

Parental confidence in measles, mumps and rubella vaccine: evidence from vaccine coverage and attitudinal surveys

Mary E Ramsay, J Yarwood, D Lewis, H Campbell and J M White

SUMMARY

Background: The measles, mumps and rubella (MMR) vaccine has been the focus of considerable adverse publicity in recent years.

Aim: To describe recent trends in parental attitudes to, and coverage of, MMR vaccine.

Design of study: Routine surveillance of vaccine coverage and cross-sectional surveys of parental attitudes.

Setting: All health authorities in England (vaccine coverage) and 132 enumeration districts in England (attitude survey).

Method: Quarterly MMR vaccine coverage for all resident children in England at two years of age was requested from computerised child health information systems. Data was also obtained from 26 English health authorities/trusts on MMR coverage at 16 months of age. The proportion of mothers who believed that MMR vaccine was safe or carried only a slight risk, and the proportion who intended to fully vaccinate any future children, was obtained from biannual interviews with a nationally representative sample of over 1000 mothers of children under three years of age.

Results: Vaccine coverage at two years of age fell 8.6% (95% confidence interval [CI] = 8.4 to 8.8) between April and June 1995 and between April and June 2001. In September 2001, 67% of mothers reported that the MMR vaccine was safe or carried only a slight risk and 92% of mothers agreed with the statement: 'If I had another child in the future I would have them fully immunised against all childhood diseases'.

Conclusions: Despite considerable adverse publicity, the fall in MMR coverage has been relatively small, mothers' attitudes to MMR remain positive, and most continue to seek advice on immunisation from health professionals. As the vast majority of mothers are willing to have future children fully immunised, we believe that health professionals should be able to use the available scientific evidence to help to maintain MMR coverage.

Keywords: immunisation; measles, mumps and rubella vaccine; vaccine coverage; parental attitudes.

Introduction

THE last measles epidemic in England and Wales occurred in 1988 and involved over 80 000 cases of measles and 13 deaths. In October that year, combined measles, mumps and rubella (MMR) vaccine was introduced routinely for all children aged between 12 and 15 months of age. The combined vaccine was preferred by parents¹ and greeted with general acclaim in the mass media.

Less than ten years later, newspapers featured headlines such as 'Ban three-in-one jab' (*Daily Mail*, 27 February 1998). This publicity was stimulated by the publications of a single research group that suggested a possible link between measles, measles vaccine, and inflammatory bowel disease; and between MMR and autism.^{2,3} Despite the lack of international support⁴⁻⁶ and good scientific evidence against such an association,⁷⁻¹⁰ stories have continued to appear in the mass media that portray apparent widespread concern and confusion among both parents and the health professionals. These stories were reminiscent of the experience with pertussis vaccine in the mid-1970s, which led to a dramatic fall in vaccine coverage and a consequent resurgence of whooping cough, with associated morbidity and mortality.¹¹

In England, data on vaccine coverage have been collated quarterly by the Public Health Laboratory Service (PHLS) since 1987. Since 1991, regular surveys of parental knowledge and attitudes to all childhood vaccinations have been conducted by Health Promotion England (HPE, Immunisation Information from April 2002). This paper describes trends in these complementary data sources from 1995 and provides evidence of the impact of recent adverse publicity on parental confidence in MMR vaccine.

Methods

Survey of attitudes

Cross-sectional surveys of attitudes towards childhood immunisations have been conducted every six months since 1991. For each survey, face-to-face interviews are conducted at home with a nationally representative sample of mothers of children aged under three years. Since March 1997 the research sample size has been 1000; double that in previous surveys. Random location sampling — a tightly controlled form of quota sampling — is used.¹² Interviewers approach consecutive households in 132 randomly selected enumeration districts, each constituting around 150 households, until the full quota of mothers is obtained. This technique ensures a representative sample in terms of geographic and socioeconomic factors. As eligible mothers make up only approximately 6% of the total population and the number of eligible mothers in each enumeration district

M E Ramsay, MSc, MRCP, FPHM, consultant epidemiologist; and JM White, BSc, principal scientist, Immunisation Division, PHLS Communicable Disease Surveillance Centre, London. J Yarwood, MSc, SRN, SCM, FPCert, DipHSS, immunisation programme manager, Immunisation Programme, Health Promotion England, London. D Lewis, BA, associate director, British Market Research Bureau International, London. H Campbell, MSc, senior scientific officer, Immunisation Team, Department of Health, London.

Address for correspondence

Dr Mary Ramsay, Immunisation Division, PHLS Communicable Disease Surveillance Centre, 61 Colindale Avenue, London NW9 5EQ. E-mail: MRamsay@phls.org.uk

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HOW THIS FITS IN*What do we know?*

MMR vaccine has been the focus of considerable adverse publicity in recent years. England has unique access to two complementary routine data sources on vaccine coverage and parental attitudes towards immunisation.

What does this paper add?

The attitudinal surveys show that most mothers seek advice from health professionals before having their children immunised. Trends in the two data sources from 1995 provide evidence that, while there has been an increase in mothers' concerns about the safety of MMR vaccine, 92% of mothers still intend to fully immunise any future child. This is reflected in the relatively small and contained fall in MMR vaccine coverage to date.



is not known, it is not possible to estimate response rates.

The quantitative questionnaire deals with all aspects of the immunisation process. It concentrates on mothers' awareness and knowledge of vaccinations, their attitudes towards the safety of immunisations, their visits to health professionals, and awareness and attitudes towards relevant advertising. Mothers are asked to assess the safety of immunisations, including MMR, by rating them as 'completely safe', 'slight risk', 'moderate risk' or 'high risk'. The demographic profile of the sample (in terms of age, socioeconomic grade of the chief income earner in the household, and geographical location) is also collected. Data are weighted using these characteristics, according to the National Readership Survey (NRS Ltd, data for the period January to December 1998, www.nrs.co.uk).

Vaccine coverage

PHLS Communicable Disease Surveillance Centre requests data from computerised child health information systems each quarter, for children resident in English health authorities. The data requested include the number of children who reached their second birthday during the evaluation quarter, and the number of these children who received one dose of MMR before their second birthday.¹³

The MMR vaccine is scheduled to be administered between 12 and 15 months of age. Coverage by the second birthday is therefore not available until almost one year after children in each cohort become eligible to receive MMR. Concern about falling MMR coverage therefore led to surveillance of MMR coverage being initiated at an earlier age. Since 1998, sentinel surveillance at both 16 and 24 months of age has been conducted in 26 English health authorities/trusts using the National Child Health System computer.¹⁴ These health authorities represent around 12% of the English population and include both urban and rural health authorities in five regions. Data are generated on the vaccination status of children aged 16 months and 24 months at the beginning of April, August, and December 1998 (i.e. children born in November and March 1996, March and July 1996, and November 1996 and March 1997, respectively,

Table 1. MMR coverage by two years of age by region.

Region	Apr- Jun 1995	Jul- Sept 1995	Oct- Dec 1995	Jan- Mar 1996	Apr- Jun 1996	Jul- Sept 1996	Oct- Dec 1996	Jan- Mar 1997	Apr- Jun 1997	Jul- Sept 1997	Oct- Dec 1997	Jan- Mar 1998	Apr- Jun 1998	Jul- Sept 1998	Oct- Dec 1998	Jan- Mar 1999	Apr- Jun 1999	Jul- Sept 1999	Oct- Dec 1999	Jan- Mar 2000	Apr- Jun 2000	Jul- Sept 2000	Oct- Dec 2000	Jan- Mar 2001	Apr- Jun 2001
Eastern	93.7	93.6	92.4	92.7	92.6	92.8	92.6	93.3	93.3	92.8	92.9	92.4	90.7	89.3	89.0	88.1	88.7	88.4	88.9	89.0	89.5	89.4	89.3	87.6	85.9
London	87.2	86.5	86.5	86.7	86.6	86.2	85.9	85.8	86.0	85.0	84.9	84.4	83.7	82.2	81.6	79.8	79.7	80.0	79.3	81.8	80.1	79.2	78.8	76.4	72.3
North West	92.0	91.0	90.1	90.6	90.9	91.1	90.8	91.4	91.2	90.2	90.5	90.5	89.7	88.3	88.2	87.6	87.6	87.3	88.3	88.9	88.5	88.9	88.7	86.5	85.6
Northern & Yorkshire	93.4	92.8	91.8	90.8	91.1	91.3	91.9	92.4	91.6	91.5	91.2	91.5	90.7	89.8	89.4	88.8	89.4	88.5	89.1	90.0	89.3	89.8	89.5	88.5	85.9
South East	93.3	92.9	92.3	91.9	92.6	92.4	92.4	92.0	92.2	91.4	91.4	90.8	90.1	88.6	88.2	87.9	88.3	87.8	87.9	87.5	87.6	87.3	87.5	85.9	84.0
South West	95.1	94.5	94.0	93.7	94.1	93.8	92.9	93.2	93.4	92.8	92.0	92.2	91.0	90.1	90.0	89.5	89.9	89.0	88.9	88.3	88.6	89.1	87.9	86.6	85.7
Trent	92.4	93.1	93.2	92.0	92.7	93.1	92.6	93.4	92.8	89.5	88.5	87.7	88.7	88.4	88.9	90.8	90.4	91.0	91.0	90.4	91.4	90.8	91.5	90.1	88.2
West Midlands	92.7	92.1	91.6	92.5	93.0	92.8	92.7	92.2	93.0	91.8	91.7	92.2	91.5	90.1	90.7	89.5	89.3	89.4	89.2	89.4	89.3	89.3	88.7	87.8	85.7
England	92.2	91.7	91.1	91.1	91.4	91.4	91.2	91.4	91.4	90.3	90.2	90.1	89.4	88.1	87.9	87.3	87.8	87.3	87.4	87.9	87.7	87.6	87.4	85.8	83.6

who became eligible for MMR vaccine around one year later). The data request was repeated in April, August, and December of each subsequent year for children of the same age until the year 2000. Retrospective data from 1993 to 1997 were also generated by interrogating the participating child health computers, to obtain the vaccination status for cohorts of the same age on the equivalent dates. Data were requested quarterly in March, June, September, and December from 2001 onwards.

Results

MMR attitudes and knowledge

In September and October 2001, 1013 interviews were conducted across 132 sampling areas in England. Overall awareness of MMR, after prompting with a list of vaccines, was extremely high at 96%. Eighty-six per cent of mothers were aware of MMR without prompting. This level of spontaneous awareness had risen significantly from around 60% in 1995 ($P < 0.01$).

Seventy-four per cent of mothers reported seeking advice from health professionals before having their children immunised. Of these mothers, 91% reported being told about the benefits, and 75% about the side effects, of immunisation.

Perceived safety of MMR has been declining since 1995 and a higher proportion of mothers are now more concerned about the safety of MMR vaccine than whooping cough vaccine (Figure 1). Between February 1998 (the peak of negative publicity that accompanied publication of a *Lancet* article²) and October 2000, some recovery was observed. In January 2001, a further publication, suggesting that the side effects of MMR vaccine had been insufficiently studied,¹⁵ received widespread media attention. Perceived safety of MMR vaccine fell to 64% in March 2001, but this fall was again followed by some recovery in confidence later that year. Mothers from higher socioeconomic grades were less likely to agree that MMR was safe. In

September/October 2001, of the 387 mothers from ABC1 families, 58% thought that MMR was safe or carried only a slight risk, compared with 73% of the 626 mothers from C2DE families ($P < 0.001$). Despite the increase in mothers' concerns about the safety of MMR, the vast majority of mothers intended to fully immunise another child in the future. In September/October 2001, 92% of mothers agreed that they would allow another child in the future to be fully immunised against all childhood diseases. Only 60 (6%) said they would refuse to have a future child immunised with MMR; 48 (80%) of these reported having refused MMR for a child in the past.

Vaccine coverage

In the period from April to June 1995, MMR coverage by the second birthday was 92.2% in England, ranging from 87.2% to 95.1% in each region. By 2001, from April to June the coverage was 83.6%, ranging from 72.3% to 88.2% in each region. MMR coverage started to decline in late 1997, stabilised during 1999 and 2000, but declined again during early 2001. Comparing coverage from April to June of 2001 with that in the same period of 1995, the overall size of decline has been 8.6 percentage points (95% CI = 8.4 to 8.8) and there were significant differences in the decline by region ($P < 0.001$). The largest decline was in the London region, where coverage fell almost 15 percentage points. Decline was also more than nine percentage points in the South East and South West regions. The smallest fall (4.2 percentage points) was in Trent, although coverage in Trent has been less consistent, owing to intermittent data collection problems in two health authorities.

Comparison of the coverage at 16 months of age and the HPE tracking data show similar trends over time (Figure 2). Both sources suggest a decline in parental confidence since late 1997, which recovered slightly between mid-1998 and late 1999, but has then declined again.

Sentinel surveillance of MMR coverage at 16 months of

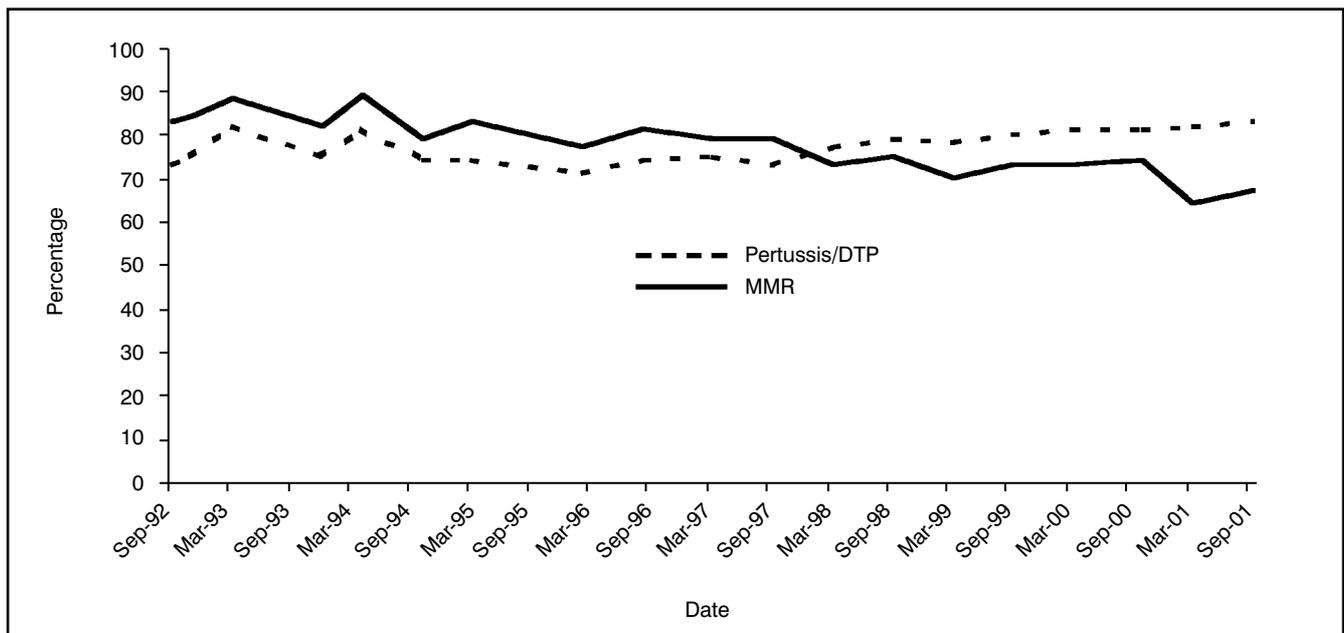


Figure 1. MMR and pertussis vaccines — percentage of mothers who believe each vaccine is safe or carries only a slight risk.

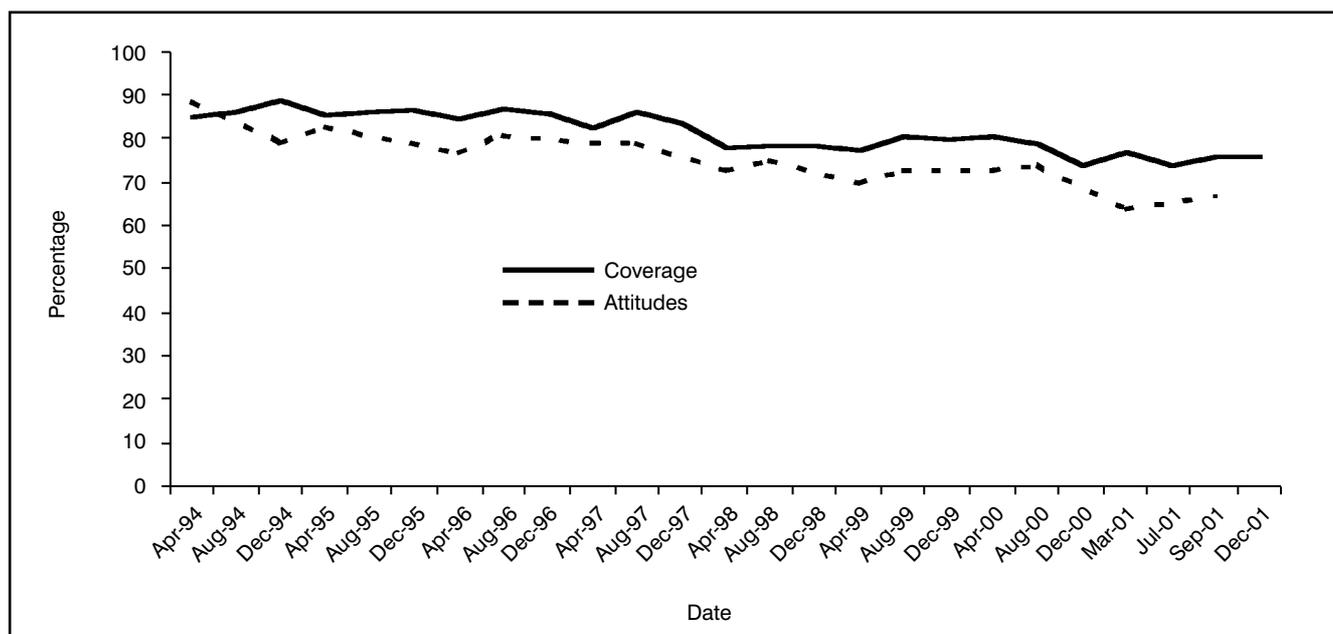


Figure 2. MMR coverage at 16 months of age and percentage of mothers who believe MMR is safe or carries only a slight risk in the corresponding period.

age has predicted changes in coverage in the same health authorities at 24 months. For children born since July 1997, coverage at 24 months in the 26 sentinel health authorities has been between 0.9 to 3.5 percentage points higher than the national coverage for children born in the equivalent quarter. Sentinel surveillance at 16 months can therefore be used to detect trends in national MMR coverage at an earlier stage. In the latest cohort (children born in January 2000), vaccination coverage at 16 months fell from the previous cohort, suggesting that national coverage at 24 months will be stable in the short term.

Discussion

This paper describes the impact of adverse publicity on the MMR vaccination programme over the past three years. Our ability to describe this impact depends upon the availability of high quality, timely data on both vaccine coverage and on parental attitudes to vaccination. We believe that England is the only country with access to these two complementary routine data sources and that this has allowed us to detect and respond to problems at an early stage. We also believe that this prompt response has helped to limit the magnitude of damage to the programme.

Both datasets show that there has been a fall in parental acceptability of MMR vaccine. Overall, the magnitude of the decline is small and has been contained in the face of continued adverse publicity. This contrasts sharply with the experience with safety concerns about pertussis vaccine that occurred in the 1970s. At that time, coverage of pertussis vaccine fell from over 80% to 30% and recovery took more than a decade.¹¹ The impact of adverse publicity on pertussis vaccination rates was greatest in the upper social classes,¹⁶ and the decline in the acceptability of MMR appears to also be greater in parents from higher socioeconomic grades.

Coverage is measured by using computerised records of

vaccination status for all resident children in each health authority in England. It is likely to be a minimum estimate, as vaccination details may not be returned or may be returned late for children immunised outside of the scheduled appointment or in other settings, such as private practice.¹⁷ Despite this, trends in measured coverage are valid and the detection of a decline in MMR coverage, while coverage of other antigens has been maintained,¹⁸ is likely to be a real effect.

The attitudinal survey is based upon a representative but non-random sample of mothers. Mothers are made aware that the survey concerns health issues of relevance to young children, but are not aware that the survey relates to immunisation before they are asked to participate. However, details of non-responders are not collected and we are therefore unable to assess the effect that any refusals or non-contacts may have on the survey findings. We believe that, because the sample for the survey is designed to be representative of the target group, the results should accurately reflect mothers' attitudes and opinions towards childhood immunisation. Although the trends in attitudes are consistent with the coverage measurements, parental attitudes may not translate into actual behaviour with an individual child. However, a high proportion of parents who said they would refuse MMR in the future reported having refused MMR in the past, suggesting that attitudes and behaviour are related.

We believe that the extent of media interest in the potential side effects of MMR has been disproportionate to the weight of negative evidence. In addition, sufficient weight has not been given to the positive evidence that allows redress of the balance in favour of MMR.¹⁹ Each fall in coverage and acceptability has been relatively small and there appears to be some signs of recovery after each decline. This recovery may be owing to local action by health authorities,²⁰ GPs,²¹ and other health professionals, supported by the prompt national dissemination of information and

resources.²²⁻²⁴ Although media interest tends to be transient, the potential public health implications can be long term. Coverage data at five years of age suggests that over 90% of children entering school have received MMR vaccine.¹⁸ Even in the absence of parental concerns, maintaining high vaccination coverage is a challenge, particularly in highly mobile inner-city populations.¹ A further drop in coverage owing to unfounded safety concerns, will leave a substantial number of children unprotected against measles. Unless efforts to recall these children at a later stage are made, exposure to measles is likely to occur at school or when travelling to a country where measles remains common. Measles is commonly imported from neighbouring countries, and recent experience in Ireland²⁵ and The Netherlands²⁶ reminds us that measles is a severe infection that can kill — even in developed countries. A fall in MMR coverage may also contribute to a resurgence in rubella and mumps. Such resurgences are likely to involve adults who are too old to have been offered MMR vaccination, who may be more at risk of the severe complications of mumps or of acquiring rubella during pregnancy. The devastating consequences of low coverage in a country where a universal rubella immunisation strategy has been adopted have been recently demonstrated in Greece, where 25 cases of congenital rubella were confirmed.²⁷

Our data demonstrate that media reports of widespread public refusal to accept MMR are wrong. Most mothers continue to seek advice from health professionals and the vast majority will go on to have their child immunised with MMR. A small number of mothers, some of whom may have previously refused MMR, will refuse the vaccine, but the survey suggests that most parents' concerns should be allayed by a well-informed health professional. General practitioners, practice nurses, and health visitors are the key professionals in the provision of advice on immunisation. A good understanding of the scientific basis for vaccine policy is likely to lead to stronger recommendations to vaccinate.²⁰ The mass media impacts on both the public and health professionals, but these professionals have a responsibility to return to the overwhelming weight of scientific evidence to support their own practice.²⁴

The United Kingdom has achieved good control of measles, mumps, and rubella. This level of control has been facilitated by a population that is broadly supportive of immunisation, and reflects the strengthened co-ordination of local immunisation services introduced after the tragic experience with whooping cough. However, there is no room for complacency as the potential for epidemics exists with current levels of coverage. Efforts should be made to try and identify children who were not vaccinated at two years of age, and to ensure that they are offered MMR vaccine before starting school. A recent survey suggests that most parents would welcome more open discussion with health professionals.²⁸ To support this discussion, national resources now include three detailed fact sheets on MMR, a new parental leaflet, and information videos (see www.mmrthefacts.nhs.uk). Central support for training of health professionals has also been provided. The UK has all the mechanisms in place to monitor and respond to public and professional concerns rapidly. The importance of this continued surveillance must not be underestimated.

References

1. Peckham C, Bedford H, Senturia Y, Ades A. *The Peckham Report: National immunisation study. Factors influencing immunisation uptake in childhood*. Horsham: Action Research for the Crippled Child, 1989.
2. Thompson NP, Montgomery SM, Pounder RE, Wakefield AJ. Is measles vaccination a risk factor for inflammatory bowel disease? *Lancet* 1995; **345**: 1071-1074.
3. Wakefield AJ, Murch SH, Anthony A, et al. Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children. *Lancet* 1998; **351**: 637-641.
4. Anonymous. Expanded Programme on Immunization (EPI). Association between measles infection and the occurrence of chronic inflammatory bowel disease. *Wkly Epidemiol Rec* 1998; **73**: 33-39.
5. Chen RT, DeStefano F. Vaccine adverse events: causal or coincidental? *Lancet* 1998; **351**: 611-612.
6. Ward B, DeWals P. Association between measles infection and the occurrence of chronic inflammatory bowel disease. *Can Commun Dis Rep* 1997; **23**: 1-5.
7. Miller E, Waight P. Measles, measles vaccination, and Crohn's disease. *BMJ* 1998; **316**: 1745.
8. Pebody RG, Paunio M, Ruutu P. Measles, measles vaccination, and Crohn's disease. Crohn's disease has not increased in Finland. *BMJ* 1998; **316**: 1745-1746.
9. Peltola H, Patja A, Leinikki P, et al. No evidence for measles, mumps, and rubella vaccine-associated inflammatory bowel disease or autism in a 14-year prospective study. *Lancet* 1998; **351**: 1327-1328.
10. Taylor B, Miller E, Farrington C, et al. MMR vaccine and autism: no epidemiological evidence for a causal association. *Lancet* 1999; **353**: 2026-2029.
11. Gangarosa E, Galazka A, Wolfe C, et al. Impact of anti-vaccine movements on pertussis control: the untold story. *Lancet* 1998; **351**: 356-361.
12. Orton S. Cheque book versus textbook — cost effective sampling methods. *Survey Methods Centre Newsletter* 1994; **15**(1).
13. White JM, Rush M, Leon S, Ramsay ME. COVER/Korner 95-1 (April to June 1995). Vaccination coverage statistics for children up to 2 years old in the United Kingdom. *Commun Dis Rep CDR Rev* 1995; **5**: R186-R187.
14. Anonymous. Sentinel surveillance shows small decline in MMR coverage. *Commun Dis Rep CDR Wkly* 1998; **8**: 317-320.
15. Wakefield AJ, Montgomery SM. Measles, mumps, rubella vaccine: through a glass, darkly. *Adverse Drug React Toxicol Rev* 2000; **19**: 265-283.
16. Pollock TM, Miller E, Lobb J. Severity of whooping cough in England before and after the decline in pertussis immunisation. *Arch Dis Child* 1984; **59**: 162-165.
17. Clark A, Marshall R. Measles, mumps, and rubella vaccine coverage in 2 year old children in East Lancashire — better than it looks. *Commun Dis Public Health* 1999; **2**: 50-53.
18. Anonymous. Fall in MMR vaccine coverage reported as further evidence of vaccine safety is published. *Commun Dis Rep CDR Wkly* 1999; **9**: 227-230.
19. Begg N, Ramsay M, White J, Bozoky Z. Media dents confidence in MMR vaccine. *BMJ* 1998; **316**: 561.
20. Petrovic M, Roberts R, Ramsay M. Second dose of measles, mumps, and rubella vaccine: questionnaire survey of health professionals. *BMJ* 2001; **322**: 82-85.
21. Crawley H. How we reassure parents on MMR. *Pulse* 25 April 1998; 89-90.
22. Chief Medical Officer. *Urgent Communications*. London: Department of Health, 1997.
23. Chief Medical Officer. *Measles, Mumps Rubella (MMR) Vaccine, Crohn's disease and autism*. (PL/CMO/98/2.) London: Department of Health, 1998.
24. Anonymous. The safety of MMR vaccine. *Curr Prob Pharmacovigil* 1999; **25**: 9-10.
25. Cronin M, Fitzgerald M. Measles outbreak in the Republic of Ireland: update. *Euro Surveill Wkly* 2000; **4**(37): 14 September.
26. Anonymous. Measles outbreak, Netherlands. *Wkly Epidemiol Rec* 2000; **75**: 119-121.
27. Panagiotopoulos T, Antoniadou I, Valassi-Adam E. Increase in congenital rubella occurrence after immunisation in Greece: retrospective survey and systematic review. *BMJ* 1999; **319**: 1462-1466.
28. Evans M, Stoddart H, Condon L, et al. Parents' perspectives on the MMR immunisation: a focus group study. *Br J Gen Pract* 2001; **51**: 904-910.