify any directly relevant work, either on the differential uptake of immunisations by different ethnic groups or on the ages at which children actually received the immunisations.

Information on immunisation is routinely collected and stored on the mainframe computer at the Yorkshire Regional Health Authority in Harrogate. Data for the Bradford health district also contain information on ethnic groups. Every two weeks the regional computer is used to generate a list of children in date of birth order with their immunisation history. This list is put on to microfiche before being sent out to the Bradford health district. The computer service also issues the postcards calling individual children for immunisation.[5]

The regional computer service was asked to generate tables for each ethnic group in the 1980 birth cohort for the Bradford health district showing the number of children at each age in months who received specified immunisations. The immunisations specified were diphtheria 1, diphtheria 3, pertussis 1, pertussis 3, measles and BCG. Observation of individual records suggested that tetanus and polio immunisation states correlated closely to those for diphtheria. Information on ethnic origin is related to information about the ethnic group of both parents; in Bradford this has been found to be a more relevant health factor than place of birth of the parents.

The 1980 cohort was considered to include all children born in the year starting 1 January 1980 who are currently resident in Bradford. This cohort was selected because: (*a*) it is sufficiently recent for immunisation practices to be comparable to current practice, (*b*) it is long enough ago for the entire cohort to be at least 27 months old at the time of the study; and (*c*) 1980 was the first year of implementation in Bradford of the revised timetable for basic immunisations recommended in the circular *Revised Schedule on Vaccination and Immunisation* (CMO(78) 15).

The tables supplied by the regional computer service were used to generate life tables for all six specified immunisations for each of the seven larger ethnic groups.[6 7] The ethnic groups selected were British, Bangladeshi, Pakistani, Indian, West Indian, half Negro, and half Asian. In constructing the life tables immunisation state was expressed in terms of probability. The use of a 100% sample means that the probabilities expressed are the same as the proportions of the cohort being immunised or not immunised.

Using the data on probability of immunisation at a given age and the probability of not being immunised by any particular age, graphs were constructed using a computerised graph plotter. By superimposing one graph on another the plotter showed several ethnic groups on one graph and thus allowed visual comparisons of different patterns of uptake. The space under the line for each ethnic group indicates the proportion of unvaccinated children at particular ages who represent the remaining workload for the NHS and more importantly, who are not yet protected by immunisation.

The number of individuals in each group is different so divergence shown on the graphs may be misleading. Using the graphs and the life tables for each antigen, comparisons were made between the British group and the other ethnic groups. Having determined the point of greatest divergence, we used the Kolmogorov-Smirnov test, which allows an observed cumulative frequency distribution to be compared with a standard cumulative frequency distribution, giving a probability that the observed sample comes from the standard population.[8] The observed divergence is compared direct with a table of critical values of divergence arranged in rows of sample size. Columns of critical values correspond to defined probabilities, allowing the probability of the observed divergence to be determined simply. Because it uses all the data the Kolmogorov-Smirnov test is considered to be a powerful statistical test.

The British group was used as the standard population for all antigens apart from BCG, for which the Indian group was used because of their good uptake of the other antigens.

The same method was applied to data from the adjacent health district of Airedale.

One problem with this method is its reliance on regionally collected data, the validity of which is difficult to check because it is such a large database collected from many different sources. Nevertheless, some 50 immunisation records from the same cohort checked with the general practitioners' records, in connection with another study, proved correct. The health visitor of any child called three times for immunisation who fails to attend is informed by the computer with a request to follow up the child. If the child has moved the health visitor is asked to notify this and the register is then amended. This procedure should limit the errors caused by including children no longer resident in the district.

Results

Table II shows the probability of the rate of uptake of vaccination being the same in the different ethnic groups compared with the standard population. Significant differences in the patterns of uptake were found between the British group (standard population for all antigens except BCG) and the Pakistani, Indian, and half Negro groups, but were not found for the half Asian group. Some differences were noted in the Bangladeshi and West Indian groups. Differences

TABLE II—*Probability (based on Kolmogorov Smirnov test) of rate of uptake of vaccination being the same in various ethnic groups compared with standard population* from 1980 cohort of Bradford health district*

Ethnic group	Antigen: Diphtheria 1		Diphtheria 3		Pertussis 1		Pertussis 3		Measles		BCG	
	p Value	Age at greatest divergence† (months)	p Value	Age at greatest divergence† (months)	p Value	Age at greatest divergence† (months)	p Value	Age at greatest divergence† (months)	p Value	Age at greatest divergence† (months)	p Value	Age at greatest divergence† (months)
Bangladeshi	0·05	5 (−)	0·05	17 (−)	0·05	21 (+)	0·2	24 (+)	0·2	23 (−)	0·01	9 (−)
Pakistani	0·01	4 (−)	0·01	10 (−)	0·01	27 (+)	0·01	27 (+)	0·01	26 (+)	0·01	3 (−)
Indian	0·01	4 (+)	0·01	24 (+)	0·01	12 (+)	0·01	25 (+)	0·2	26 (+)		
West Indian	0·2	6 (−)	0·01	11 (−)	0·2	22 (+)	0·2	11 (−)	0·2	15 (−)	0·05	3 (−)
Half Negro	0·01	4 (−)	0·01	12 (−)	0·05	8 (−)	0·05	12 (−)	0·01	16 (−)	0·01	16 (−)
Half Asian	0·2	8 (−)	0·2	19 (+)	0·2	22 (−)	0·2	10 (−)	0·2	14 (−)	0·01	8 (−)

* British group was used as standard population for all antigens apart from BCG, for which Indian group was used because of their good uptake of other antigens.
† Greatest divergence from value of standard population (+ = greater rate of uptake, − = lesser rate).

were found between the Indian (standard population for BCG) and other ethnic groups in taking BCG, in spite of a policy of offering BCG to all children with ethnic origins in Asia.

Table III shows the immunisation state of all children at 27 months. By the age of 27 months 81·2% of the half Negro group had received diphtheria 1 immunisation compared with 91·4% of the British group, 95·4% of the Pakistani group, and 99·1% of the Indian group. Figure 1 shows the pattern of uptake of diphtheria 3 for all ethnic groups. Overall the rate of uptake of pertussis immunisation was lower (fig 2) than that of diphtheria and the pattern was similar to that of measles. Figure 3 shows the pattern of uptake of BCG.

The figures show that the Indian group took up immunisation in a manner nearer the optimum than the British group while the half Negro group had a most unsatisfactory rate of uptake. The Pakistani group tended to take immunisation later than the British group in the early months after the recommended age, but subsequently to "overtake" the British group—for example, at 9 months of age in the case of diphtheria 1.

A common finding was that with each month over the recommended age for immunisation the probability of being immunised, for those not already immunised, diminishes. This almost commonsense finding does suggest that an even greater effort should be made to ensure that children are immunised at the recommended time.

Conclusion

Differences in rate of uptake of immunisation have been shown among children of different ethnic origins in the Bradford health district, suggesting that there are differences in utilisation of the NHS among the different groups. No explanation of these differences has been shown, but it is likely to be due to a mixture of factors relating to the NHS, the community, and the environment in which they interact. The differences found do not relate closely to known differences in morbidity and mortality.

TABLE III—*Immunisation state of children at 27 months in seven ethnic groups from the 1980 cohort in Bradford health district. Figures are numbers of children*

Antigen doses given		Ethnic group						
		British (n = 3545)	Bangladeshi (n = 37)	Pakistani (n = 1396)	Indian (n = 343)	West Indian (n = 35)	Half Negro (n = 48)	Half Asian (n = 54)
Diphtheria	0	296	0	61	4	4	9	6
	1	162	3	48	4	4	4	1
	2	238	5	90	6	2	4	3
	3	2849	29	1197	329	25	31	44
Pertussis	0	1562	10	217	50	11	33	26
	1	153	3	90	17	3	1	1
	2	142	4	120	6	4	0	2
	3	1688	20	969	270	17	14	25
Measles	0	1584	13	501	63	18	32	25
	1	1961	24	895	280	17	16	29
BCG	0	3388	11	188	45	13	34	29
	1	157	26	1208	298	22	14	25

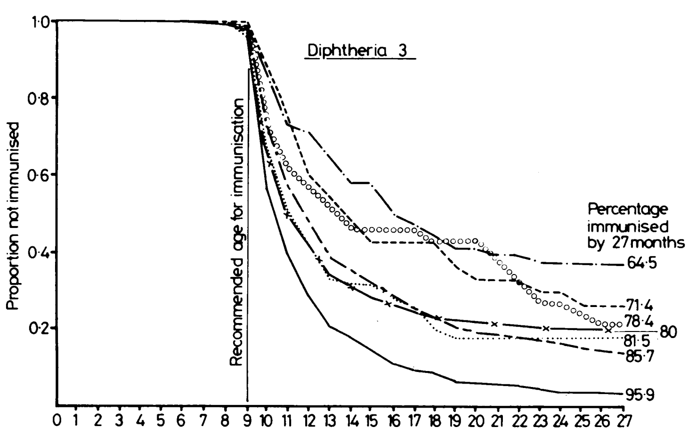

Fig 1

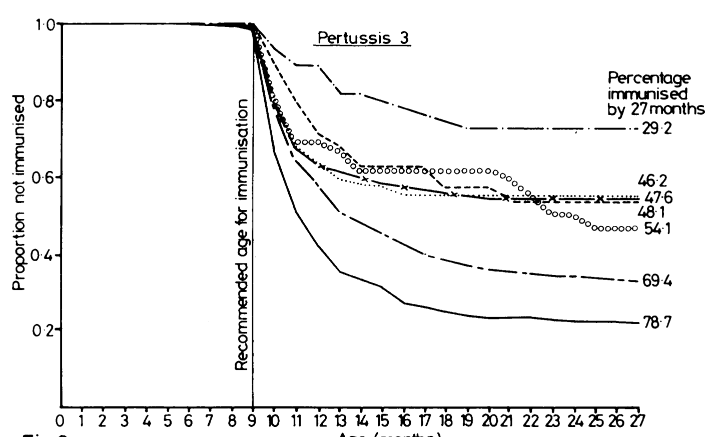

Fig 2

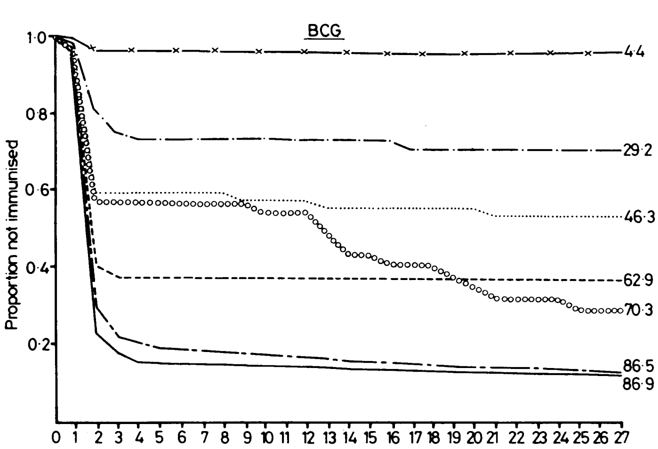

Fig 3

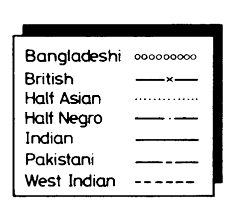

FIG 1—Pattern of uptake of diphtheria 3 immunisation for all designated ethnic groups in 1980 cohort of Bradford health district.

FIG 2—Pattern of uptake of pertussis 3 immunisation for all designated ethnic groups in 1980 cohort of Bradford health district.

FIG 3—Pattern of uptake of BCG immunisation for all designated ethnic groups in 1980 cohort of Bradford health district.

The importance of the observations lies in the fact that a service offered to all is not being taken up evenly across the whole community.

It is also clear that many children from all ethnic groups are not receiving immunisations at the recommended ages. Delay in taking immunisation might occur for a number of reasons such as frequent change of address, the child may be unwell or considered unfit for immunisation by the doctor or health visitor on the scheduled day, and there may be poor understanding and poor motivation to accept immunisation on the part of the parents or of the health service staff. This is unfortunate when 33% of notifications for whooping cough and 28% of notifications for measles in Bradford are for children aged 24 months or less.

It is not possible to quantify how many of the differences are related to ethnic group as opposed to factors such as social class, place of residence, or the practices of local health professionals. Further research using the same life table method could clarify this and allow better targeting of health care.

It is also suggested that a study should be made of the Indian community to identify those characteristics that encourage their desirable pattern of immunisation uptake so that these can be encouraged in other groups.

Finally, it is suggested that the graphical method of presenting life table data on immunisation be developed as a form of understandable feedback to those directly working in immunisation programmes.

We thank Dr R Turner, Yorkshire Regional Health Authority, for his help in preparing the graphs, and Dr D Clayden, department of community medicine, University of Leeds, for his help with statistics.

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Four years' experience with a mobile gammacamera service

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Mobile gammacameras and mobile computed *x* ray transmission tomographic units are widely available in the United States. A commercial mobile computed *x* ray transmission tomographic unit has recently begun operating in the United Kingdom. Little has been written about these services; their continued survival and expansion are in themselves evidence for their commercial viability but do not necessarily prove that such a service is of benefit to the National Health Service.

The Borders, Fife, and Lothian health boards are jointly responsible for a population of about 1·25 million spread over about 3000 square miles. Specialised services are largely concentrated in the city of Edinburgh, which covers one third of the total population but only 2% of the land area, and one hospital is designated as the regional centre for a number of specialties including nuclear medicine. By 1976 it was evident that the existing facilities for nuclear imaging in the south east of Scotland were approaching saturation point, and provision for growth had to be considered. A survey of users indicated a large discrepancy between hospitals with facilities on site and those without: even after taking into account referrals from general medical and surgical units, and excluding those from specialised units such as oncology, there was a fivefold difference in referral rate. In 1977 therefore, it was decided to establish an experimental mobile gammacamera service to study both practical problems and their economic consequences.

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The service opened in January 1980, and we discuss the experience gained and the conclusions reached after almost four years of experience.

Choice of hospital

The region served contains 15 general hospitals without nuclear imaging facilities. Three further general hospitals, including the base hospital, had nuclear imaging facilities, and these were subsequently installed at one of the other hospitals. The region also contains many specialised hospitals (orthopaedic, paediatric, geriatric, psychiatric, etc) that were not considered for the service, as well as numerous smaller hospitals. The distance by road from the general hospitals without facilities for nuclear medicine to the regional centre ranged from less than half a mile to over 30 miles.

To provide a useful service one visit a week was considered to be the minimum and two visits a week optimum, which would leave a maximum of four days between visits. Many patients with suspected pulmonary emboli can be given heparin for this period, and lung scintigraphy could then be used to decide whether or not to proceed to long term oral anticoagulants.

As it was clearly impossible for a single mobile camera to visit all the hospitals in the area, precedence was given to the larger and more distant hospitals, provided that they were able to accommodate the camera. This required a room not less than 3 m² (10 ft²), with a door large enough to allow access for a patient on a trolley and a floor strong enough to withstand the weight of the gammacamera (about one tonne). A single 13 amp power point was the only service required: no special radiation shielding is required as the scattered radiation from the procedures to be performed is much less than in radiography and