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# Differences in risk factors for partial and no immunisation in the first year of life: prospective cohort study

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## Abstract

**Objective** To compare demographic, social, maternal, and infant related factors associated with partial immunisation and no immunisation in the first year of life in the United Kingdom.

**Design** Prospective cohort study.

**Setting** Sample of electoral wards in England, Wales, Scotland, and Northern Ireland, stratified by measures of ethnic composition and social disadvantage.

**Participants** 18 488 infants born between September 2000 and January 2002, resident in the UK and eligible to receive child benefit (a universal benefit available to all families) at age 9 months.

**Main outcome measure** Immunisation status at 9 months of age, defined as fully immunised, partially immunised, or not immunised.

**Results** Overall in the UK, 3.3% of infants were partially immunised and 1.1% were unimmunised; these rates were highest in England (3.6% and 1.3%, respectively;  $P < 0.01$ ). Residence in ethnic or disadvantaged wards, larger family size, lone or teenaged parenthood, maternal smoking in pregnancy, and admission to hospital by 9 months of age were independently associated with partial immunisation status. In contrast, a higher proportion of mothers of unimmunised infants were educated to degree level or above (1.9%), were older (3.1%), or were of black Caribbean ethnicity (4.7%).

**Conclusions** Mothers of unimmunised infants differ in terms of age and education from those of partially immunised infants. Interventions to reduce incomplete immunisation in infancy need different approaches.

## Introduction

Over the past decade, the uptake of primary vaccines has been high among 1 year olds in the United Kingdom.<sup>1</sup> Factors influencing uptake may change over time and need to be investigated to ensure that high rates are sustained. Overall, most scientific literature has included children who are not fully immunised as one group. In the UK, one small study based on children with full, partial, and no vaccination has explored parental attitudes, but this was mainly with respect to pertussis vaccine and found that the unvaccinated group had significantly more concerns about the safety of the vaccine.<sup>2</sup> Our study is the first large scale UK study to explore whether the risk factors, including the reasons given by mothers, differ between infants who are partially immunised and those who are unimmunised, and thus to identify if different interventions to maximise uptake are needed for these groups.

## Methods

We analysed data from the millennium cohort study, a cohort of children born between September 2000 and January 2002 in the UK. The sample was stratified by UK country and electoral wards to adequately represent infants from ethnic minority groups, disadvantaged backgrounds, and the three Celtic countries. The overall response rate to the survey was 72%.<sup>3</sup> Survey interviews were done when the infants were about 9 months old. Mothers were shown a card listing the primary vaccines (the first vaccines given at 2, 3, and 4 months of age in the UK) and asked if the infants had received three doses of all listed vaccines.

We analysed the immunisation status of 18 488 singleton (or in the case of multiple births, first born) infants. We estimated rate ratios by using Poisson regression analysis in Stata 8.2, with sample weights to adjust for the effect of survey design. We did multivariate analyses, retaining only those variables significant at the 5% level in the final model.

## Results

Overall, 3.3% (weighted percentage; 712/17 544) infants in the UK were reported to be partially immunised and 1.1% (weighted percentage; 232/17 544) were unimmunised; these figures were highest in England (weighted percentages 3.6% (476/11 495) and 1.3% (181/11 495), respectively). Factors found to be independently associated with partial immunisation were teenaged or lone parenthood, large family size, residence in disadvantaged or ethnic wards, maternal smoking in pregnancy, and infants with a history of at least one hospital admission (table). Large family size, lone parent status, and residence in disadvantaged or ethnic wards were also significant associations for the unimmunised group. In addition, unimmunised infants were more likely to have older ( $\geq 40$  years) and more highly qualified mothers. Infants of black Caribbean mothers were also more likely to be unimmunised than were those of white mothers.

Mothers cited medical factors relating to their child or family (328/697; weighted percentage 45%) as the predominant reason for partial immunisation. Maternal beliefs or attitudes towards immunisation (92/228; 47%) were the predominant reason cited for no immunisation.

## Discussion

Our findings indicate that mothers of unimmunised and partially immunised infants are differentiated by age and education as well as by the reasons given by mothers to explain these outcomes. These findings also add to the limited evidence on the role of

Association of infants' immunisation status with maternal factors (n=18 488)

Maternal factors	No	Adjusted rate ratio* (95% CI)	
		Partially immunised (n=712) versus fully immunised (n=17 544) infants	Unimmunised (n=232) versus fully immunised (n=17 544) infants
<b>Age (years) at millennium cohort study birth</b>			
14-19	1 573	1.7 (1.3 to 2.1)	1.3 (0.8 to 2.2)
20-29	8 666	1	1
30-39	7 851	0.7 (0.6 to 0.8)	1.2 (0.9 to 1.6)
≥40	391	0.4 (0.2 to 0.8)	2.3 (1.3 to 4.0)
<b>Education</b>			
Higher degree/degree	2 903	0.9 (0.6 to 1.3)	1.9 (1.2 to 3.0)
Diploma in higher education	1 554	0.7 (0.5 to 1.1)	0.6 (0.3 to 1.3)
A/AS level	1 715	0.9 (0.7 to 1.2)	1.2 (0.7 to 2.0)
GCSE grade A-C	6 172	0.8 (0.7 to 0.9)	0.6 (0.4 to 0.8)
GCSE grade D-G	1 975	0.7 (0.5 to 0.9)	0.5 (0.3 to 0.9)
Other or overseas qualification	530	1.0 (0.6 to 1.6)	1.0 (0.4 to 2.8)
None of these qualifications	3 592	1	1
<b>Family size</b>			
1 child	7 661	1	1
2 or 3 children	9 276	2.3 (1.9 to 2.8)	1.6 (1.1 to 2.2)
≥4 children	1 551	5.0 (3.8 to 6.4)	2.4 (1.4 to 3.9)
<b>Country</b>			
England	11 495	1	1
Wales	2 750	0.9 (0.7 to 1.1)	0.6 (0.4 to 1.0)
Scotland	2 325	0.9 (0.7 to 1.1)	0.4 (0.3 to 0.7)
Northern Ireland	1 918	0.6 (0.5 to 0.8)	0.2 (0.1 to 0.5)
<b>Ward type</b>			
Advantaged	7 301	1	1
Disadvantaged	8 807	1.3 (1.0 to 1.5)	2.1 (1.4 to 3.2)
Ethnic	2 380	1.6 (1.1 to 2.2)	2.2 (1.3 to 4.0)
<b>Lone parenthood</b>			
No	15 319	1	1
Yes	3 169	1.5 (1.3 to 1.8)	1.4 (1.1 to 1.9)
<b>Returned to or started work since birth of cohort baby</b>			
No	9 947	1	1
Yes	8 502	0.7 (0.6 to 0.8)	0.6 (0.4 to 0.8)
<b>Maternal smoking</b>			
No	11 862	1	–
Yes	6 561	1.6 (1.4 to 1.9)	–
<b>Ethnic group</b>			
White	15 506	1	1
Mixed	191	0.8 (0.4 to 1.9)	1.2 (0.5 to 2.9)
Indian	476	0.6 (0.3 to 1.3)	0.4 (0.2 to 1.0)
Pakistani	891	1.2 (0.8 to 1.8)	0.5 (0.3 to 0.9)
Bangladeshi	371	1.0 (0.6 to 1.7)	0.6 (0.2 to 1.8)
Black Caribbean	264	1.2 (0.8 to 1.8)	2.4 (1.6 to 3.7)
Black African	377	0.6 (0.4 to 1.0)	0.3 (0.1 to 0.8)
Other	382	0.6 (0.3 to 1.1)	0.7 (0.3 to 1.5)
<b>Hospital admission(s) (infants)</b>			
No	15 798	1	–
Yes	2 688	1.7 (1.4 to 2.0)	–

\*Adjusted for factors shown in table. Missing data: age at millennium cohort birth, n=7; education, n=48; returned to/started work, n=39; maternal smoking, n=65; ethnic group, n=30; hospital admission(s), n=2; family size, country, ward type, and lone parenthood, n=0.

ethnicity in uptake of immunisation in the UK.<sup>4 5</sup> Interventions to reduce incomplete immunisation in infancy need different approaches. Besides emphasising the importance of accessible immunisation services for socially disadvantaged families, which may include opportunistic and domiciliary immunisation,

## What is already known on this topic

Factors associated with low immunisation uptake have been well described

One small UK study of parental beliefs found that parents of unimmunised children have more concerns about vaccine safety than parents of fully or partially immunised children

## What this study adds

Mothers of unimmunised infants are older and more highly qualified than those of partially immunised infants

Different approaches may be needed to maximise uptake of immunisation in these two groups

our study suggests that different interventions are needed to promote uptake of immunisation among older and more highly qualified mothers who reject primary immunisations.

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Contributors: LS, HB, and CD designed and coordinated this study. LS, HB, and ART analysed and interpreted data. LS wrote the first draft of the paper together with HB and CD. LS, HB, ART, CD, CP, and NB critically reviewed the draft. Members of the Millennium Cohort Study Child Health Group contributed to the paper through analysis and construction of explanatory variables and commented on the early drafts of the manuscript. HB is the guarantor.

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Competing interests: HB has received funding from vaccine manufacturers Wyeth and Sanofi Pasteur to attend symposiums, speak at meetings, and do research. All other authors have nothing to declare.

Ethical approval: The millennium cohort study was approved by the London multicentre research ethics committee. The analyses presented here needed no further ethical approval.

- 1 Health Protection Agency. Quarterly communicable disease reports on the COVER programme for childhood immunisation. [www.hpa.org.uk/infections/topics\\_az/vaccination/cover\\_cdr.htm](http://www.hpa.org.uk/infections/topics_az/vaccination/cover_cdr.htm) (accessed 20 Dec 2004).
- 2 Bennett P, Smith C. Parents attitudinal and social influences on childhood vaccination. *Health Educ Res* 1992;7:341-8.
- 3 Plewis I. *Millennium cohort study: technical report on sampling*. London: Institute of Education University of London, 2004.
- 4 Baker MR, Bandaranayake R, Schweiger M. Differences in rate of immunisation among ethnic groups. *BMJ* 1984;288:1075-8.
- 5 Bhopal RS, Samin AK. Immunisation uptake of Glasgow Asian children: paradoxical benefit of communication barriers. *Community Med* 1988;10:215-20.

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