

**SHORT REPORT**

# Determinants of universal adolescent hepatitis B vaccine uptake

L A Wallace, J C Bramley, S Ahmed, R Duff, S J Hutchinson, W F Carman, N R E Kitchin, D J Goldberg

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The UK is currently considering the introduction of universal hepatitis B vaccination. This study of determinants of vaccine uptake among school based adolescents shows that living in areas of high deprivation, commonly associated with injecting drug risk behaviours, was the most important factor, with statistically significant lower odds of receiving three doses. This was less pronounced for receipt of two doses. Thus, there are implications for future policy; if universal vaccination is approved, a licensed two dose schedule would be most appropriate in this setting.

By May 2003, 151 countries had followed the WHO recommendation that all should have implemented universal infant and/or adolescent hepatitis B virus (HBV) vaccination by 1997.<sup>1</sup> This is an important part of the global effort to eradicate an infection that may cause liver failure and cancer. Currently, the Joint Committee on Vaccination and Immunisation (JCVI) is reviewing the UK's existing policy of offering vaccine to those belonging to high risk categories only. Both the rise in the incidence of HBV infection in high risk groups, particularly evident in recent outbreaks among injecting drug users,<sup>2</sup> and the large increase in prevalence of imported HBV among immigrants and asylum seekers, suggest that greater attention to prevention of infection is required. One option is the introduction of a universal adolescent hepatitis B policy.

In the UK's first major study to determine the acceptability and feasibility of offering HBV vaccine universally, 89% and 80% of 12 year olds in Glasgow received at least two doses and three doses, respectively, within the context of a schools based programme during 2001/2002.<sup>3</sup> This paper reports the findings of an analysis to determine whether certain demographic characteristics, particularly those associated with an increased risk of acquiring HBV, were associated with lower uptake. Such information is crucial in informing the UK's HBV vaccine policy debate.

## METHODS

Vaccination was offered to 10 832 secondary one (S1) pupils in schools within the Greater Glasgow NHS Board area, by the schools health service. Vaccine was delivered using a zero, one, and seven month schedule.

Data on vaccine uptake and demographic characteristics (table 1) were collected from vaccine study consent forms and pupil records held in schools and Local Authority Education Departments. Analyses were performed on both characteristics associated with the pupils themselves and also those related to the schools attended.

Multivariate multi-level logistic regression was performed and the results for the determinants for the uptake of at least two doses and three doses of vaccine are presented in table 1.

## RESULTS

On multivariate multi-level logistic regression analysis, either being male, living in medium to high deprivation areas, attending a special education needs school, or a school with more than 10% of its pupils belonging to non-Caucasian ethnic groups or an absenteeism rate averaging 10% or greater, was significantly associated with a lower uptake rate for the receipt of at least two doses and receipt of three doses of vaccine; neither the gender mix, religious status, nor funding status of the school influenced uptake. The characteristic most strongly associated with uptake was deprivation; pupils living in extremely high (Carstairs categories 6 and 7), compared to those living in low (Carstairs categories 1, 2, or 3), deprivation areas had much reduced odds of receiving at least two doses (OR 0.56; 95% CI 0.45 to 0.68) and three doses (OR 0.47; 95% CI 0.40 to 0.55).

## DISCUSSION

This study has shown that uptake rates, for at least two doses of hepatitis B vaccine, approached or even exceeded 90%, regardless of pupil or school characteristic, in a city with considerable social, religious, and ethnic diversity. Various factors had a statistically significant bearing on uptake; the only one of any major public health significance, however, was deprivation in the context of adolescents, resident in extremely deprived areas (Carstairs categories 6 and 7), receiving three doses (74.3%) but not at least two doses (86.6%). Reduced uptake rates were also noted in those of lower socioeconomic status in an adolescent schools' HBV vaccine programme in the USA.<sup>5</sup> It was not possible to ascertain if the reason(s) for the 12% difference in the uptake rates related to the interval between the provision of doses 2 and 3 (4–6 months), the actual number of doses, or a combination of the two. Since 95% of those who received at least two doses of vaccine were administered their second dose one or two months after their first, we are unable to predict what the uptake rate might have been if the forthcoming two-dose (0, 4–6 month) schedule<sup>6</sup> had been employed. However, as there would be ongoing opportunities for young persons enrolled in a routine, as opposed to a one year, schools based programme to complete their course, it is anticipated that the completion rate for such a schedule would be higher than that observed for the standard three-dose one (0, 1, and 6 months), but possibly lower than that which might be achieved using a compressed 0, 1, and 2 month schedule.

Injecting drug use is the principal risk factor for acute HBV infection in the UK, and the great majority of injectors live in areas of high deprivation; the current selective policy, however, has consistently failed to achieve vaccine uptake rates greater than 30–40% among this population,<sup>7</sup> although recent experience of vaccinating prisoners in Scotland suggests that such rates might be increased to the 50–60% level (S Hutchinson, SCIEH, personal communication).

**Table 1** Multivariate multi-level logistic regression analyses of pupil and school characteristics for the uptake of at least two doses and three doses of hepatitis B vaccine

	Total no. of pupils		Uptake of at least 2 doses		Uptake of 3 doses	
	N1 (%)	N2 (% of N1)	Odds ratio (95% CI)	N3 (% of N1)	Odds ratio (95% CI)	
<b>Pupil characteristics</b>						
Gender						
Male	5491 (50.7)	4804 (87.5)	1.00 baseline	4301 (78.3)	1.00 baseline	
Female	5341 (49.3)	4863 (91.0)	<b>1.46 (1.28 to 1.66)</b>	4378 (82.0)	<b>1.25 (1.13 to 1.38)</b>	
Deprivation category*						
Low (Carstairs 1–3)	3184 (29.4)	2973 (93.4)	1.00 baseline	2830 (88.9)	1.00 baseline	
Medium (Carstairs 4–5)	2290 (21.1)	2064 (90.1)	<b>0.74 (0.59 to 0.92)</b>	1873 (81.8)	<b>0.68 (0.56 to 0.81)</b>	
High (Carstairs 6–7)	5348 (49.4)	4630 (86.6)	<b>0.56 (0.45 to 0.68)</b>	3976 (74.3)	<b>0.47 (0.40 to 0.55)</b>	
Unknown	10 (0.09)					
<b>School characteristics</b>						
School type						
State	9931 (91.7)	8860 (89.2)	1.00 baseline	7922 (79.8)	1.00 baseline	
Independent	696 (6.4)	645 (92.7)	1.06 (0.67 to 1.70)	621 (89.2)	1.15 (0.79 to 1.68)	
Special education needs	205 (1.9)	162 (79.0)	<b>0.55 (0.36 to 0.85)</b>	136 (66.3)	<b>0.57 (0.40 to 0.82)</b>	
Mixed	10602 (97.9)	9460 (89.2)	1.00 baseline	8483 (80.0)	1.00 baseline	
Single sex	230 (2.1)	207 (90.0)	1.02 (0.55 to 1.88)	196 (85.2)	1.30 (0.77 to 2.20)	
Non-denomination						
Roman Catholic	7302 (67.4)	6559 (89.8)	1.00 baseline	5921 (81.1)	1.00 baseline	
	3530 (32.6)	3108 (88.0)	0.83 (0.68 to 1.02)	2758 (78.1)	0.89 (0.75 to 1.05)	
Ethnicity†						
95–100%	1775 (16.4)	1591 (89.6)	1.00 baseline	1411 (79.5)	1.00 baseline	
90–94.9%	3821 (35.3)	3482 (91.1)	0.87 (0.65 to 1.17)	3169 (82.9)	0.94 (0.74 to 1.20)	
85–89.9%	2778 (25.6)	2452 (88.3)	<b>0.72 (0.54 to 0.95)</b>	2192 (78.9)	<b>0.79 (0.62 to 0.99)</b>	
80–84.9%	1025 (9.5)	911 (88.9)	<b>0.66 (0.45 to 0.96)</b>	832 (81.2)	0.81 (0.59 to 1.12)	
60–79.9%	1433 (13.2)	1231 (85.9)	<b>0.62 (0.44 to 0.86)</b>	1075 (75.0)	<b>0.71 (0.54 to 0.95)</b>	
Absenteeism‡						
1.6–9.9%	6659 (61.5)	6045 (90.8)	1.00 baseline	5554 (83.4)	1.00 baseline	
10–17.05%	3981 (36.8)	3451 (86.7)	<b>0.77 (0.63 to 0.95)</b>	2957 (74.3)	<b>0.72 (0.61 to 0.86)</b>	
Unknown	192 (1.8)					

\*A deprivation category for each pupil was derived from the Carstairs score, based on an individual's postcode sector of residence.

The deprivation scores were based on the 1991 census.<sup>4</sup>

†Ethnicity was assigned to each pupil as the percentage of their school's secondary one population that was Caucasian (e.g. 1433 pupils attended schools where 60–79.9% of the pupils in the class were Caucasian).

‡Absenteeism was assigned to each pupil as the average percentage of secondary one pupils absent from their school on any school day during the academic year 2001/2002.

Accordingly, the observed association between deprivation and uptake is important; it suggests that if the JCVI recommends the universal adolescent approach for either national or regional implementation in the UK, a two-dose regimen, now available and recommended in the USA, and expected to be available soon in Europe, would likely achieve highly satisfactory uptake rates—far in excess of those achieved through the current selective approach—among all populations including those vulnerable to injecting drug use. The implementation of such a policy would not preclude the adoption of universal infant immunisation against hepatitis B—an approach which would protect both children and, at least 15 years later, people who engage in high risk behaviours.

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