

# Infant immunization and family size

Richard Reading, Heidi Surridge and Ruth Adamson

## Abstract

**Background** To investigate whether a delay in infant immunization is associated with the number of older siblings.

**Methods** A cohort analysis of cumulative immunization uptake in 616 children aged 1–4 years recruited for a case–control study of atopic dermatitis in Norwich, UK was performed. The main outcome measures were the age of third pertussis and MMR immunizations. Delayed immunization was defined as a pertussis immunization age 6 months or greater, and MMR immunization aged 16 months or greater.

**Results** Having a larger number of older siblings was associated with a delay in pertussis immunization (6.2 per cent for children with no older siblings versus 23.3 per cent for children with two or more older siblings), but not in MMR immunization.

**Conclusion** Infants with older siblings are at greater risk of pertussis infection from intrafamilial contagion yet are less likely to be immunized on time.

**Keywords:** immunization coverage, birth order, family size, siblings, pertussis

## Introduction

Immunization is an effective preventive measure against certain infectious diseases spread by contagion within the family such as pertussis and measles. Prompt immunization of infants with older siblings is particularly important as these are at greatest risk of the most severe disease.<sup>1</sup> Delayed immunization has been shown to be a risk factor for admission to hospital with pertussis infection.<sup>2</sup>

Previous studies of pertussis<sup>3–5</sup> and measles or MMR<sup>4–6</sup> immunization uptake by family size have shown that infants from larger families were less likely to be fully immunized and more likely to have delayed immunization. However, these studies were all conducted before the current accelerated schedule of primary immunizations in the UK at ages 2, 3 and 4 months and the recent vaccine scares which have led to reduced MMR uptake.

We have re-examined primary pertussis and MMR immunization uptake according to family size using data assembled for a case–control study of childhood atopic dermatitis in a district in the UK which has always had high overall coverage.

## Methods

Data were available on all 616 children aged 1–4 years whose families participated in a case–control study of atopic derma-

titis.<sup>7</sup> The children were selected from the lists of 12 general practices in and around Norwich, UK. Data on family characteristics and social circumstances were collected at interview with the child's mother. Immunization data were taken from the computerized district child health records. The data were collected between 1999 and 2001 with a further check on immunization status in 2003.

The third primary pertussis immunization was scheduled for 4 months and the MMR immunization for 14 months in the study district. Delayed immunization was defined as age 6 months or greater for pertussis, and age 16 months or greater for MMR. Variables recorded at the interview were receipt of benefits, overcrowding, room sharing in infancy, lone parenthood, housing tenure, number of house moves in infancy, family income, mother's age, social class of father and of mother, educational level of father and of mother, and age of child (to identify any cohort effects). Cumulative immunization uptake and sociodemographic variables were the same in cases and controls.

Unadjusted odds ratios were calculated for the effect of explanatory variables on delayed uptake of the two immunizations. Unconditional multiple logistic regression with delayed uptake as the dependent variable was used to identify independent effects.

## Results

The number of older sibling was strongly associated with a delay in primary pertussis immunization but not in MMR immunization (Table). Ultimately, 98 per cent of children completed the primary pertussis immunization course (606/616) and 94 per cent received MMR (581/616).

Of the other variables, a delay in pertussis immunization was significantly associated only with housing tenure and mother's social class when the child was an infant – in each case delay was associated with more disadvantaged families. Delay in MMR

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**Table** Delay in completion of primary pertussis immunization and MMR immunization by number of older siblings

Number of older sibs (number of cases)	Third pertussis immunization			MMR immunization		
	Per cent delayed (number of cases)	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)	Per cent delayed (number of cases)	Unadjusted OR (95% CI)	Adjusted OR† (95%CI)
None (273)	6.2% (17)	1	1	19.0% (52)	1	1
One (240)	13.8% (33)	2.40 (1.30, 4.43)	2.24 (1.21, 4.16)	20.4% (49)	1.09 (0.71, 1.69)	1.09 (0.69, 1.73)
Two or more (103)	23.3% (24)	4.57 (2.34, 8.94)	4.00 (2.03, 7.89)	25.2% (26)	1.44 (0.84, 2.46)	1.22 (0.68, 2.18)

\*Adjusted for housing tenure and mothers social class when child was born.

†Adjusted for mother's age, child's age, mother's education and father's education.

immunization was significantly associated with the mother's age, mother's educational level, father's educational level and the age of the child. There was a J-shaped relationship between both mother's and father's education and immunization delay. Younger children and those with older mothers had higher proportions of delayed immunization. Unadjusted odds ratios for the effect of number of older siblings on delay in immunization are shown in the Table. Adjustment for the social and demographic factors found to be significant on univariate analysis made little difference to the results.

## Discussion

Despite the accelerated schedule, higher overall coverage, and greater governmental backing for immunization, increasing family size is still associated with delayed uptake for primary pertussis immunization, but not for MMR.

The strengths of this study are the linkage between accurate and complete immunization records and detailed social and demographic information from individual families. The weaknesses are due to an under-representation of the most socially disadvantaged families in our sample in which 51, 43 and 6 per cent were classed respectively in non-manual, manual and other groups compared with equivalent figures of 42, 49 and 9 per cent of men aged 20–39 years from the 1991 census. This may have underestimated the effect of socioeconomic disadvantage but as this was independent of the effect of sibship size then it is unlikely to alter our conclusions.

The contrast between the effects of increasing numbers of older siblings on pertussis and on MMR uptake is striking and differs from previously reported findings. The available evidence suggests that reasons for delay in immunization among children from larger families include problems of access to clinics, competing care responsibilities, and more frequent minor infections in the infant.<sup>8</sup> These problems may be greater with the accelerated schedule because the period for immunizing is shorter and the postnatal period is more stressful. This would explain the continuing phenomenon of delays in pertussis immunization. However, the reasons why children are not immunized with MMR have changed over the past 5 years and are now much more related to active decisions on the parents

part to avoid or delay immunization.<sup>9,10</sup> The association we found between uptake and maternal age and educational level but not with sibling numbers supports the suggestion that active decisions rather than practical constraints explain delays in MMR uptake.

The persistence of the effect of older siblings on pertussis uptake is disappointing. There are two types of solution. The first is to improve access to clinics and to reduce inconvenience. Measures include home immunization, flexible clinic timing and locations, and practical help with childcare. Calls for these measures have been made previously<sup>3,5,8</sup> but have been either ineffective or have not been implemented for practical or financial reasons. The second is to address these concerns in immunization advice. Recent qualitative research points to the importance that parents place on information and evidence that is presented in an unbiased and reasoned way.<sup>9,10</sup> The importance of ensuring that infants from larger families complete their primary immunizations on time should be made clear in immunization advice and publicity because the very children who are less likely to be protected by immunization are the ones at increased risk of exposure to infection from older siblings.

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