A. Supporting Information

A.1. Source-Specific Probabilities of Infection

To estimate source-specific VE, we define λ_{iH} and λ_{iC} as the probability that person i is infected from a household (H) or community (C) contact during the study, respectively. The source-specific probabilities of infection during the study can be written in terms of the daily probabilities of infection. The source-specific probabilities of being infected on day d are:

$$\begin{aligned}
\mathbb{P}(\text{Infected from the household on day } d) &= \left[1 - (1 - \beta_v)^{m_{id}}\right](1 - \gamma_v \cdot p(d)) \cdot \psi_{i0(d-1)} \\
\mathbb{P}(\text{Infected from the community on day } d) &= (1 - \beta_v)^{m_{id}} \gamma_v \cdot p(d) \cdot \psi_{i0(d-1)}
\end{aligned}$$

The probabilities of being infected during the study can be expressed as the sum of the daily probabilities of infection,

$$\begin{aligned}
\lambda_{iH} &= \sum_{d=1}^{D}\left\{\left[1 - (1 - \beta_v)^{m_{id}}\right](1 - \gamma_v \cdot p(d)) \cdot \psi_{i0(d-1)}\right\} \\
\lambda_{iC} &= \sum_{d=1}^{D}\left\{(1 - \beta_v)^{m_{id}} \gamma_v \cdot p(d) \cdot \psi_{i0(d-1)}\right\}
\end{aligned}$$

When estimating the VEs we ignore the possibility of co-infection and assume that a person can only be infected once during the study.

A.2. Model Adequacy

Table A1. Frequencies of cases per household size from 200 simulated influenza outbreaks using the Michigan Study data as input

HH Size / # of cases	0	1	2	3	4	5	6
4	124.70	30.87	8.36	1.83	0.25	0	0
5	71.07	19.86	6.09	1.57	0.38	0.04	0
6	25.60	7.73	2.61	0.83	0.21	0.04	0
7	8.63	2.59	1.09	0.48	0.19	0.05	0.01
8	2.45	0.96	0.38	0.15	0.05	0.02	0
9	0	0	0	0	0	0	0
10	1.04	0.37	0.25	0.14	0.12	0.07	0.02

Using the estimated transmission parameters from the data analysis as input for our simulation program, we obtained mean number of cases per household size from 200 influenza outbreak simulations.

Statist. Med. **2017**, 00 **??**–1
Prepared using simauth.cls

Copyright © 2017 John Wiley & Sons, Ltd.

www.sim.org   1

Table A2. Observed frequencies of cases per household size from the Michigan Study

# of cases HH Size	0	1	2	3	4	5	6
4	129	26	8	2	1	0	0
5	77	17	3	2	0	0	0
6	25	8	1	1	2	0	0
7	9	3	0	0	0	1	0
8	3	1	0	0	0	0	0
9	0	0	0	0	0	0	0
10	2	0	0	0	0	0	0

Prepared using *simauth.cls*