Letters

COMMENT & RESPONSE

In Reply We agree with Snelling and McIntyre that our model, like all models, relies on several assumptions. However, we believe the explicit underlying assumption that an initial dose of the whole-cell pertussis (wP) vaccine followed by the standard course of acellular pertussis vaccination blocks asymptomatic infection is supported by rigorous clinical evidence (studies by Liko et al,[1] Witt et al,[2] and Sheridan et al,[3] as cited in our original study).[4]

They cite Préziosi et al[5] to argue that 1 dose of wP is not likely to protect against asymptomatic infection because 1 dose did not significantly reduce the secondary attack rate of symptomatically infected individuals.[5] The study showed that infected individuals who had previously been vaccinated with a single dose of wP transmitted pertussis at the same rate as those who had not been vaccinated. Our model agrees with these findings: symptomatically and asymptomatically infected individuals transmit disease with the same force of infection. In our model, the only difference between acellular pertussis vaccine and wP is that the acellular vaccine allows for asymptomatic infection and wP reduces it.[4] Because the Préziosi study only examined the effects of vaccination on transmission once infected and not the ability of wP to block infection, it provides little guidance on the ability of the wP to prevent asymptomatic infection.

Additionally, the Préziosi study was conducted in Senegal in 1993, which had drastically different contact rates, population demographics, and vaccination schedules than the United States, where our study was focused. Our model was built to simulate pertussis transmission in the United States and fit to recent Centers for Disease Control and Prevention data, providing a realistic environment to test the novel vaccination strategy.

As for interaction of the diphtheria, tetanus, and whole-cell pertussis (DTP) vaccine with maternal antibodies, Englund et al[6] do find a negative effect of DTP when there are high levels of maternal pertussis antibodies.[6] However, the effect was measured as a reduction in pertactin antibodies in the infant, which is known to be a poor measure of protection against infection. We take the reasoning by Snelling and McIntyre that a single dose of DTP and nothing further is ineffective at preventing cases and that maternal antibodies interfere with DTP as not addressing our study, which was inspired by several cohort studies of children receiving 1 dose of DTP and then finishing the rest of the schedule with DTaP. These 3 studies (Liko et al,[1] Witt et al,[2] and Sheridan et al[3]) found that individuals vaccinated with the mixed-dose schedule had less than half the incidence of whooping cough than those vaccinated with only acellular pertussis vaccine (as cited in our original study).[4]

Finally, the goal of our model was to motivate further study for a better vaccine regimen against pertussis. As we stated, "rigorous clinical trial for safety and efficacy would be needed before recommendations could be made to support a change in the vaccine schedule."[4] We did not evaluate and consequently do not underestimate either the cost or the operational difficulty of introducing a whole-cell vaccine. We encourage an explicit consideration of potential obstacles weighed against the potential medical benefits and economic savings suggested in our study.

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Published Online: October 31, 2016. doi:10.1001/jamapediatrics.2016.2819

Conflict of Interest Disclosures: Drs Scarpino and Althouse have served as consultants to ILiAD Biotechnologies, which is developing a new Bordetella pertussis vaccine.

Additional Contributions: We thank Meagan Fitzpatrick, PhD, Yale University, and Alison Galvani, PhD, Yale University, for helpful comments on the letter. No compensation was received for their contributions.

1. Liko J, Robison SG, Cieslak PR. Priming with whole-cell versus acellular pertussis vaccine. *N Engl J Med*. 2013;368(6):581-582.

2. Witt MA, Arias L, Katz PH, Truong ET, Witt DJ. Reduced risk of pertussis among persons ever vaccinated with whole cell pertussis vaccine compared to recipients of acellular pertussis vaccines in a large US cohort. *Clin Infect Dis*. 2013;56(9):1248-1254.

3. Sheridan SL, Ware RS, Grimwood K, Lambert SB. Number and order of whole cell pertussis vaccines in infancy and disease protection. *JAMA*. 2012;308(5):454-456.

4. DeAngelis H, Scarpino SV, Fitzpatrick MC, Galvani AP, Althouse BM. Epidemiological and economic effects of priming with the whole-cell bordetella pertussis vaccine. *JAMA Pediatr*. 2016;170(5):459-465.

5. Préziosi M-P, Halloran ME. Effects of pertussis vaccination on transmission: vaccine efficacy for infectiousness. *Vaccine*. 2003;21(17-18):1853-1861.

6. Englund JA, Anderson EL, Reed GF, et al. The effect of maternal antibody on the serologic response and the incidence of adverse reactions after primary immunization with acellular and whole-cell pertussis vaccines combined with diphtheria and tetanus toxoids. *Pediatrics*. 1995;96(3 Pt 2):580-584.