THE AUTHORS REPLY

We thank Lennon et al. for their interest (1) in our study (2). They question the reliability of our estimate of vaccine effectiveness on the basis of three observations: 1) Vaccine uptake may vary across ethnicity and household crowding or other factors; 2) disease confirmation rates may have differed across the time period studied; and 3) the estimated disease rates in children less than 1 year of age are lower than those expected based on other evidence. The first two observations are valid but may not have a significant effect on our estimate of vaccine effectiveness, as discussed below. The third observation is not correct but is based on our figure 1 that shows the disease rates in one stratum only. Overall, our estimates show decreasing risk as age increases, as expected.

As acknowledged by Lennon et al. (1), ethnicity was included in our model. Therefore, any variation in vaccine uptake among different ethnic groups is likely to have been taken into account. Contrary to their letter (1), household crowding was also included in our model as a component of the (area-based) New Zealand index of socioeconomic deprivation. Notably, our sensitivity analyses show that varying vaccination uptake across deprivation levels has little effect on the vaccine effectiveness estimate. It is possible that other, unmeasured, covariates may be associated with vaccine uptake, and there is always potential for an observational study based on routine data such as ours to be affected by them. Nevertheless, we have incorporated all available covariates into our analysis and found a significant vaccine effect with an estimate robust to variations in our assumptions, as shown in our sensitivity analysis. Under the circumstances of the vaccination program, a case-control study would be a more appropriate design to investigate the impact of household overcrowding and other individual-level factors.

Regarding the changing rates of laboratory confirmation of disease over time, in our model the confirmation rate is confounded with the underlying epidemic rate. However, this does not bias the estimate of vaccination effectiveness as long as the confirmation rate at any given time is independent of vaccination status. We note that the numeric values quoted by Lennon et al. (1) of confirmation rates ranging from 50 percent to 100 percent relate to a single District Health Board. National values are much less variable and range from 72 percent confirmed in 2003 to 91 percent in 2006. Moreover, the estimate of vaccine effectiveness is most strongly determined by the data in the 2-year period from July 2004 to June 2006 in which vaccinated and unvaccinated populations coexisted, when confirmation rates were consistently high (81.7 percent for 2004–2005 and 84.9 percent for 2005–2006).

We recognize that the published figure 1 (2) and the accompanying discussion may have given a misleading impression about the age-specific rates. Figure 1 shows meningococcal disease rates by age and ethnicity for the reference group (i.e., the least deprived group in the southern region). When averaged over all deprivation groups and regions and incorporating the deprivation-by-age interaction effect, our model does indeed show rates that are highest in the youngest age group (refer to figure 1 herein), with a significant decrease in rates with increasing age.

Because of insufficient statistical power, our study was not able to address the specific issue of whether the risk ratio for infants aged under 1 year differed from the risk ratios of other age groups. Similarly, because of insufficient follow-up time...
to date, our study was not able to address the issue of whether vaccine effectiveness changes over time. We have not attempted to draw conclusions on these matters, although we raise them as suitable topics for further investigation.

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REFERENCES


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