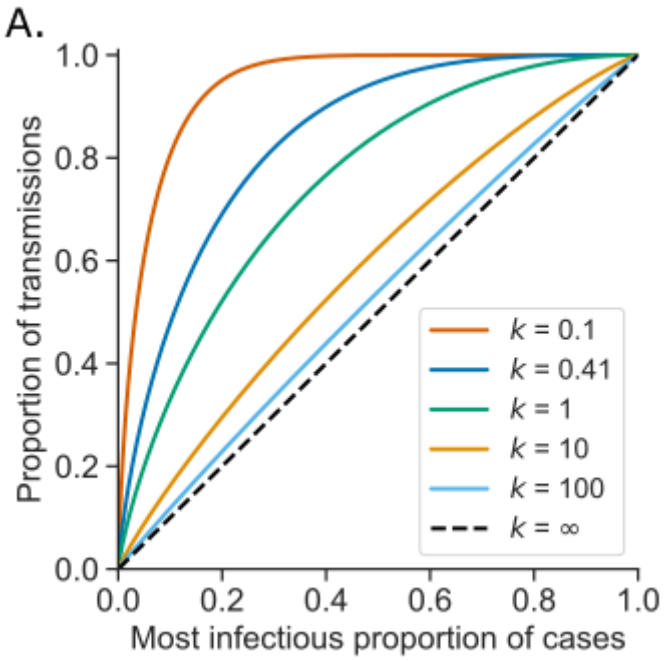
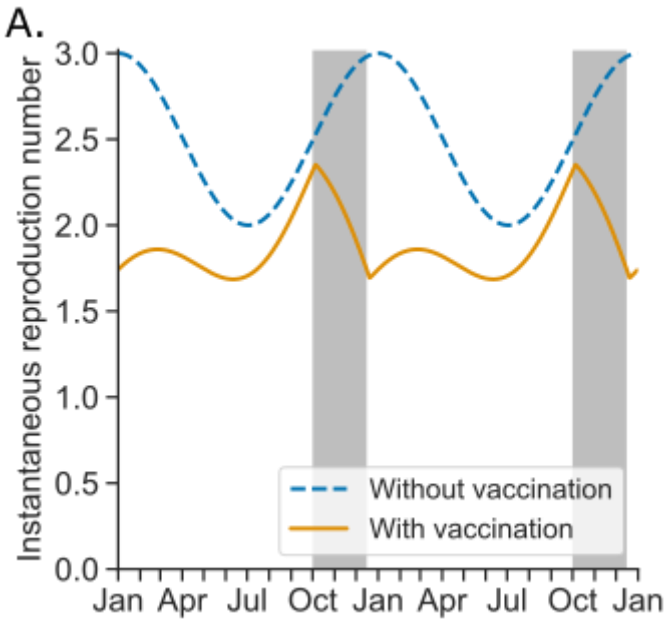
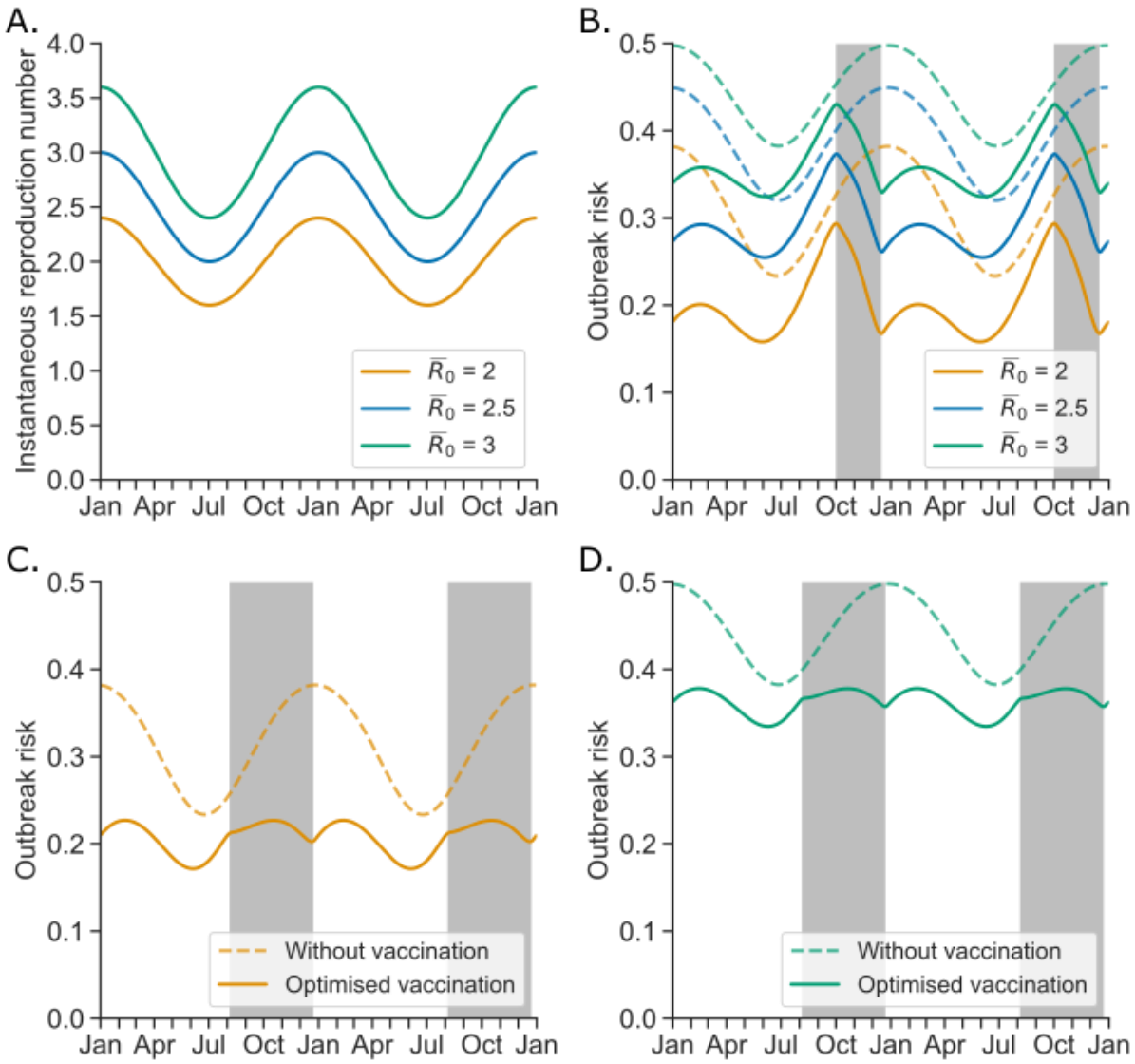
Extended Data Figures



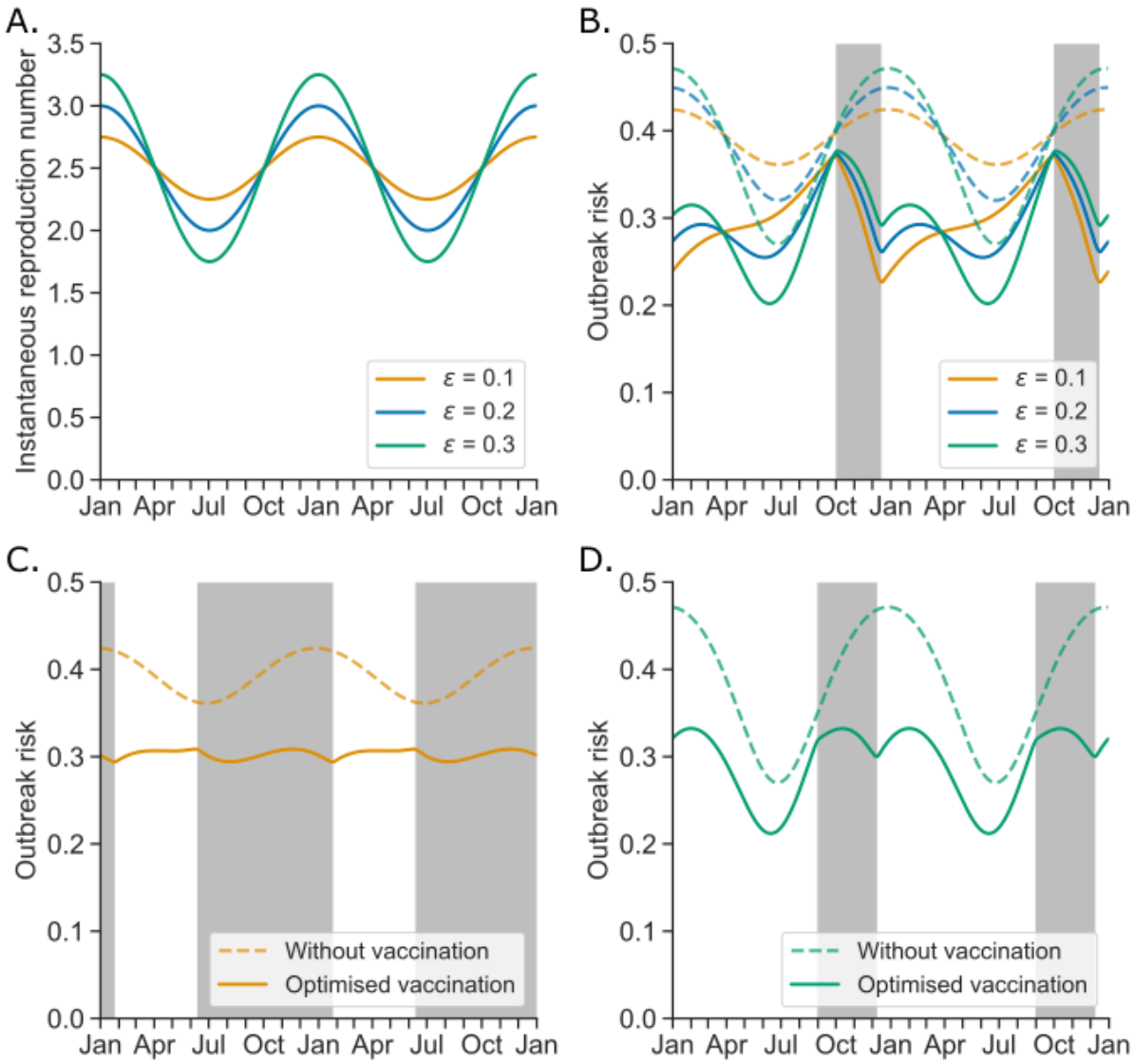
Extended Data Figure 1. Heterogeneity in transmission between individuals. For each specified proportion of infected individuals, ordered from the most to the least infectious (based on an assigned individual infectiousness factor – see Figure 1B), the proportion of expected total transmissions generated by those individuals is plotted for a range of values of the dispersion parameter, k (the shape parameter of the gamma distribution of infectiousness factors). A greater extent of heterogeneity (i.e., degree of superspreading) is seen for smaller values of k, since a larger proportion of transmissions are then generated by a given (ordered) proportion of infected individuals. For details of the calculation underlying this figure, see (1).



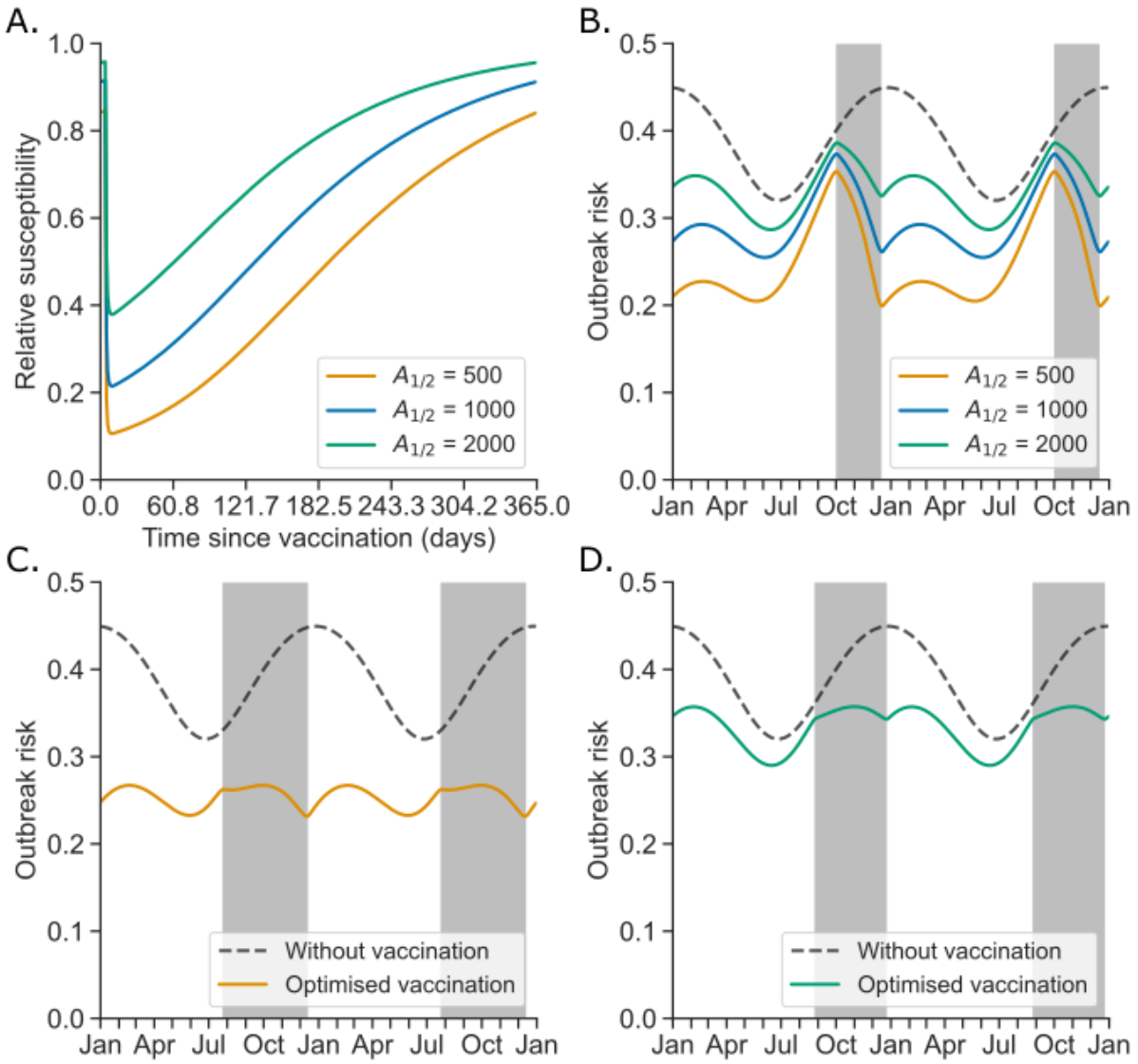
Extended Data Figure 2. Reproduction number under booster vaccination. The instantaneous reproduction number, R_t, both without booster vaccination ($R_t = R_{0,t}$), and when booster vaccination takes place ($R_t = \eta_t R_{0,t}$), is shown under the default model inputs considered in Figure 2.



Extended Data Figure 3. Sensitivity of results to the annual mean reproduction number in the absence of booster vaccination, $\overline{R_0}$. A. Instantaneous reproduction number for values of $\overline{R_0} = 2, 2.5$ (our default assumed value) and 3. B. Outbreak risk without booster vaccination (dashed curve) and under the default assumed timing of booster vaccine distribution (solid curves) for the three values of $\overline{R_0}$. C-D. Outbreak risk without booster vaccination and with optimised booster vaccine distribution timing (the optimal time period each year is shown in the grey shaded regions) for $\overline{R_0} = 2$ (C) and $\overline{R_0} = 3$ (D).



Extended Data Figure 4. Sensitivity of results to the extent of seasonality of transmission in the absence of booster vaccination, ε. The value of ε gives the proportion by which the annual maximum and minimum instantaneous reproduction number each differ from the annual mean value (see equation 11 in the main text). A. Instantaneous reproduction number for values of $\varepsilon = 0.1, 0.2$ (our default assumed value) and 0.3. B. Outbreak risk without booster vaccination (dashed curve) and under the default assumed timing of booster vaccine distribution (solid curves) for the three values of ε. C-D. Outbreak risk without booster vaccination and with optimised booster vaccine distribution timing (the optimal time period each year is shown in the grey shaded regions) for $\varepsilon = 0.1$ (C) and $\varepsilon = 0.3$ (D).



Extended Data Figure 5. Sensitivity of results to the extent of vaccine protection. The extent of vaccine protection is characterised by the parameter $A_{1/2}$, which gives the antibody titre at which 50% protection against infection is conferred (see equation 9 in the main text), so that a higher value of $A_{1/2}$ corresponds to a smaller extent of vaccine protection (i.e., higher susceptibility to infection). A. Average relative susceptibility to infection as a function of time since (most recent) vaccination for $A_{1/2} = 500$, 1,000 (our default assumed value) and 2,000 AU/mL. B. Outbreak risk without booster vaccination (dashed curve) and under the default assumed timing of booster vaccine distribution (solid curves) for the three values of $A_{1/2}$. C-D. Outbreak risk without booster vaccination and with optimised booster vaccine distribution timing (the optimal time period each year is shown in the grey shaded regions) for $A_{1/2} = 500$ (C) and $A_{1/2} = 2{,}000$ (D).