

Estimates of impact of interventions based on time use.

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General approach

- Use time use data to explore where people spend their time (Gershuny and O. Sullivan (2017); Table 1).
- Map the time use data to polymod contact locations (Table 1).
- Make assumptions about how the scenarios proposed by SAGE influence time used at each polymod location (Table 2). **These assumptions are mostly based on best guesses and open for discussion.**
- Using the reduction in time to calculate the reduction at each polymod location (Table 3). Note that this assumes that number of contacts is proportional to the time spend independent of the actual activity.
- Calculate the **relative reproduction number** for each scenario using the above (Table 4).

Discussion points

- The effect of SAGE interventions on time use are mostly based on best guesses. **SPI-B input would be invaluable here.**
 - The soon to be released google mobility data, which will be near real time, could be used to track the impact of measures on time use.
- We assume that time use is proportional to number of contacts. This is unlikely to be the case. The available time use data can be partly used to explore this further, but we did not have time to do so yet.
- We did not (yet) stratify the time use data by age group. This would add further detail, but is likely overshadowed by the uncertainty in the effect of the interventions on time use.
- Currently home contacts weights are always kept at 1. This is because while more time at home will increase the number of contacts it will have very little effect on the number of unique contacts (in the home location). The epidemiological effect of more time at home is, therefore, likely to be limited.

Time use data

We used data from the Time Use Survey of 2014-2015 (Gershuny and O. Sullivan 2017) to calculate how much time people on average spent at restaurants, bars, parks etc. (Table 1). The data only includes people 8 and above.

- The most significant leisure time-use consists of visits to family and friends. We have some data from the YouGuv survey that indicates this is significantly reduced at the moment (11 percent of normal).
- There is also a large percentage of time spend in undefined locations (0.78; otherplace). It is especially hard to estimate the effect of the different scenarios is on these contacts.
- Transport is divided into work related and other transport.

Table 1: Percentage of time spent in each location. The last two columns show the relevant polymod locations and the relative contribution to each of the polymod locations (in time spent there).

Detail1	Detail2	Time Use	Polymod	Contribution
home				
		0.704	home	1.000
other				
visit		0.038	leisure	0.593
Bars and restaurants		0.013	leisure	0.208
public spaces	exercise	0.007	leisure	0.106
	parks	0.005	leisure	0.084
	cultural	0.001	leisure	0.010
holiday		0.011	leisure	0.000
		0.051	otherplace	0.776
shopping		0.011	otherplace	0.172
	food	0.003	otherplace	0.052
transport		0.059	transport	0.831
	work	0.012	transport	0.169
workorschool				
		0.084	work/school	1.000

* Holiday contribution is set to 0, because we are outside holiday season

Table 2: Assumptions about how the different scenarios proposed by SAGE influence time use. The current scenario (S123) is partly based on the YouGov survey, which found that visits to family and friends were reduced to 10 percent and work to 33 percent. Also included in the analysis are the same scenarios but with schools open (S123a, S4a, etc.)

Detail1	Detail2	S123	S4	S5	S6	S7
home						
		1.00	1.00	1.00	1.00	1
leisure						
visit		0.11	0.11	0.50	0.50	1
Bars and restaurants		0.00	0.00	0.00	0.00	1
public spaces	exercise	0.11	0.50	0.11	1.00	1
	parks	0.20	0.50	1.00	1.00	1
	cultural	0.00	0.50	1.00	1.00	1
holiday		0.00	0.00	0.00	0.00	1
otherplace						
		0.11	0.11	0.30	0.50	1
shopping		0.00	0.50	0.11	1.00	1
	food	0.50	0.50	0.50	1.00	1
transport						
transport		0.11	0.40	0.60	0.80	1
	work	0.33	0.50	0.50	0.80	1
work						
		0.33	0.50	0.50	0.80	1
school						
		0.03	0.03	0.03	0.03	1

Table 3: Contact weights in polymod by scenario with uncertainty. We also evaluated alternative scenarios, where school was kept fully open (set to 1).

Polymod	S123	S4	S5	S6	S7
home	1 (1,1)	1 (1,1)	1 (1,1)	1 (1,1)	1 (1,1)
leisure	0.095 (0.034,0.152)	0.163 (0.105,0.223)	0.401 (0.342,0.459)	0.495 (0.435,0.547)	1 (1,1)
otherplace	0.114 (0.039,0.185)	0.201 (0.122,0.279)	0.275 (0.198,0.357)	0.605 (0.531,0.681)	1 (1,1)
school	0.03 (0.021,0.04)	0.031 (0.021,0.04)	0.03 (0.021,0.039)	0.03 (0.021,0.039)	1 (1,1)
transport	0.147 (0.066,0.23)	0.419 (0.334,0.498)	0.582 (0.501,0.665)	0.797 (0.718,0.88)	1 (1,1)
work	0.327 (0.235,0.423)	0.502 (0.404,0.595)	0.498 (0.404,0.595)	0.802 (0.706,0.896)	1 (1,1)

Table 4: Reproduction number for the different scenarios, based on a 2.8 reproduction number without interventions. Results using both all contacts and physical only contacts are shown. The scenarios indicated by *a* are similar scenarios but with schools open.

Scenario	All	Physical
S123	1.15 (1.06,1.23)	1.42 (1.36,1.48)
S123a	1.84 (1.77,1.91)	2.05 (1.99,2.11)
S4	1.3 (1.21,1.39)	1.51 (1.45,1.57)
S4a	1.96 (1.89,2.04)	2.14 (2.08,2.2)
S5	1.37 (1.27,1.46)	1.57 (1.5,1.63)
S5a	2.02 (1.95,2.1)	2.19 (2.13,2.25)
S6	1.8 (1.71,1.89)	1.86 (1.8,1.92)
S6a	2.4 (2.31,2.47)	2.48 (2.42,2.54)
S7	2.8 (2.8,2.8)	2.8 (2.8,2.8)

SAGE summary options

Table 2 shows the weights used for each scenario and the different time use locations. These values are partly based on the recent YouGov survey, but mainly on our best guess. These assumptions are open for discussion.

- Work related transport is assumed to scale up/down with the work participation.
- Part of exercise time will be spend at fitness clubs etc. This is assumed to be part of the non-essential retail in the SAGE document.
- Uncertainty was added to these assumptions by taking 1000 draws out of uniform distributions $U(x - 0.1, x + 0.1)$ except for options that are all or nothing, e.g. closing of pubs and restaurants, and for school where a narrower distribution was used, because we have good data here $U(x - 0.01, x + 0.01)$.

If we assume that time use is directly proportional to the number of contacts in each activity then we can now calculate the relative weight of contacts for Polymod (Table 3) and using these weights we can then estimate the relative reproduction number under each intervention scenario (Table 4)

Appendix

References

Gershuny, J., and O. Sullivan. 2017. “United Kingdom Time Use Survey, 2014-2015.” *UK Data Service*. <https://doi.org/http://doi.org/10.5255/UKDA-SN-8128-1>.