

# Predicting uptake of MMR vaccination: a prospective questionnaire study

Mary Flynn and Jane Ogden

## SUMMARY

**Background:** Recent years have seen a decline in the uptake of the measles, mumps, and rubella (MMR) vaccination.

**Aim:** To describe parents' beliefs about the MMR vaccination and to explore the best predictors of uptake by the age of 2 years.

**Design of study:** Prospective questionnaire study.

**Setting:** Brighton and Hove area of East Sussex.

**Method:** Five hundred and eleven parents (response rate = 56.9%) completed a baseline questionnaire regarding their profile characteristics, beliefs about MMR and previous vaccination history prior to receiving a letter to attend for their child's vaccination. Attendance data was collected at follow-up by the age of 2 years.

**Results:** The majority of parents believed that measles, mumps and rubella were serious illnesses and stated that they would feel guilty about any adverse consequences of their decision about vaccination. Many responders were ambivalent about the benefit of vaccinations and were unsure whether to trust either the medical profession or the media. Uptake of MMR vaccination at follow-up was related to previous uptake for vaccination, increased faith in the medical profession, increased faith in the media, and a lower belief that vaccination is unhealthy and can harm the immune system.

**Conclusion:** Many parents hold mixed beliefs about the MMR vaccination and the doctors who administer it. Uptake relates to past vaccination and more positive beliefs.

**Keywords:** beliefs; doctor-patient relations; measles-mumps-rubella vaccine; patient compliance; prospective studies; questionnaires; trust.

## Introduction

THE measles, mumps, and rubella (MMR) vaccine is administered in order to prevent these diseases, which can cause significant morbidity and mortality. Complications include otitis media, deafness, pneumonia, orchitis, sterility, convulsions, encephalitis, meningitis, congenital rubella syndrome, and death.<sup>1</sup> However, publications suggesting a link between the MMR vaccine, autism, and bowel disorders have generated concerns about it,<sup>2-3</sup> and the rate of vaccination uptake has fallen. Since then, published scientific evidence has failed to confirm any link,<sup>4-5</sup> yet parents are still declining the vaccine. The year 2000 saw a measles outbreak in Dublin, with 1220 cases notified and two deaths, despite the availability of the vaccine.<sup>6</sup>

Why are parents choosing or not choosing to have the MMR vaccine? It has been suggested that the media may be an important influence on patient choice.<sup>7-8</sup> Some studies also indicate the importance of profile characteristics, such as age, social class, number of children, and single parent status.<sup>9-11</sup> Other studies have focused on an individual's beliefs. Bennett and Smith explored parents' beliefs about mumps, measles and rubella infections and noted concern specific to the MMR vaccination even before the controversial publications.<sup>12</sup> Qualitative studies have reported that some parents who chose not to vaccinate believed that vaccinations could harm the immune system.<sup>13-15</sup>

Research has also indicated that parents' attitudes towards health professionals and the attitudes of those giving social support may also have a role in parents' decisions about vaccinating their children.<sup>16</sup> In particular, Evans *et al* carried out a focus group study of parents and concluded that many parents lack confidence in the recommendations of health professionals as they know that these professionals have immunisation targets to reach.<sup>17</sup> This is in line with the recent emphasis on the importance of trust in the doctor-patient relationship.<sup>18</sup>

However, in a quantitative study, Ramsay *et al* reported that the large majority of the parents questioned believed that the MMR vaccine was safe and carried only a slight risk to health, and nearly all stated that they would have their children fully immunised against all childhood infections.<sup>19</sup> The decision to vaccinate may also be influenced by a fear of how they might feel if something went wrong. Kai explored this in a qualitative study of children's illness in general, and reported that when children are ill parents are strongly influenced by a sense of responsibility to act as competent parents and the fear of overwhelming guilt should they fail to do so.<sup>20</sup>

Finally, previous research exploring a multitude of health-related behaviours illustrates the importance of past behaviour as being the best predictor of future behaviour.<sup>21</sup> In line with this, the decision to vaccinate a child may also relate to

M Flynn, MB BS, MSc, general practitioner, Ardingly Court Surgery, Brighton. J Ogden, PhD, reader in health psychology, Department of General Practice, Guy's, King's and St Thomas' School of Medicine, London.

## Address for correspondence

Jane Ogden, Department of General Practice, Guy's, King's and St Thomas' School of Medicine, 5 Lambeth Walk, London SE11 6SP. E-mail: jane.ogden@kcl.ac.uk

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## HOW THIS FITS IN

### *What is known already*

Scares about the measles, mumps and rubella (MMR) vaccination have resulted in a decline in its uptake. Cross-sectional and qualitative research highlights the role of patients' beliefs.

### *What this paper adds*

Parents often have mixed and complex beliefs about the MMR vaccination and about doctors that may be difficult to change. The best predictors of uptake were past vaccination behaviour, positive beliefs about the medical profession and the vaccination, and an increased faith in the media. By encouraging uptake of earlier, less controversial vaccinations a culture of uptake could be created.

the child's and their siblings' vaccination history. To date, most research examining vaccination uptake has either been qualitative and descriptive or cross-sectional in design. The present study uses a prospective design to first describe baseline beliefs about MMR vaccine and then to assess the role of profile characteristics, beliefs and past behaviour in predicting actual uptake of the MMR vaccine at follow-up.

## Method

### *Participants*

The study population comprised all the parents of children in the Brighton and Hove area ( $n = 898$ ), who were due to receive an invitation for the MMR vaccination over a 3-month period. Questionnaires were sent out prior to the letter of invitation and 513 responses were received, with 511 responders having answered sufficiently for their responses to be used for analysis (response rate = 56.9%). Follow-up data on uptake was collected for all 898 parents from the child health records.

### *Design*

The study involved a prospective design. Baseline measures of profile characteristics and beliefs were assessed prior to invitation to attend for vaccination for MMR, and actual uptake of vaccination by 2 years of age was measured at follow-up.

### *Procedure*

Parents of children born between 1 November 1997 and 31 January 1998 were identified using the child health system, which maintains computerised data on the immunisation status of all the children in the area. The child health department sent out the questionnaire and covering letter in order to comply with the Data Protection Act, and they also sent out reminders to non-responders. Uptake of vaccination was checked at two years of age.

### *The questionnaire*

The questionnaire was developed from themes taken from the qualitative literature and from previous questionnaire surveys.<sup>7-22</sup> The questionnaire was piloted on parents whose

- *Beliefs of others.* This contained four items; for example, 'My relatives have encouraged me to vaccinate my child', 'My friends have encouraged me not to vaccinate my child'. A higher score reflected increased encouragement from others (Cronbach's  $\alpha = 0.4$ )
- *Severity of illnesses.* This contained four items; for example, 'Measles may be a serious illness for a child', 'Mumps may be a dangerous illness'. A higher score reflected increased belief that measles, mumps and rubella are serious illnesses (Cronbach's  $\alpha = 0.54$ )
- *Guilt about consequences.* This contained three items; for example, 'I would feel guilty if my child caught an illness that could have been prevented by vaccination', 'I would feel it was my fault if my child was damaged by vaccination'. A higher score reflected an increased concern about the consequences of the decision (Cronbach's  $\alpha = 0.51$ )
- *Experience of issues.* This contained four items; for example, 'I have a friend/relative who has been affected seriously by being vaccinated', 'I have a friend/relative who has been seriously affected by catching measles or mumps or rubella'. A higher score reflected increased experience of the issues involved (Cronbach's  $\alpha = 0.46$ )
- *Vaccination is unhealthy.* This contained six items; for example, 'Natural protection from catching the real illness is better than immunity from vaccination', 'Vaccination could possibly harm the body's immune system'. An increased score reflected an increased belief that vaccination is unhealthy (Cronbach's  $\alpha = 0.83$ )
- *Faith in the medical profession.* This contained four items; for example, 'I have confidence that my doctor will always do what is best for my family and me', 'I would ask my [general practitioner] GP if I needed information about vaccinations'. An increased score reflected increased faith in the medical profession (Cronbach's  $\alpha = 0.65$ )
- *Faith in the media.* This contained four items; for example, 'I rely on information about health problems from magazines', 'Magazines have interesting stories about health but they are not always accurate'. An increased score reflected increased faith in the media (Cronbach's  $\alpha = 0.40$ )

Box 1. Details of the beliefs section of the study questionnaire.

children were above the age to be included in the study. Ethical approval was obtained from the East Sussex Local Research Ethics Committee.

The questionnaire was broken down into the following sections:

*Profile characteristics and past behaviour.* Participants recorded their age, sex, ethnic origin, employment status, home-ownership and whether or not they were single parents, as well as details about how many children they had and whether or not they had previously received vaccinations.

*Beliefs.* Participants noted their response to a series of statements (Box 1) on a 5-point Likert scale, ranging from 'strongly disagree' (1) to 'strongly agree' (5). Total scores were summated and the reliability of the scores was assessed using Cronbach's  $\alpha$ . For descriptive purposes these scores were recoded as 'disagree' (1 to 2), 'somewhat agree' (3) and 'agree' (4 to 5).

*Uptake.* At the age of 2 years, actual uptake of the MMR vaccine was accessed via the child health department, and entered as 'yes or no'.

### Data analysis

The results were analysed using SPSS for Windows to describe the participants' profile characteristics, past behaviour and beliefs using descriptive statistics, and to identify the best predictors of uptake of vaccination using logistic regression with uptake entered as the dependent variable. Probabilities and confidence intervals are reported.

## Results

### Profile characteristics

Participants' profile characteristics are shown in Table 1. The majority of the responses were from women. One questionnaire was returned by both parents. The parents' median age was 31 years, most responders had one or two children and were homeowners, and a fifth were single parents. There were very few responses from ethnic minorities, which reflects the mainly white population of the area being studied. The majority of responders' children had previously attended for all vaccinations.

### Beliefs

Participants' beliefs are shown in Table 2. Over half of the responders showed only moderate agreement that they had been encouraged by others to have their children vaccinated, but only a very small minority stated that they had clearly been discouraged. A large majority felt that measles, mumps and rubella were severe illnesses and reported concerns about the consequences of their decision, although very few had any direct experience of the issues involved. In response to questions regarding the beliefs about vaccinations, almost half of responders disagreed that they were unhealthy. However, almost as many were unsure. Finally, the majority were mixed in their confidence in doctors, and the majority reported having little faith in the media.

### Predicting uptake of MMR vaccination

The follow-up data showed that 22.3% ( $n = 114$ ) of the study sample did not have their child vaccinated by the age of 2 years and that 77.7% ( $n = 397$ ) did. Logistic regression was used to assess the best predictors of uptake of the MMR vaccination. Profile characteristics and total beliefs were entered into the analysis as the independent variables, and uptake was the dependent variable (Table 3). Uptake of MMR was related to previous attendance for vaccination, increased faith in the medical profession, increased faith in the media, and a lower belief that vaccination is unhealthy.

## Discussion

This study aimed to describe parents' beliefs about the MMR vaccination and to assess the best predictors of uptake. The data were collected in 1999 and 2000 and provide insights into beliefs and vaccination behaviour after a time of intense media coverage concerning the MMR vaccine and its possible risks.

### Summary of main findings

With regard to beliefs about MMR, the majority of the parents believed that measles, mumps and rubella are serious

Table 1. Profile characteristics.<sup>a</sup>

Characteristic	
Sex ( $n$ [%])	
Male	29 (5.8)
Female	470 (94.2)
Median age in years	31
Interquartile range of age in years	28–35
Number of children (%)	
One	257 (51.5)
Two	160 (32.1)
Three	62 (12.4)
Four	17 (3.4)
Five	1 (0.2)
Six	2 (0.4)
Ethnic group (%)	
White	481 (96.2)
Black	2 (0.4)
Asian	6 (1.2)
Other	11 (2.2)
Single parent (%)	67 (14.3)
Homeowner (%)	360 (74.5)
Employed (%)	281 (59.2)
Previous vaccination (%)	
Yes	406 (84.1)
Some	67 (15.9)
No	10 (2.1)

<sup>a</sup>The numbers do not always add up to 511 as not all responders answered all questions.

illnesses and that they would feel guilty about any adverse consequences of their decision about vaccination. However, many responders were ambivalent about the benefit of vaccinations and were unsure whether to trust either the medical profession or the media. Much previous research has been qualitative and has involved small sample sizes.<sup>13–17</sup> The results from the present study provide support for these studies. These results indicate that, although measles, mumps and rubella are generally recognised as serious, concerns about vaccination and the medical profession are not confined to a small minority of dissenters. Patients are sometimes considered to be either for or against medicine and for or against the medical profession. The results from this study suggest that this is a simplistic picture of patients' beliefs. Patients may believe that some illnesses have serious medical complications, they may be sceptical of the medical solution and the medical professionals offering this solution, and yet still follow the orthodox medical advice. Individuals can hold complex sets of beliefs that, although appearing inconsistent to the medical profession, make sense to the individuals themselves.

In terms of understanding vaccination uptake, the best predictors of uptake for the MMR vaccination were previous attendance for vaccination, increased faith in the medical profession, increased faith in the media, and less concern that vaccination is unhealthy. These results support previous research, which has highlighted an important role for past behaviour in predicting future behaviour and suggests that vaccination uptake is similarly consistent.<sup>20</sup> The results also support a central role for trust in doctors and the need for a good doctor–patient relationship if uptake targets are to be met.<sup>18</sup> However, although biased media coverage was

Table 2. Beliefs about vaccination.

	Disagree (n [%])	Somewhat agree (n [%])	Agree (n [%])
Encouragement from others	14 (2.8)	270 (53.1)	224 (44.1)
Severity of illnesses	4 (0.8)	68 (13.4)	437 (85.9)
Guilt about consequences	14 (2.7)	68 (13.4)	428 (83.9)
Experience of issues	243 (47.6)	240 (47.1)	27 (5.3)
Belief that vaccination is unhealthy	253 (49.5)	216 (42.3)	41 (8)
Faith in the medical profession	85 (16.6)	287 (56.2)	137 (26.8)
Faith in the media	364 (71.7)	144 (28.2)	0 (0)

Table 3. Predicting attendance for MMR vaccination at 2 years.<sup>a</sup>

	$\beta$	Exp ( $\beta$ ) odds ratio	P-value	95% confidence intervals
Sex of parent	-0.01	0.99	0.99	0.31 to 3.1
Age of parent	-0.04	0.96	0.23	0.91 to 1.02
Number of children	0.02	1.02	0.91	0.72 to 1.45
<b>Previous vaccination</b>	1.44	4.24	0.001	2.22 to 8.09
Single parent	-0.32	0.73	0.45	0.32 to 1.67
Homeowner	0.04	1.05	0.91	0.48 to 2.28
Employed	-0.13	0.88	0.68	0.47 to 1.6
Encouragement from others	0.41	1.51	0.16	0.85 to 2.68
Perceived risk of illness	0.17	1.18	0.58	0.65 to 2.1
Guilt about consequences	0.01	1.01	0.97	0.66 to 1.55
Experience of issues	-0.15	0.86	0.5	0.56 to 1.32
<b>Faith in the media</b>	0.86	2.37	0.01	1.28 to 4.38
<b>Faith in the medical profession</b>	0.58	1.78	0.02	1.11 to 2.87
<b>Belief that vaccination is unhealthy</b>	-0.73	0.48	0.002	0.29 to 0.77

<sup>a</sup>Logistic regression was used for 397 (77.7%) who attended versus 114 (22.3%) who did not attend. Highlighted text indicates significance.

blamed for the fall in vaccination rates,<sup>7-8</sup> the results from the present study do not support the view that parents of unvaccinated children are more likely to believe media reports. Perhaps the media is not always anti-vaccination.

### Strengths and weaknesses of the study

Previous studies exploring uptake of MMR have mainly been descriptive and have used cross-sectional designs. The present study used a prospective design, enabling conclusions to be drawn about baseline predictors. This is the main strength of the study, as it removes the possibility of retrospective bias and post hoc justifications. However, some patients did not return the questionnaire, raising the problem of responder bias. It is possible that those who returned the questionnaire had different beliefs and profile characteristics than those who did not. Owing to the anonymous nature of the questionnaire we do not have any information about the non-responders. However, the demographics of the responders reflect those of the population studied, and their beliefs are consistent with those found in previous research, indicating that generalisations from this sample can be made.

### Implications for practice

The results from the present study indicate concern about both the MMR vaccination and the risks of related illnesses, and show mixed feelings towards the medical profession and the media. Within the context of such beliefs, the deliberations made by parents about whether or not to vaccinate become more understandable, as they are often balancing a set of complex and sometimes contradictory concerns. These

results provide a dilemma for doctors. By illuminating how parents think about vaccinations, these results could help doctors to understand and respect parents' beliefs and their resulting decision not to vaccinate. Such an approach is in tune with patient-centred care and makes the patient's choice paramount.<sup>20-22</sup> However, many GPs may not feel that this is in the best interest of the child or the community and may wish to influence parents' choice. In contrast, therefore, these results could provide doctors with some insights into how to change beliefs and increase uptake rates. If doctors wish to encourage parents to vaccinate their children they need to promote positive views about both themselves and the MMR vaccination itself. However, this is not a novel conclusion<sup>17,19</sup> and simply repeating the need for such a change in views may not make such changes any more likely.<sup>26</sup> In contrast, perhaps the role of past behaviour does provide doctors with a window of opportunity for change. The results from this study show that past vaccination history predicts MMR vaccination uptake. This relates to all vaccinations, not just to MMR. Doctors could, therefore, place more emphasis on encouraging uptake for earlier, less controversial vaccinations and use these earlier vaccinations as an opportunity for discussing the issues about vaccination. Such an early emphasis may create a culture of vaccination uptake which could itself become self-perpetuating.

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