

care were less likely to be vaccinated than those at home unless they were under 5 years of age in districts C, D, and E or aged 5-9 in district G (table). Retrieving data was difficult in all but one district, which had electronic records of looked after children. No district had a joint health and social services database.

## Comment

Overall, children looked after by local authorities were more than twice as likely to not receive meningococcal C vaccine than children at home (risk ratio 2.17 adjusting for age and district, 95% confidence interval 2.06 to 2.28, Mantel-Haenszel method). Because universal childhood meningococcal C vaccination was introduced recently, we were able to study the effectiveness of public care without bias from historical health neglect. Although sampling was opportunistic, our findings are likely to be generalisable as immunisation indices for children in public care in the districts surveyed all fell within one standard deviation of the national mean.<sup>4</sup>

We did not examine the reasons for failure to immunise. However, during 2001, 16% of children in public care moved placement more than three times.<sup>4</sup> This instability creates potent risk factors, including missed school based immunisation and discontinuity of primary care. The reversed risk ratio for young children in some districts may reflect greater stability in their placements, primary care organisation of the pre-

school campaign, or targeting of vulnerable children by health visitors.<sup>5</sup>

We suggest two ways forward. Firstly, health services should be made accountable for immunisation uptake as well as social services. Secondly, effective shared information systems between health and social services need to be introduced. Together these measures would better protect our most vulnerable children from disease.

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# Herd immunity from meningococcal serogroup C conjugate vaccination in England: database analysis

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In November 1999, the United Kingdom introduced routine meningococcal serogroup C conjugate vaccination for infants. The vaccine was also offered to everyone aged under 18 years in a phased catch-up programme.<sup>1</sup> The first to be vaccinated were adolescents, and the entire programme was completed by the end of 2000. On the basis of direct protection provided by the vaccine,<sup>1 2</sup> this catch-up programme was likely to be cost effective.<sup>3</sup>

Maiden et al described a 67% reduction (from 0.45% to 0.15%) in the prevalence of nasopharyngeal carriage of serogroup C meningococci in adolescents before and after the vaccination programme.<sup>4</sup> A fall in meningococcal carriage would be expected to reduce exposure among unvaccinated children and therefore to enhance the effectiveness of meningococcal conjugate vaccine. We present rates of disease in vaccinated and unvaccinated children to provide the first evidence of an indirect effect from meningococcal conjugate vaccine.

## Methods and results

Since December 1999 we have investigated the vaccination history of all cases of serogroup C disease confirmed by the meningococcal reference unit of the Public Health Laboratory Service in age groups

targeted for immunisation.<sup>1</sup> We collected data on vaccination coverage from immunisation coordinators and departments of child health in England.<sup>5</sup> Between 1 July 2001 and 30 June 2002, we identified a total of 37 cases in the cohorts targeted for catch-up vaccination, eight (22%) in vaccinated children and 29 (78%) in unvaccinated children. We compared cases in unvaccinated children from each age group in the 2001-2 cohort with those in the same age groups for the period from 1 July 1998 to 30 June 1999. The denominator was mid-1999 population estimates from the Office for National Statistics for the age group, adjusted for the proportion of each cohort vaccinated.

Overall, in the age groups targeted for catch-up vaccination, a reduction of 67% (95% confidence interval 52% to 77%) in the attack rate occurred, with a range of 48% to 80% across the age groups (table). A smaller fall occurred in adults not eligible for vaccination (aged  $\geq 25$  years), for whom the incidence declined by 35% (20% to 49%) from 0.53 (193/36 315 726) to 0.34 (123/36 315 726) per 100 000.

Because of possible underestimation of coverage<sup>5</sup> we recalculated the attack rates, assuming that coverage was 10% higher in adolescents and 5% higher in other children (based on our experience with other vaccines). The resulting overall estimate was of a 52% reduction (95% confidence interval 30% to 77%) in

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Attack rate of confirmed meningococcal serogroup C infection in unvaccinated children before and after the launch of the vaccination campaign

Cohort	July 1998-June 1999				July 2001-June 2002				% reduction (95% CI)*	
	Date of birth	Cases	Population	Attack rate per 100 000 (95% CI)	Date of birth	Cases	Estimated coverage (%)	Estimated population		Attack rate per 100 000 (95% CI)
Adolescent	1 Sep 1978 to 31 Aug 1981	96	1 818 034	5.28 (4.2 to 6.3)	1 Sep 1981 to 31 Aug 1984	11	66	614 110	1.79 (0.7 to 2.8)	66 (37 to 82)
School years 7-10	1 Sep 1981 to 31 Aug 1985	141	2 546 938	5.54 (4.6 to 6.4)	1 Sep 1984 to 31 Aug 1988	4	86	359 118	1.11 (0.02 to 2.2)	80 (46 to 93)
School years 1-6	1 Sep 1985 to 31 Aug 1991	76	3 911 606	1.94 (1.5 to 2.4)	1 Sep 1988 to 31 Aug 1994	5	87	498 068	1.00 (0.1 to 1.9)	48 (-28 to 79)
Preschool	1 Sep 1991 to 31 Dec 1994	81	2 055 120	3.94 (3.1 to 4.8)	1 Sep 1994 to 31 Dec 1997	6	76	501 449	1.20 (0.2 to 2.2)	70 (30 to 87)
Toddlers	1 Jan 1995 to 31 Dec 1995	41	601 045	6.82 (4.7 to 8.9)	1 Jan 1998 to 31 Dec 1998	2	84	97 369	2.05 (-0.7 to 4.9)	70 (-24 to 93)
Infants	1 Jan 1996 to 28 Jul 1996	24	320 562	7.49 (1.5 to 10.5)	1 Jan 1999 to 28 Jul 1999	1	80	64 112	1.56 (-1.5 to 4.6)	79 (-54 to 97)
Overall		459	11 235 305	4.08 (3.7 to 4.5)		29		2 134 226	1.36 (0.86 to 1.85)	67 (52 to 77)

\*95% confidence intervals were estimated by using the Taylor series method for relative risks.

unvaccinated children; this included a 52% reduction (10% to 74%) in adolescents (where coverage was likely to be least accurate).

We estimated vaccine efficacy (the percentage reduction in attack rate in vaccinated compared with unvaccinated children) by using the same data sources and applying methods described previously.<sup>2</sup> From July 2001 to 30 June 2002 the attack rate in vaccinated children was 0.09/100 000 (8/9 119 078) corresponding to an overall vaccine efficacy of 94% (86% to 97%). Using the adjusted coverage we estimated an efficacy of 96% (91% to 98%).

## Comment

These data show that, in addition to direct protection, meningococcal conjugate vaccine contributes to the control of meningococcal infection by indirect protection, by reducing the attack rate in the unvaccinated population by 67%. These observations may be explained by a natural decline in the incidence of serogroup C disease, although this is unlikely. The reduction in the attack rate is consistent with a reduction in serogroup C carriage rates<sup>1</sup> and goes against the trends in serogroup C disease before 2000<sup>1</sup> and in serogroup B disease. As adolescents are the only group in which carriage rates have been studied,<sup>4</sup> these data provide more robust evidence of herd immunity across the whole population. Countries considering introducing meningococcal conjugate vaccine may wish to take account of this indirect protection in the economic evaluation of vaccine policy.

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Ethical approval: The Public Health Laboratory Service has approval under Section 60 of the Health and Social Care Act to process confidential information about patients for the purposes of monitoring the efficacy and safety of vaccination programmes.

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## One hundred years ago

### The war against quackery in Germany

A German Society for the Repression of Quackery has just been founded at Berlin. The first public meeting was held on March 8th, in the large Hall of the Rathhaus. Among the members of the Society are a large number of laymen as well as medical practitioners. The object of the Society is to enlighten the public mind as to the harm done by quackery to the public health, and as to the proper care of the sick. In furtherance of these objects, a regular propaganda is to be instituted. Public meetings will be held and addresses delivered; leaflets will be distributed and other means of educating the man in the street will be adopted. The

Society also proposes to take part in the meetings of quacks, in order to confute their arguments and expose their misstatements. A weekly journal is to be founded, in which all the misdeeds of quacks will be published and brought to the notice of the police authorities. The Society will do its utmost to influence legislation for the repression of quackery and to ensure the enforcement of existing laws. The subscription has been fixed at 1 mark, in order to make the membership of the Society accessible to all who are interested in the promotion of its objects.

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