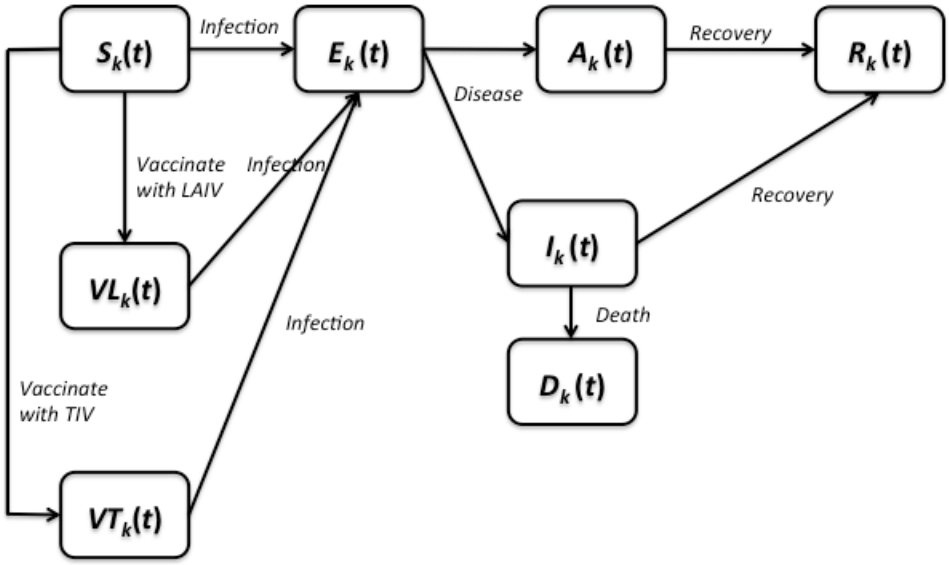
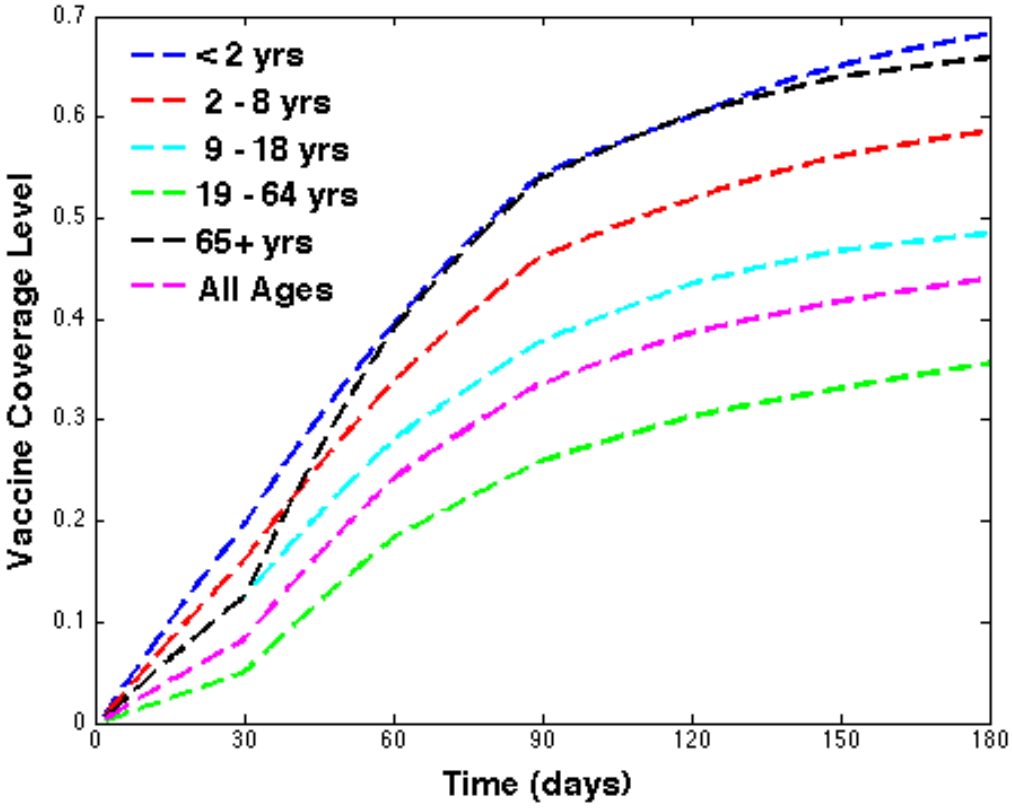
Appendix Figure 1. The model diagram. Population are divided into influenza-related age-dependent epidemiological classes: susceptible (S_k); vaccinated with LAIV (VL_k); vaccinated with IIV (VT_k); latently infected (E_k); asymptomatically or symptomatically infected (A_k or I_k); recovered (R_k) and dead due to influenza illness (D_k). The subscript k indicates these age groups (k = 1,…, 6). The age groups used for our model were 0-6 months, 6 months-2 yr, 2-8 yr, 8-19 yr, 20-64 yr, and ≥ 65 yr.



Appendix Figure2. Age-specific cumulative vaccine coverage levels in the 2012-2013 influenza season in the U.S. We assume that all age groups are vaccinated according to the average monthly influenza vaccination likelihood observed in the 2012-2013 influenza season in the U.S.



Parameterization of σ_k and ω_k Using the Attack Rates (Cumulative Incidence) in the Unvaccinated and Vaccinated Groups

Shim et al. derived the expression for Ω_{A0} and Ω_{A1} based on the attack rates calculated from a mathematical model of disease transmission where Ω_{A0} and Ω_{A1} represent the attack rates (cumulative incidence) in the unvaccinated and vaccinated groups, respectively.[21] Specifically, Ω_{A0} and Ω_{A1} are expressed in the following implicit equations using the vaccine coverage (f), the average length of infected period (τ), transmission rate (β) and the reduction in relative risk of infection among the vaccinated compared to the unvaccinated (σ):

$$\Omega_{A0} = 1 - \exp[-\beta\{\tau(1-f)\Omega_{A0} + \tau f \Omega_{A1}\}],$$
$$\Omega_{A1} = 1 - \exp[-\beta(1-\sigma)\{\tau(1-f)\Omega_{A0} + \tau f \Omega_{A1}\}].$$

In addition, the vaccine effectiveness is defined as

$$VE = 1 - \frac{\Omega_{A1}(1-\Omega_{A0})}{\Omega_{A0}(1-\Omega_{A1})}.$$

Using the equations above, we estimated σ based on the vaccine effectiveness of our choice and the baseline parameter values of our model. For instance, when the vaccine coverage is 47% (f=0.47), consistent with the observations, σ=0.13 and σ=0.18 give the vaccine effectiveness of 15% and 20%, respectively.