

# PRACTICE OBSERVED

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## *Practice Research*

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### **Uptake of immunisation in district health authorities in England**

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#### **Abstract**

The uptakes of immunisation in the district health authorities in England were studied for the years 1983-5. Multiple regression analysis showed that the factors significantly associated with a low uptake of immunisation were mainly related to social conditions, particularly overcrowding of households and population density. Of the service factors, high proportions of elderly and singlehanded general practitioners and high average list sizes were also associated with a low uptake of immunisation in some of the analyses.

The results suggest that the measures outlined in the government's white paper on improving primary health care services are likely to lead to improved uptakes of immunisation. If, however, the uptakes of immunisation are used as a measure of standards of the services provided they should first be adjusted to control for variations in social conditions, and the quality of vaccination data would have to be improved.

#### **Introduction**

In 1977 the World Health Organisation approved the policy of providing immunisations for all of the world's children by 1990<sup>1</sup> and set a target of 90% primary immunisation for all children under 2 years by 1990.<sup>2</sup> In 1985 the uptakes of immunisation in England

were 85% for diphtheria, tetanus, and polio; 68% for measles; and 65% for whooping cough.

In the United Kingdom immunisations are given by staff from the community health services at child health clinics or at schools or in conjunction with general practitioners at their surgeries or health centres. General practitioners can arrange to immunise the children on their lists themselves or with their staff. There can be problems if these two separate policies are not well coordinated, and this may lead to varying uptakes of immunisation or poor recording of uptakes of immunisation.<sup>3-6</sup> Such a difficulty is inherent in this country because general practitioners are independent contractors, and community health services are part of the structure of district health authorities.<sup>7,8</sup> General practitioners may adopt various strategies regarding the way that they provide their services, and they may or may not include maximising the number of immunisations that they give.<sup>9</sup> District health authorities have limited influence on the behaviour and policy of general practitioners, yet a considerable, though varying, proportion of immunisations are performed by general practitioners. For instance, in Devon 82% of routine immunisations are undertaken by general practitioners, whereas the figure for Northumberland is only 27%.<sup>3</sup>

In some countries that do not have a form of general practice similar to that in the United Kingdom it has been possible to achieve high uptakes of immunisation by concentrating attention on community health services,<sup>10,11</sup> although this is very variable.<sup>12-15</sup> In this country both systems exist side by side, at times competing with each other.<sup>3</sup> The lists held by general practitioners of patients for whom they are responsible would seem in theory to provide an ideal method of contacting patients who are due for immunisation and for arranging routine updating of immunisations at the appropriate times. There can, however, be problems if there is no system in the practice for making sure that the appropriate immunisations are done on time.<sup>16</sup>

An additional factor to consider, about which little is published, is the difficulty of achieving a high uptake of immunisation in inner cities, where potentially adverse social conditions are more common. It is in just such areas that general practitioners have difficulty in establishing good primary care teams in adequate

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### Factors studied in connection with uptake of immunisation

<i>State of health</i>	Aged 17 and not in education
Standardised mortality ratios to ages 65, 75, and 85	Housing tenure
Standardised mortality ratios and crude death rates for each chapter of <i>International Classification of Diseases</i>	Single householders
Infant and perinatal mortality	Marital state
Percentage of babies weighing <2500 g at birth	Socioeconomic group weighted for bed usage
	Population density
	Underprivileged area score
	<i>Primary care</i>
<i>Social and demographic factors</i>	Proportions of singlehanded general practitioners
Social class	Proportions of general practitioners aged $\geq 65$
Socioeconomic groups	Average size of general practitioners' lists
Unemployment in different age and sex groups	Average list size adjusted for inflation
Proportions in each age-sex group	Total community health service expenditure/head
Elderly alone	Expenditure on general community care/head
Single parent families	No of health visitors/1000 population aged under 5
Overcrowding	
Mobility	
Households with no car	
Various ethnic groups	

premises and also that fewer patients are registered with general practitioners.<sup>17,19</sup> In the same areas the expenditure per person on community health services is generally higher.<sup>20</sup>

It is difficult to sort out the effects of these different factors, as they are all interrelated and vary from place to place according to different social conditions and the types of services provided. It is, however, important to try to determine the contribution of each factor and to separate the influences of social conditions and services provided on the variation in the uptake of immunisation, because service factors are in theory quite amenable to change, whereas social conditions are not.

For these reasons we decided to study the uptakes of immunisation achieved in the district health authorities in England and to determine how they varied according to various factors related to social conditions in each district and to the services provided mainly by the general practitioner and community health services.

### Methods

Two sets of figures were available for the uptakes of immunisation against diphtheria, pertussis (whooping cough), tetanus, polio, and measles in the 191 district health authorities in England.

*Uptake calculated by the Department of Health and Social Security (DHSS)*—This is based on the number of completed primary courses of immunisation, obtained from the district clinic immunisation records and from general practitioners' immunisation claim forms from family practitioner committees. Uptakes were calculated as the number of children born in 1983 and immunised in each district in 1983-5 expressed as a percentage of live births in the districts in 1983. The figures may give a misleading impression of the uptakes of immunisation by residents of districts where there are large flows across boundaries or where there have been large inflows or outflows of residents who have young families.

*Uptake calculated by district health authorities*—This is based on records from the child health register. These estimates are the percentage of district residents in 1985 who were born in 1983 and had been immunised by the end of 1985.

Similar data were supplied for children who were born in 1982 and immunised by the end of 1984. For 1982-4 the district estimates of immunisation uptakes were missing for 54 districts, but for 1983-5 they were missing for only 20 of the 191 districts. The 1983-5 data were therefore analysed. The estimates by the DHSS and districts differed greatly in a number of districts, particularly in the North East Thames region. This highlights the need for improved data on vaccination. In this study the 20 districts for which there were no district estimates of immunisation uptakes

and the 43 districts where the district estimates differed by more than 4% from the DHSS figures for any of the five immunisation types were excluded from the analyses, leaving 128 districts.

Data on other relevant factors were also available for each district (see box). The social data were mainly from the 1981 census; the remainder were for 1983 and 1985. The data on general practitioners were supplied by the Medical Practices Committee with the agreement of the General Medical Services Committee of the BMA for each of the roughly 1500 areas covered by the Medical Practices Committee in England. The data from the Medical Practices Committee were then aggregated up to district health authority level.

Multiple regression analysis was used, with the uptakes of immunisation as the dependent variables, to determine which combination of the variables in the box best explained the variation in uptakes. Variables (independent or dependent) that had a skewed distribution were made more symmetric by applying an angular transformation (arcsin of the square root of the variable as a fraction). The results differed little from those obtained from untransformed variables. For instance, when we used overcrowding and uptake as transformed variables overcrowding accounted for 48% of the variation in uptake of immunisation against diphtheria; when we used untransformed variables they accounted for 47%. For simplicity, only results from untransformed variables are reported here.

### Results

Table I shows the range of uptakes of immunisation for children born in 1983 and immunised by the end of 1985. Table II shows the means and standard deviations of the DHSS figures for uptakes for the 128 districts included in the analyses and the 63 districts excluded. It can be seen that the mean uptakes of immunisation for the excluded districts are between 3% and 5% lower than those for the included districts, and the standard deviations are greater. The underprivileged area score,<sup>21,22</sup> which is a measure of

TABLE I—Uptake of immunisation (%) for children born in 1983 and immunised by end of 1985

Immunisation	Uptake		
	Average	Maximum	Minimum
Measles	70	91	41
Pertussis	66	78	40
Diphtheria	87	98	67
Tetanus	86	98	64
Polio	86	100	67

Based on data from Department of Health and Social Security and district health authorities that did not differ by more than 4%.

TABLE II—Average (SD) uptake of immunisation (%) in 128 districts included and 63 districts excluded

Immunisation	Districts included (n=128)	Districts excluded (n=63)
Measles	70 (11)	65 (13)
Pertussis	66 (8)	63 (11)
Diphtheria	87 (7)	82 (13)
Tetanus	86 (7)	83 (13)
Polio	86 (7)	82 (12)

workload or pressure on the services of general practitioners, is higher in inner cities and has a mean (SD) of 0 (17) for all 191 districts. Its mean value for the 128 included districts, however, is -2 compared with a mean of 4 for the 63 excluded districts. This suggests that there is a small tendency for the excluded districts to be in the inner cities.

The uptakes of immunisation against diphtheria, tetanus, and polio were similar in any one district, as these immunisations are usually given together; the uptakes of immunisation against whooping cough and measles were lower.

From the regression analyses we found that social factors were the most strongly associated with uptakes of immunisation (see table IV). For example, overcrowding of households can be used to predict the uptake of diphtheria immunisation with the following formula:

$$\begin{aligned} \text{Predicted uptake of diphtheria immunisation (\%)} = \\ 97 - 1.57 \times (\% \text{ overcrowding} \pm 0.14 \text{ standard error}) \\ R^2 (\text{proportion of the explanation of the variance}) = 0.48, \end{aligned}$$

where overcrowding is defined as the proportion of the population that lives in households that have more than one person per room (from 1981 census).

The figure shows the relation between the uptake of diphtheria immunisation (from the DHSS figures for the 128 districts) and overcrowding. Among the service factors the only ones that contributed significantly to explaining the variance were related to the services provided by general practitioners and then only in some of the combinations of independent variables for some types of immunisations. Some of the results showed that there were significantly fewer immunisations in areas where the average size of the general practitioners' lists was greater or where there were more single-handed and elderly general practitioners (which occurs in areas where there are fewer primary care teams<sup>17,18</sup>).

The expenditure per 1000 resident population on community health services was negatively associated with uptakes of immunisation ( $p < 0.05$ ), but its effect was no longer significant when combined with overcrowding. This remained true when some inner city districts, in which there was a high proportion of expenditure by community health services on non-residents, were excluded from the analyses. This is not surprising, given that district health authorities run different programmes of child health surveillance.<sup>23,24</sup> The number of health visitors/1000 population aged under 5 years was not significantly associated with uptakes of immunisation. It should be borne in mind throughout that association does not imply causation.

Table III shows the details of some of the results. All of the factors listed in table III correlated significantly and negatively with uptakes of immunisation. We were surprised to find that the mobility of the population was not significantly associated with uptake.

The results should be treated with reservations about the accuracy of the data on the uptake of immunisation stated above because of the known difficulties in obtaining accurate data.<sup>25,26</sup> For the 128 districts in which the data from the DHSS and districts were within 4% of each other a league table was prepared that showed which districts were furthest above and which were furthest below their predicted uptakes of immunisation based on, firstly, overcrowding and, secondly, overcrowding plus average length of general practitioners' lists. We found that even allowing for social conditions the uptake of immunisation against diphtheria varied from 15% below (except in one district, which was 21% below) to 10% above the predicted values. Similar variations were found for the other immunisations.

## Discussion

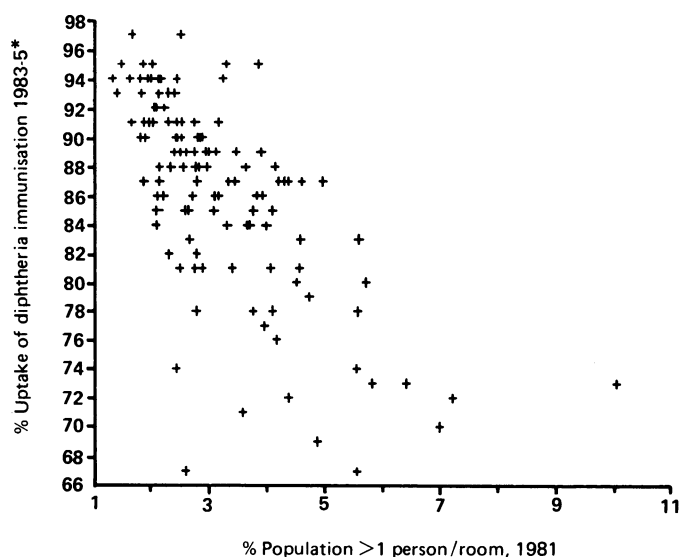
It is clear from this study that the uptakes of immunisation are lower in urban areas. Apart from this "inner city" factor, however, there is a second factor that is important in some of the analyses, and that is the services provided by general practice. There is some indication that uptakes of immunisation are lower, after allowing for social factors, where the average size of practitioners' lists is greater and there are higher proportions of singlehanded and elderly general practitioners.

Using only the DHSS and district estimates of uptakes of

TABLE III—Factors independently associated with low uptake of immunisation against diphtheria ( $p < 0.05$ , all negatively correlated with immunisation uptake)

Factor	Proportion explanation of variance $R^2$	Mean (SD) (n=128)
Social (all values % except where stated):		
Overcrowding of households (>1 person/room)	0.47	3.12 (1.33)
Not married	0.40	49.83 (2.41)
Single parent families	0.36	5.11 (1.01)
Population density >1983 persons/hectare	0.31	12.44 (16.34)
Unskilled	0.29	4.41 (1.59)
Households with no car	0.28	37.86 (10.05)
Unemployment as % of economically active	0.28	9.42 (3.42)
Households lacking basic amenities	0.24	4.11 (1.66)
Ethnic groups (New Commonwealth and Pakistan)	0.24	3.54 (4.36)
Households not owner occupiers	0.20	41.78 (11.47)
Not in education at age 17	0.09	63.93 (7.23)
Aged under 5 years in population	0.06	6.06 (0.58)
Underprivileged area score <sup>21,22</sup>	0.35	-2.18 (14.05)
Primary care (1983):		
Singlehanded general practitioners (%)	0.19	11.25 (7.35)
General practitioners aged $\geq 65$ (%)	0.19	4.56 (3.55)
Average size of general practitioners' list (No of patients)	0.03	2120 (127)
Community health services expenditure/1000 population (£) in 1983	0.18	16786 (3546)

Dependent variable is proportion of uptake of diphtheria immunisation for children born in 1983 and immunised by end of 1985 from data from Department of Health and Social Security for the 128 districts in which DHSS and district figures do not differ by more than 4%.



Uptake of diphtheria immunisation *v* overcrowding.

\*Figures for 128 district health authorities in England from Department of Health and Social Security.

immunisation that were in good agreement we found that there were very wide variations between the uptakes achieved by different district health authorities. DHSS estimates showed that the uptakes of diphtheria, tetanus, and polio immunisations for 1983-5 varied from 64% to 100% of the children in the relevant age group; for measles the variation was from 41% to 91%. These differences are less if the figures are corrected for the effects of the relevant social conditions in each district but are still quite large.

The most common explanations for variation in the uptakes of immunisation<sup>11,27-30</sup> are focused on: confusion about contra-indications to immunisation; attitudes towards the importance of measles, in particular, as a fairly minor disease; organisation of services; and higher uptakes of immunisation being associated with high motivation and enthusiasm of staff. Health visitors are seen in at least one study as being the major influence on uptake.<sup>31</sup> There seems to be little published about the relation between uptakes of immunisation and social factors.

In the United States the uptakes of immunisation have been increased by schools requiring proof of immunisation before entry: about 95% uptake of measles immunisation has been achieved and the number of cases greatly reduced.<sup>32</sup> Poore stated that Czechoslovakia, Hungary, and Albania are close to eradicating measles,<sup>11</sup> whereas the immunisation uptakes in the United Kingdom, France, and Italy are 55%, 15%, and 5%, respectively. The uptake in England is increasing,<sup>33</sup> and the results from our study, with the DHSS data from all 191 districts, show an average uptake of measles immunisation of 69% for England for 1983-5. For 60 districts, however, the uptake was below 65% and for 15 below 50%.

What lessons can be learned from these analyses if we are to try to improve the overall national uptakes of immunisation in a voluntary way rather than imposing preschool requirements? The degree of urbanisation of the district seems to be an important factor in the uptake of immunisation achieved. Other studies have shown more admissions to hospital of children in socially deprived areas.<sup>33</sup> In districts characterised by high population density, overcrowded households, and many unmarried people there needs to be a greater concentration on organising health care resources that are shown to be associated with increased uptakes of immunisation. The results tend to suggest that general practitioners' lists that are shorter than average and more primary care teams are also associated with greater uptakes of immunisation.

The government's white paper on ways of improving primary health care services promises: incentives that will be incorporated into the pay system of general practitioners to improve the uptakes of immunisation (paragraph 3.16); a reduction in the average list sizes of general practitioners (appendix 1.12); encouragement for

the establishment of group practices (paragraph 10.10); a retirement age of 70 for general practitioners (paragraph 3.40); and support for general practitioners in inner cities by paying a "deprived areas allowance" (paragraph 3.38).<sup>4</sup> The results of our study suggest that these policies may lead to an increase in national uptakes of immunisation, but these would still vary, mainly with social conditions. Any assessments of standards of general practice based on uptakes of immunisation would need to take account of this, but, assuming that accurate data were available, such assessments could be based on the expected uptakes of immunisation in the local district after allowance had been made for social factors. This is supported by Mant *et al* in a study of the uptakes of immunisation in five general practices in one district.<sup>5</sup> They found a "clear correlation between the social class structure of the practice populations and the immunisation rate" and concluded that the uptakes of immunisation should be standardised for the social mix of the population in the practice if they were to be used as indicators of good practice.

Our findings could be important in enabling district health authorities and general practitioners to decide how to concentrate their resources most effectively and may have implications for policy on the relation between services provided by family practitioner committees and district health authorities.

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## ONE HUNDRED YEARS AGO

THE habit of tea-drinking is becoming more and more thoroughly national in the British islands as the century draws to a close. Eighty years ago, the practice was looked upon as a sign of effeminacy, a well-known patriotic ballad in praise of roast beef lauding the good old days, "ere coffee and tea, and such slip-slops were known." Cobbett, in his *Advice to Young Men*, said, "let me beseech you to resolve to free yourselves from the slavery of the tea-and-coffee and other slop-kettle." He thinks that his model young man should devote to the study of arithmetic one-half of the time "usually wasted over the tea-slops." In 1888 tea-drinking is universal. The poor and the rich have long been tea-drinkers; it is amongst the lower middle classes that the habit has recently spread to so marked a degree. Young men beginning life and the great army of elder men, so well known in great cities, whose duties involve much going about from one quarter of the town to another, are steadily recognising the fact that tea is better than alcohol at lunch. In real society and sham society the "afternoon tea" affords to that beverage the powerful sanction of fashion. The chief evil of tea-drinking amongst the poor is the practice of taking tea whilst it is very hot, so that it acts both directly and indirectly as a cardiac stimulant, causing pleasurable feelings to the drinker, but at the same time irritating the gastric mucous membrane. At the "afternoon tea" of polite society, too much is often consumed by the same person, who may pay half a dozen visits before the dinner-hour. Well-bred people hate excess, and dislike to be seen eating and drinking, nevertheless they are often automatic in their doings, so that the fact that somebody is sipping tea often causes everybody else in the same room to accept the offer of a cup, which is the simplest, tidiest, and least demonstrative way of refreshing the inner man or woman. The evils of tea-drinking have long been recognised, or, at least, we know certain bad results, though it does not follow that others have not been as yet overlooked. The acute objective symptoms of an overdose of tea are relatively trifling compared with opium-poisoning or alcoholic intoxication, yet amongst them is vomiting, and violent sickness under most unfortunate circumstances may be the result of dining or smoking too soon after taking tea. This accident may

happen even to a strong-stomached person, at a "high tea," "severe tea," or "tea-dinner," for, as Dr. Lauder Brunton has shown, the tannin of the tea interferes with the digestion of fresh meat, whilst Dr. J. W. Fraser has observed that it does not interfere with the digestion of ham, tongue, and other cured and dried flesh. Hence a slice of tongue is better than a cut off the best joint at a "high tea," as at breakfast. Again, severe and intractable dyspepsia may follow tea-drinking, especially between lunch and dinner. Under these circumstances the tannin and the special alkaloid of tea mix with the half-digested food and gastric juice, the products of this abnormal mixture remaining till food is swallowed at dinner, or at least irritating the stomach so as to render it unprepared for the digestion of a good dinner. Several living physicians have shown, on the evidence of experience and of chemistry, that tea cannot be served up free from tannin, even if it be filtered during the process of infusion, like coffee, and poured into a teapot free from leaves. What distant evil effects may be caused by tea-drinking, physicians have not yet determined. Yet we know that it often sets up dyspepsia, which may cause several deadly visceral disorders; it also impedes assimilation, and the resistance to cold. More interesting is the question as to whether it may not induce disease of the circulatory organs by affecting the blood-pressure. On the nervous system, both as understood by physiologists and by hypochondriacs, the habit may exercise a very bad influence. A true tea-vice is not unknown; even certain business men feel, at five o'clock, an irresistible desire to break off important duties in favour of the tea-cup. In hysterical subjects this vice is often a most serious symptom. Though tea too soon before dinner causes dyspepsia, dinner unexpectedly delayed for many hours after a heavy draught of tea, sets up in some persons very severe nervous symptoms, especially marked by tremulousness and an inability to keep the attention fixed on any subject of duty, pleasure, or conversation. In short, the rules of all things in due season, and not too much of anything, apply to tea quite as much as to flesh diet and to alcohol.

(*British Medical Journal* 1888;ii:811)