Homebound by COVID19: The Benefits and Consequences of Non-Pharmaceutical Intervention Strategies Supplementary Material

Section A: Modeling Peer-to-Peer Interactions

In Georgia there are 1,336,490 children, 1,418,910 youths, 6,685,870 adults, and 1,356,730 elderly [1]. For computational efficiency, we assumed an agent consists of 10 individuals of the same age, hence the simulated population is about 1/10th of the population in the state, following the same age distribution.

Children (ages 0-9) and youth (ages 10-19) were considered homebound under any combination of the following settings: symptomatic, complying with voluntary quarantine, or school closure. *Compliance with voluntary quarantine* is defined as all household members staying home if there is a person with cold/flu like symptoms in the household, until the entire household is symptom-free. Adults (ages 20-64) and elderly (ages 65+) were considered homebound under any combination of the following settings: at home childcare, symptomatic, complying with voluntary quarantine, or shelter-in-place. *At home childcare* is defined as providing supervision to a child who is home due to their status. *Table B1* provides a list of statuses considered for each age group.

In the simulation scenarios, this study accounted for the following recommendations from the Georgia Division of Family and Children Services[2]: children ages 0-8 require at-home supervision or childcare, children ages 9-12 require partial at-home supervision, and children ages 13-19 do not require at-home supervision and can provide childcare to the younger child population.

A child needed supervision if school was closed, they were complying with voluntary quarantine, or they were symptomatic. Note that several of these situations could occur at the same time, e.g., a child was symptomatic and school was closed. Since supervision was the only care considered, a child was assumed to be supervised if a youth, adult, or elderly family member already had homebound status for other reasons (e.g., symptomatic, voluntary quarantine, shelter-in-place). That is, if at least one caregiver of the appropriate age (youth, adult, or elderly family member) was homebound in any of the capacities listed above, then no more supervision was needed at home. In the remainder of the supplementary material, reference to "at

home childcare" or "care" means that the child received at home supervision. Based on availability, it was assumed that youth were the first to provide care, then elderly, and lastly adults, considering adult participation in the workforce. However, if an adult or elderly was already homebound for other reasons and care was needed, the adult was designated as providing care, then elderly, and lastly youth.

Similarly, for any hospitalized minor (person between the ages of 0 and 19), it was assumed that an adult or elderly family member would provide supervision (referred to as hospital care).

Section B: Supplemental Figures, Tables, and Results

Below are supplementary tables, figures, and results that aid in the discussion in the main text. Definitions for homebound and inactive statuses are provided in the Modeling Case Projections and Estimating Intervention Impact section of the main text.

The following terminology and abbreviations are used in the remainder of this document:

- *SC*: school closure;
- *VQ*: voluntary quarantine;
- *SIP*: shelter-in-place;
- *Symptoms*: symptomatic infection; and
- *Symptoms & VQ*: symptomatic infection and complying with voluntary quarantine.

Under school closure, having voluntary quarantine or increasing voluntary quarantine compliance yielded up to a 92% decrease in cumulative infections and deaths while homebound days increased by at most 8% for adults, 6% for elderly, and 1.5% for the total population (*Table B5*).

Under non-school closure, having voluntary quarantine or increasing voluntary quarantine compliance yielded up to an 80% and 85% decrease in cumulative infections and deaths, respectively, while homebound days increased at most by 109% for adults, 150% for elderly, and 132% for the total population (*Table B5*).

From voluntary quarantine without school closure (Scenarios 3a, 3b, 3c) to voluntary quarantine with school closure (Scenarios 4a, 4b, 4c), school closure had the least impact to homebound

days in medium compliance (comparing Scenario 3b to 4b); however, the greatest reduction in cumulative infections and deaths was obtained in high compliance (comparing Scenario 3c to 4c). With school closure, homebound days could increase 3-9 and 7-20 times for adults and elderly, respectively. Due to voluntary quarantine, school closure was less disruptive when comparing the change in homebound days from Scenarios 3a, 3b, 3c to 4a, 4b, 4c with the change in homebound days from Scenario 1 to Scenario 2. School closure had the worst impact on homebound days but could provide up to a 61% decrease in cumulative infections and deaths. The impact of school closure on cumulative infections and deaths increased with increasing voluntary quarantine compliance (*Table B6*).

Compared to voluntary quarantine, shelter-in-place combined with school closure impacted a larger population by increasing homebound days greatly (*Tables B5 and B7*, Scenario 2 vs 4a, 4b, 4c and Scenario 2 vs 5a, 5b, 5c). However, shelter-in-place with school closure scenarios did not lead to a considerable decrease in cumulative infections and deaths compared to voluntary quarantine with school closure scenarios (Scenario 4a, 4b, 4c). Compared to school closure only (Scenario 2), shelter-in-place combined with school closure lead to at most a 7% and 17.3% decrease in cumulative infections and deaths, respectively, while increasing homebound days for adults by at least 1.6 folds. On the other hand, compared to Scenario 2, even low voluntary quarantine compliance with school closure (Scenario 4a) could provide at least a 39% decrease in cumulative infections and deaths while increasing homebound days for adults by just 6.34%.

It is estimated that 71% of adults would not be able to work from home[3]. Across all scenarios, *Figure B4* presents the number of adults who are absent from work over time, which was estimated by aggregating the number of adults who were hospitalized or provided hospital care, plus 71% of homebound adults. Under Scenarios 1, 3a, 3b, 3c (non-school closure scenarios), the peak number of adults absent from work decreased from 208,974 under Scenario 3a to 88,563 under Scenario 3c, and the peak under Scenario 1 was 208,623. Under Scenarios 2, 4a, 4b, 4c, 5a, 5b, 5c (school closure scenarios), the peak number of adults absent from work was highest under Scenarios 5a, 5b, 5c, due to shelter-in-place, ranging from 3,819,316 to 3,820,743 followed by a peak of 443,468 under Scenario 2. Higher compliance with voluntary quarantine reduced peak adults absent from work to 412,832, 384,216, and 372,074 in Scenarios 4a, 4b, 4c, respectively.

Table B1: *Main statuses for tracking children, youth, adults and elderly populations.*

		Homebound							
	Active	**SC**	**Symptoms**	**VQ**	**SIP**	**At Home Childcare**	**Hospital Care**	**Hospitalized**	**Dead**
Children	✓	✓	✓	✓				✓	✓
Youth	✓	✓	✓	✓		~		✓	✓
Adult	✓		✓	✓	✓	✓	✓	✓	✓
Elderly	✓		✓	✓	✓	✓	✓	✓	✓

Table B2: *Outcome measures: statistical summary that compares baseline and intervention scenarios with respect to cumulative deaths, cumulative infections, percentage of the population infected (infection attack rate, IAR %), peak infection (%), and peak day.*

	Cumulative Deaths	**Cumulative Infections**	**IAR (%)**	**Peak Infection (%)**	**Peak Day**
Scenario 1	23021	6488076	60.09	1.729	61
Scenario 2	20419	5581424	51.69	1.150	75
Scenario 3a	15932	4767566	44.15	0.828	75
Scenario 3b	10873	3402189	31.51	0.418	93
Scenario 3c	3630	1261218	11.68	0.099	115
Scenario 4a	11430	3354526	31.07	0.377	105
Scenario 4b	5241	1658673	15.36	0.140	125
Scenario 4c	1594	489014	4.53	0.033	122
Scenario 5a	19646	5457878	50.55	1.017	108
Scenario 5b	19148	5383971	49.86	0.970	126
Scenario 5c	16890	5195082	48.11	0.936	144

Table B3: *Percentage of days children, youth, adults, and elderly homebound.*

	Homebound Days			
	Children %	**Youth %**	**Adults %**	**Elderly %**
Scenario 1	.65	.72	.72	.61
Scenario 2	100	100	7.16	12.48
Scenario 3a	1.5	1.54	1.36	1.3
Scenario 3b	1.98	2.02	1.63	1.58
Scenario 3c	1.92	1.96	1.5	1.51
Scenario 4a	100	100	7.62	12.99
Scenario 4b	100	100	7.67	13.15

Scenario 4c	100	100	7.74	13.3
Scenario 5a	100	100	18.92	23.44
Scenario 5b	100	100	24.28	28.39
Scenario 5c	100	100	30.66	34.35

Table B4: *Homebound and inactive peak percentage for children, youth, adults, elderly, and the total population.*

Inactive					
	Children %	**Youth %**	**Adult %**	**Elderly %**	**Total %**
Scenario 1	3.38	3.79	4.17	3.70	3.95
Scenario 2	100	100	9.16	13.83	32.92
Scenario 3a	4.54	4.75	4.29	3.93	4.32
Scenario 3b	3.99	4.11	3.31	3.08	3.47
Scenario 3c	2.35	2.43	1.85	1.84	1.98
Scenario 4a	100	100	8.63	13.76	32.59
Scenario 4b	100	100	8.07	13.46	32.21
Scenario 4c	100	100	7.83	13.38	32.05
Scenario 5a	100	100	80.46	80.79	85.49
Scenario 5b	100	100	80.48	80.78	85.50
Scenario 5c	100	100	80.45	80.77	85.48
Homebound					
	Children %	**Youth %**	**Adult %**	**Elderly %**	**Total %**
Scenario 1	3.38	3.78	3.63	3.04	3.54
Scenario 2	100	100	8.74	13.34	32.59
Scenario 3a	4.53	4.75	4.00	3.59	4.11
Scenario 3b	3.99	4.11	3.17	2.90	3.35
Scenario 3c	2.35	2.43	1.81	1.80	1.96
Scenario 4a	100	100	8.48	13.58	32.47
Scenario 4b	100	100	8.01	13.39	32.16
Scenario 4c	100	100	7.82	13.37	32.04
Scenario 5a	100	100	80.45	80.78	85.49
Scenario 5b	100	100	80.47	80.77	85.49
Scenario 5c	100	100	80.44	80.76	85.47

Table B5: *Change in the cumulative infections and deaths compared to the change in homebound days with respect to increase in voluntary quarantine compliance, from 0% to 50%, 70% and 90% (Scenario 1 vs Scenarios 3a, 3b, 3c and Scenario 2 vs Scenarios 4a, 4b, 4c), 50% to 70% and 90% (Scenario 3a vs Scenarios 3b, 3c and Scenario 4a vs Scenarios 4b, 4c), 70% to 90% (Scenario 3b vs Scenario 3c and Scenario 4b vs Scenario 4c).*

|	% Change in Homebound Days				% Change in Cumulative Infections	% Change in Cumulative Deaths
	Children and Youth	Adult	Elderly	Total Pop.		
Scenario 1 vs 3a	121.97	90.44	113.76	100.92	-26.52	-30.79
Scenario 1 vs 3b	192.25	127.18	160.60	147.21	-47.56	-52.77
Scenario 1 vs 3c	182.99	109.46	149.27	132.32	-80.56	-84.23
Scenario 3a vs 3b	31.66	19.30	21.91	23.04	-28.64	-31.75
Scenario 3a vs 3c	27.49	9.99	16.61	15.62	-73.55	-77.22
Scenario 3b vs 3c	-3.17	-7.80	-4.35	-6.03	-62.93	-66.62
Scenario 2 vs 4a	0.01	6.34	4.10	1.10	-39.90	-44.02
Scenario 2 vs 4b	0.01	7.15	5.31	1.28	-70.28	-74.33
Scenario 2 vs 4c	0.01	8.07	6.52	1.47	-91.24	-92.19
Scenario 4a vs 4b	0.00	0.77	1.16	0.18	-50.55	-54.14
Scenario 4a vs 4c	0.01	1.63	2.32	0.37	-85.42	-86.05
Scenario 4b vs 4c	0.00	0.85	1.15	0.19	-70.52	-69.59

Table B6: *Change in the cumulative infections and deaths versus the change in homebound days with respect to school closure.*

|	% Change in Homebound Days				% Change in Cumulative Infections	% Change in Cumulative Deaths
	Children and Youth	Adult	Elderly	Total Pop.		
Scenario 1 vs 2	14508.76	899.33	1955.25	4436.85	-13.97	-11.30
Scenario 3a vs 4a	6481.90	458.00	900.92	2182.82	-29.64	-28.26
Scenario 3b vs 4b	4899.24	371.35	730.54	1758.68	-51.25	-51.80
Scenario 3c vs 4c	5062.92	415.59	778.26	1881.57	-61.23	-56.08

Table B7: *Change in the cumulative infections and deaths versus the change in homebound days with respect to varying durations of shelter-in-place.*

|	% Change in Homebound Days			% Change in Cumulative Infections	% Change in Cumulative Deaths
	Adult	Elderly	Total Pop.		
Scenario 2 vs 5a	164.20	87.80	27.47	-2.21	-3.79
Scenario 2 vs 5b	238.95	127.48	39.96	-3.54	-6.22
Scenario 2 vs 5c	328.12	175.16	54.88	-6.92	-17.28
Scenario 5a vs 5b	28.29	21.13	9.80	-1.35	-2.53
Scenario 5a vs 5c	62.05	46.52	21.50	-4.81	-14.03
Scenario 5b vs 5c	26.31	20.96	10.66	-3.51	-11.79

Figure B1: *Number of adults who are absent from work over time.*
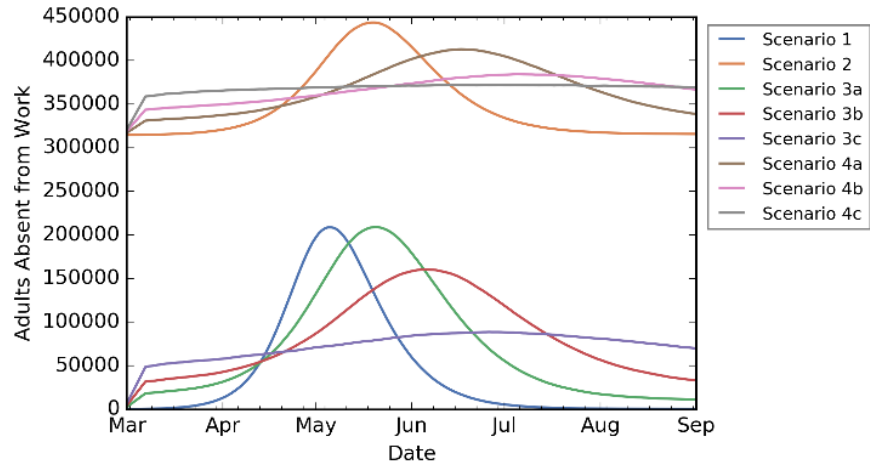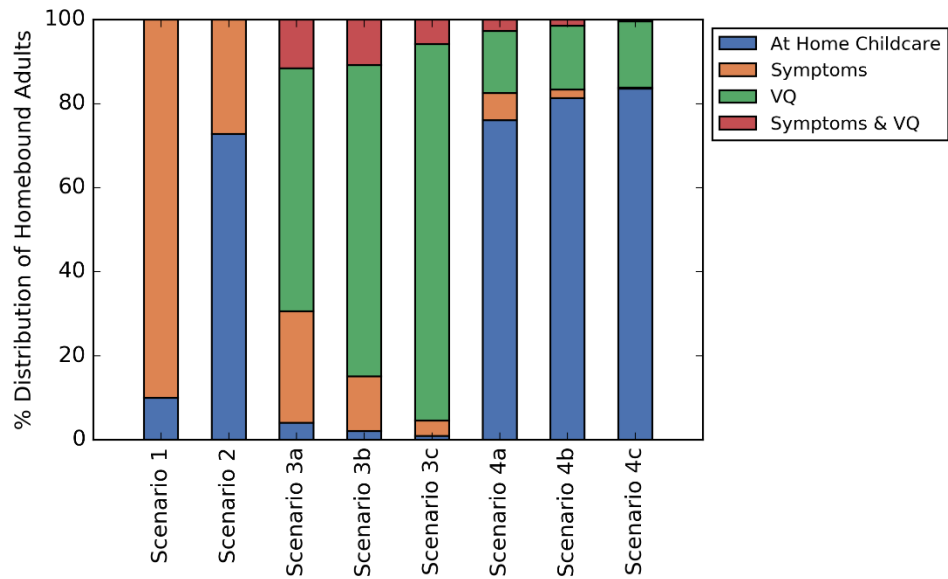
Figure B2: *Homebound peak for adults (left), and elderly (right) broken down by statuses.*
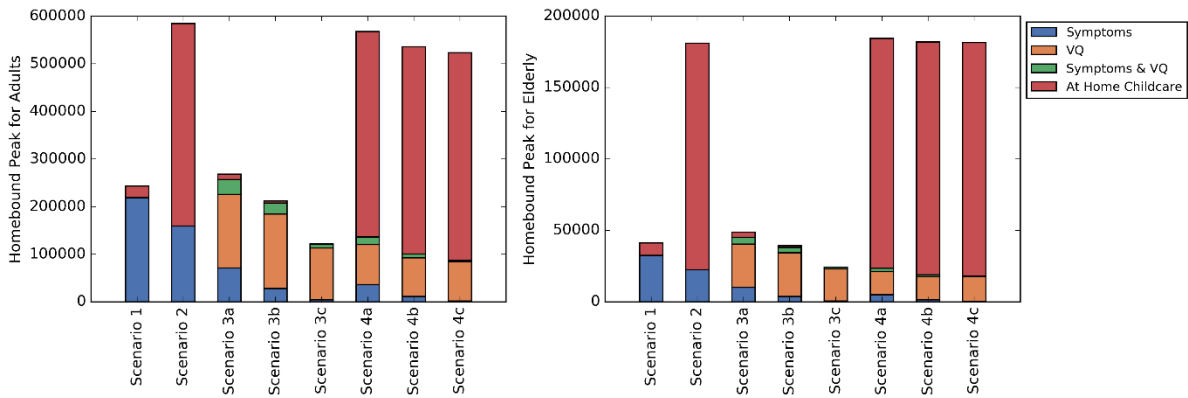
Figure B3: *Homebound peak for children (left), and youth (right) broken down by statuses.*
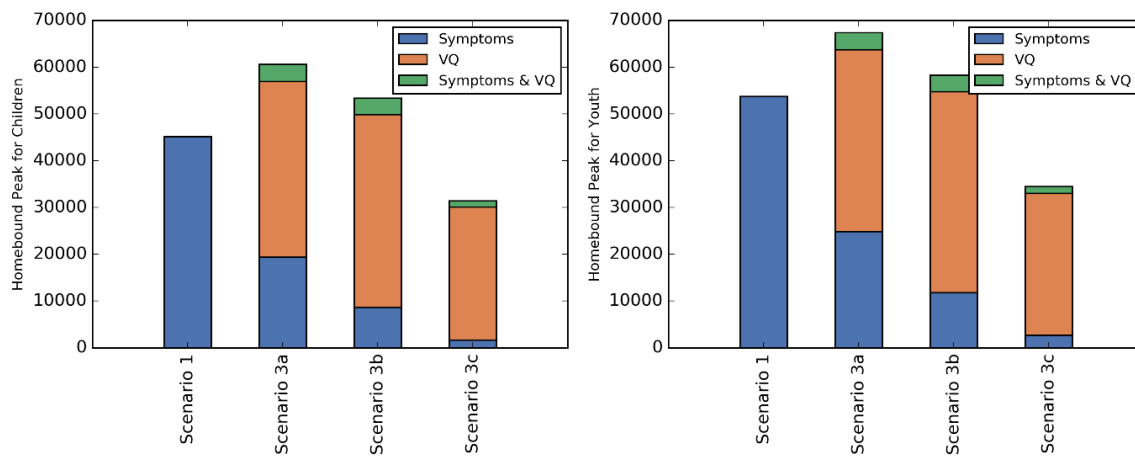
Figure B4: *Percentage distribution of statuses for homebound peak for adults.*

REFERENCES

1. American Community Survey, 2017 American Community Survey 5-year Estimates. In. U.S. Census Bureau2017.

2. Georgia State University. Child Supervision Guidelines in Georgia. https://abuse.publichealth.gsu.edu/child-supervision-guidelines-in-georgia/, 2020.

3. U.S. Department of Labor. *Job Flexibilities and Work Schedules -- 2017-2018 Data From The American Time Use Survey.* 2019.