

Supplementary Material for Chapter 3

Callum R.K. Arnold^{1,2,*}, Nita Bharti^{1,2}, Cara Exten³, Meg Small^{4,5}, Sreenidhi Srinivasan^{2,6}, Suresh V. Kuchipudi^{2,7}, Vivek Kapur^{2,6,8}, Matthew J. Ferrari^{1,2}

¹ Department of Biology, Pennsylvania State University, University Park, PA, USA 16802

² Center for Infectious Disease Dynamics, Pennsylvania State University, University Park, PA, USA 16802

³ Ross & Carole Nese College of Nursing, Pennsylvania State University, University Park, PA, USA 16802

⁴ College of Health and Human Development, Pennsylvania State University, University Park, PA, USA 16802

⁵ Social Science Research Institute, Pennsylvania State University, University Park, PA, USA 16802

⁶ Huck Institutes of the Life Sciences, Pennsylvania State University, University Park, PA, USA 16802

⁷ Department of Veterinary and Biomedical Sciences, Pennsylvania State University, University Park, PA, USA 16802

⁸ Department of Animal Science, Pennsylvania State University, University Park, PA, USA 16802

* Corresponding author. Callum R.K. Arnold. Address: Department of Biology, Pennsylvania State University, University Park, PA, USA 16802. Email: contact@callumarnold.com.

LCA Model Fitting

Measure Intention to Always:	Low Adherence	Low- Medium Adherence	Medium- High Adherence	High Adherence
Wash my hands often with soap and water for at least 20 seconds.	0.04	0.38	0.93	0.95
Wear a face cover (mask) in public	0.11	0.88	0.88	0.99
Avoid face-touching with unwashed hands	0.00	0.00	0.62	0.85
Cover cough and sneeze	0.22	0.77	1.00	1.00
Stay home when ill	0.06	0.82	0.85	0.99
Seek medical attention when have symptoms and call in advance	0.02	0.68	0.75	0.98
Stay at least 6 feet (about 2 arms lengths) from other people when outside of my home.	0.00	0.22	0.10	0.92
Stay out of crowded places and avoid mass gatherings > 25 people	0.02	0.46	0.23	0.92
Tested for COVID-19 twice or more	0.76	0.81	0.84	0.81
Group Size	13.82%	30.91%	16.49%	38.78%
Seroprevalence	35.50%	31.20%	36.00%	25.70%

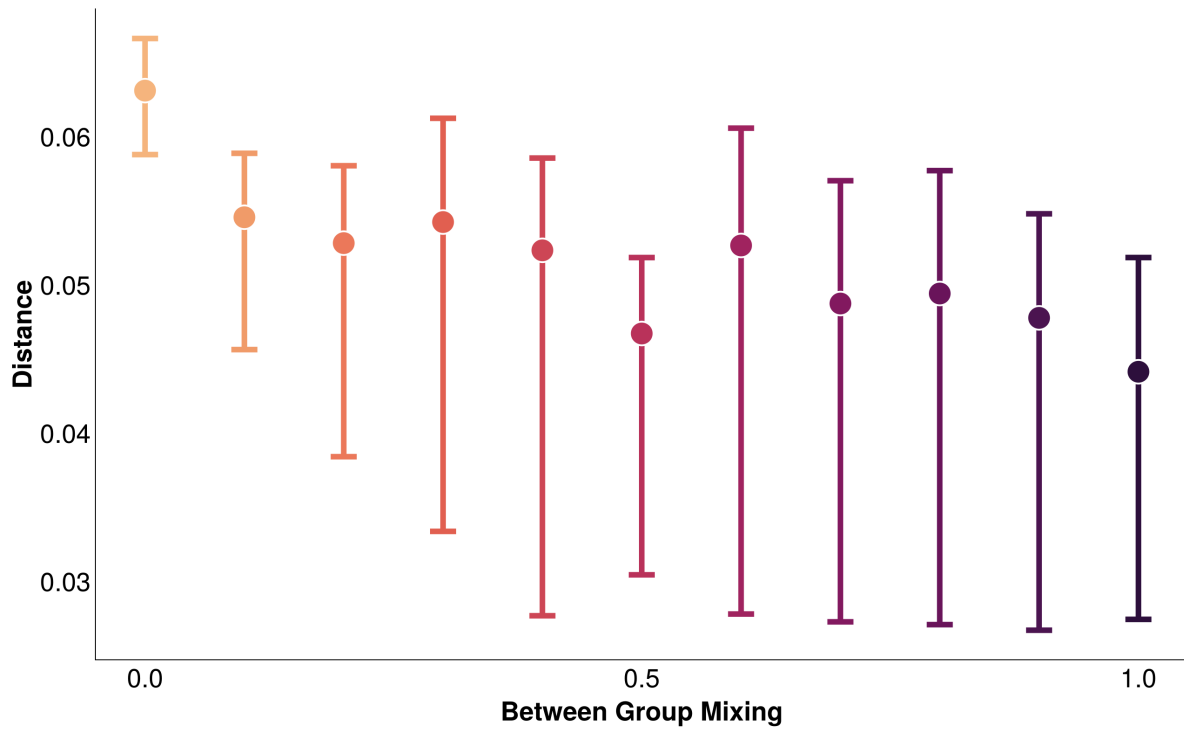
Supplemental Table 1: Class-conditional item response probabilities shown in the main body of the table for a four-class LCA model, with footers indicating the size of the respective classes, and the class-specific seroprevalence

Matrix Structure Sensitivity Analysis

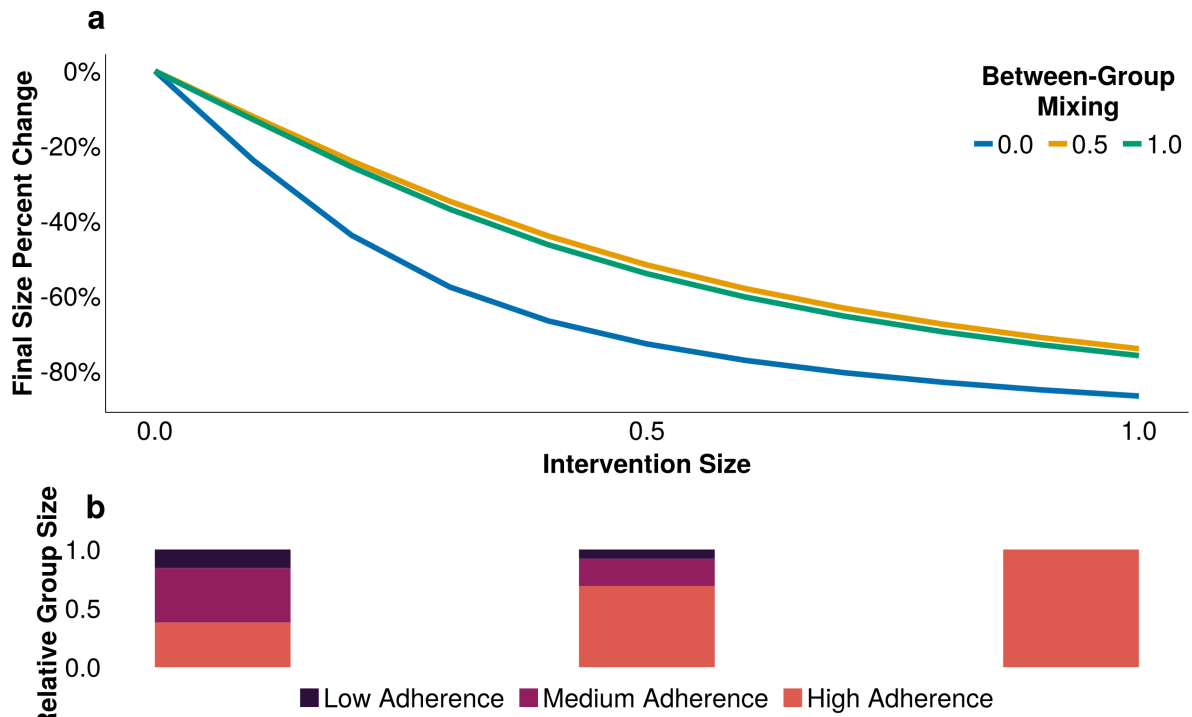
In the main body of the text, we present the results for the three-class model that corresponds to a scenario where public health measures (PHMs) reduce onwards risk of transmission (Supplemental Eq 1A), rather than conferring protection for the practitioner (Supplemental Eq 1B). Another alternative uses a single scaled value of β_{LL} , representing all between-group interactions experiencing the same risk of transmission that is a fraction of the transmission observed between Low Adherence individuals (Supplemental Eq 1C).

$$\begin{aligned}
 \rho \begin{pmatrix} \beta_{HH} & \beta_{HM} & \beta_{HL} \\ \beta_{MH} & \beta_{HM} & \beta_{ML} \\ \beta_{LH} & \beta_{HM} & \beta_{LL} \end{pmatrix} &\rightarrow \rho \begin{pmatrix} \beta_{HH} & \phi\beta_{MM} & \phi\beta_{LL} \\ \phi\beta_{HH} & \beta_{MM} & \phi\beta_{LL} \\ \phi\beta_{HH} & \phi\beta_{MM} & \beta_{LL} \end{pmatrix} \text{ mixing structure } \mathbf{A} \\
 &\rightarrow \rho \begin{pmatrix} \beta_{HH} & \phi\beta_{HH} & \phi\beta_{HH} \\ \phi\beta_{MM} & \beta_{MM} & \beta_{MM} \\ \phi\beta_{LL} & \phi\beta_{LL} & \beta_{LL} \end{pmatrix} \text{ mixing structure } \mathbf{B} \\
 &\rightarrow \rho \begin{pmatrix} \beta_{HH} & \phi\beta_{LL} & \phi\beta_{LL} \\ \phi\beta_{LL} & \beta_{MM} & \phi\beta_{LL} \\ \phi\beta_{LL} & \phi\beta_{LL} & \beta_{LL} \end{pmatrix} \text{ mixing structure } \mathbf{C}
 \end{aligned}
 \tag{1}$$

Below are results for alternative scenarios, which show qualitatively similar results to the main body of the text, albeit with a wider distribution in the Approximate Bayesian Computation distance metrics.

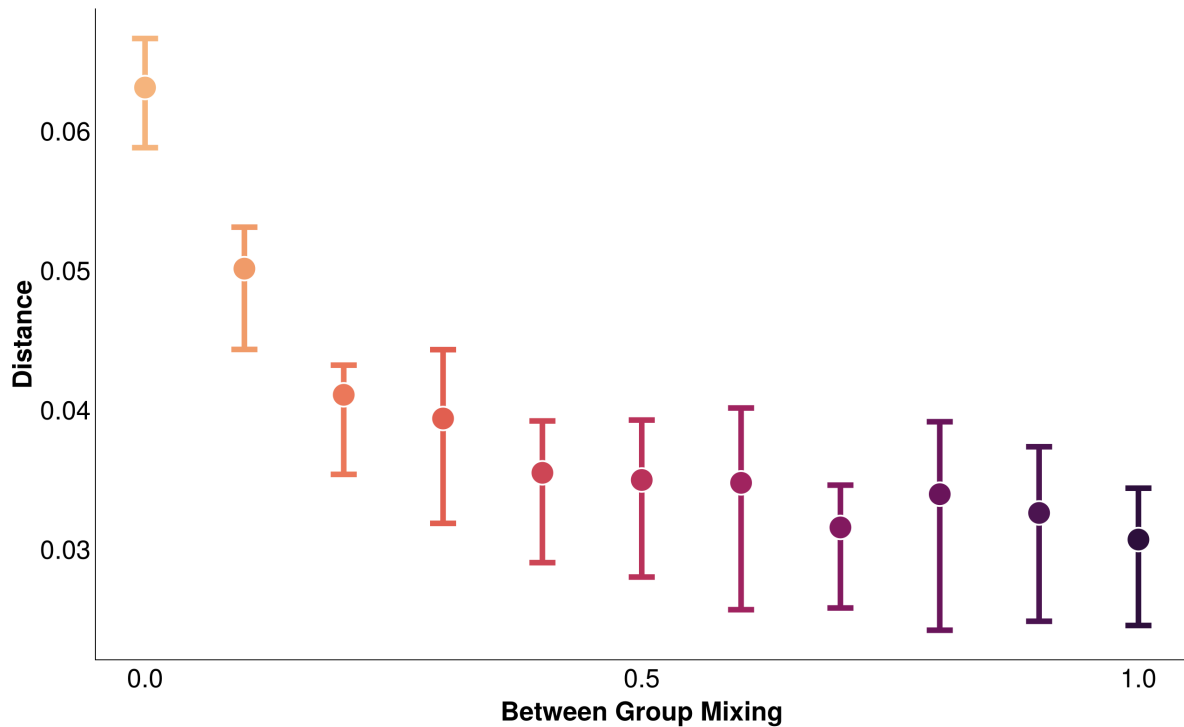
Eq 1B (PHMs Confer Protection)

Supplemental Figure 1: PHMs confer protection to the practitioner. Distribution of the distance from the ABC fits, with the minimum and maximum distances illustrated by the whiskers, and the median distance by the point. Between-group mixing of 1.0 equates to between-group mixing as likely as within-group mixing

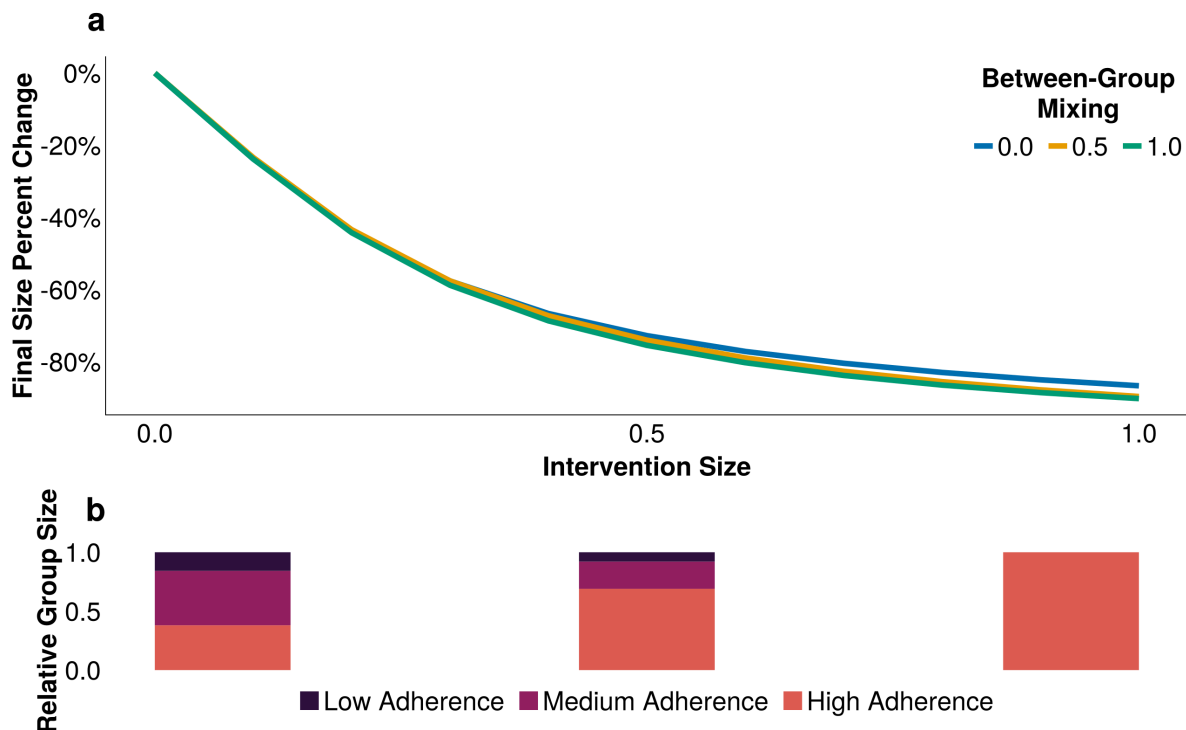


Supplemental Figure 2: PHMs confer protection to the practitioner. A) The reduction in final infection size across a range of intervention effectiveness (1.0 is a fully effective intervention), accounting for a range of assortativity. Between-group mixing of 1.0 equates to between-group mixing as likely as within-group mixing; B) The relative distribution of group sizes at three levels of intervention effectiveness (0.0, 0.5, 1.0)

Eq 1C (Identical Off-Diagonal Values)



Supplemental Figure 3: Identical off-diagonal values. Distribution of the distance from the ABC fits, with the minimum and maximum distances illustrated by the whiskers, and the median distance by the point. Between-group mixing of 1.0 equates to between-group mixing as likely as within-group mixing



Supplemental Figure 4: Identical off-diagonal values. A) The reduction in final infection size across a range of intervention effectiveness (1.0 is a fully effective intervention), accounting for a range of assortativity. Between-group mixing of 1.0 equates to between-group mixing as likely as within-group mixing; B) The relative distribution of group sizes at three levels of intervention effectiveness (0.0, 0.5, 1.0),