



# CoMix social contact survey: Report for Estonia rounds 1 to 9

*Amy Gimma, Kerry Wong, Kevin Van Zandvoort, CMMID COVID-19 Working Group, Christopher Jarvis, John Edmunds*  
London school of Hygiene and Tropical Medicine.

Created as part of the EpiPose project, funded by the EU Horizon 2020 Research and Innovations Programme - project EpiPose (Epidemic Intelligence to Minimize COVID-19's Public Health, Societal and Economical Impact, No 101003688).

**Report created:** 28 September 2021

**Survey dates:** 20 April 2021 to 23 August 2021

## Introduction & Methods

CoMix is a behavioural survey, first launched on 24 March 2020 in the UK, and launched in Estonia on 20 April 2021. The sample is broadly representative of the adult population in Estonia. Participants are invited to respond to the survey approximately once every two weeks. This report presents the results from 7 waves of adult data and 2 waves of children data. The children data was collected by having parents to complete the survey on behalf of a child in their household (aged 17 years or less). Participants record direct, face-to-face contacts made on the previous day, specifying certain characteristics for each contact including the age and sex of the contact, whether contact was physical (skin-to-skin contact), and where contact occurred (e.g. at home, work, while undertaking leisure activities, etc). Participants are instructed to report contacts individually, but are also given the opportunity to report aggregated estimates of the contacts made by age group and setting, in case they did not list all contacts individually. Further details have been published elsewhere[1,2]. The contact survey is based on the POLYMOD contact survey[3].

We calculated and plotted the crude mean number of contacts by setting, duration, and participant to contact age groups. We used the settings home, work and school (including all educational establishments, including childcare, nurseries and universities and colleges), and "other" (mostly leisure and social contacts, but includes shopping), and

report . We look at the mean contacts by age and survey wave. The mean number of contacts is influenced by a few individuals who report very high numbers of contacts (often in a work context). We show means for all contacts and means number of contacts after truncating the maximum number of contacts recorded at 50 per individual per day.

We calculated the mean contacts for the contact matrices by using the socialmixr R package [4], with 1000 bootstrapped samples. We used the World Population Prospect data from 2015 for country specific population estimates by age and gender, which is the latest available data in the socialmixr package. We constructed age-stratified contact matrices for nine age-groups (0-4, 5-11, 12-17, 18-29, 30-39, 40-49, 50-59, 60-69, and 70+). For contacts, we do not have exact ages and therefore sampled from the reported age-group.

To complete the symmetric contact matrices that capture contacts by both adults and children, we combined each wave of the adult data with

- children who attended school,
- children who did not attend school,
- Wave C1, and
- Wave C2.

The first two scenarios capture contacts that are specific to school attendance status. The result should be interpreted with caution when the number for children who went to school were very low. The latter two scenarios are specific to the data collection periods of Wave C1 and Wave C2.

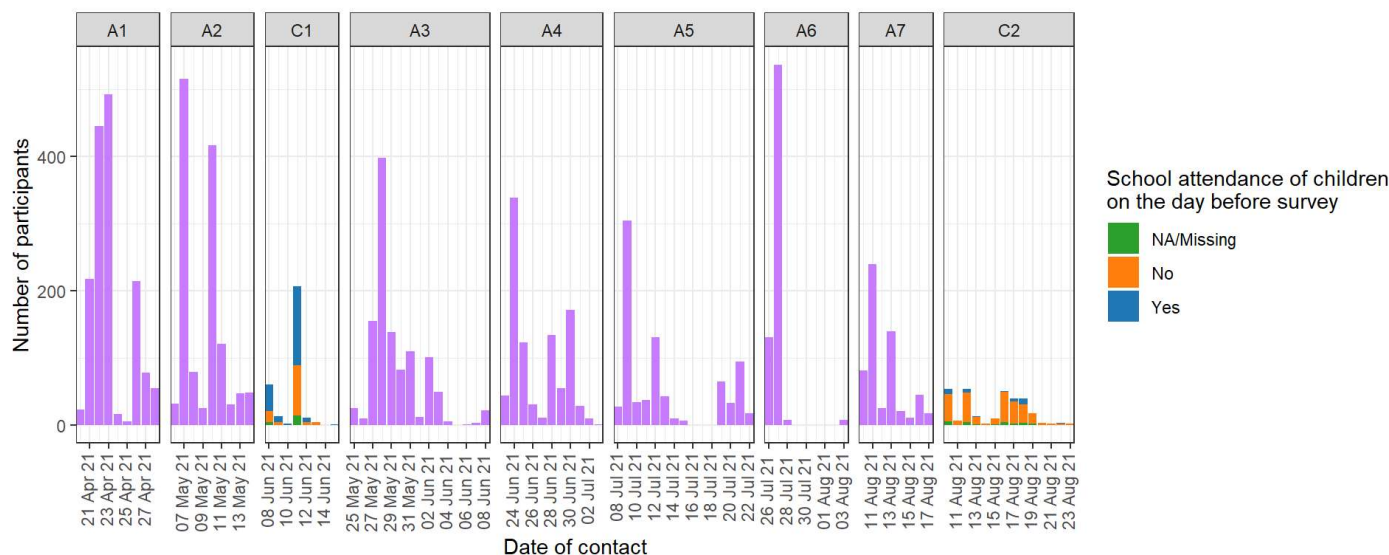
## Timeline

The CoMix survey in Estonia has had 9 waves of data collection covering the period between 20 April 2021 and 23 August 2021. Figure 1 shows survey response by date

Wave	A1	A2	C1	A3	A4	A5	A6	A7	C2
Sample type	Adults	Adults	Children	Adults	Adults	Adults	Adults	Adults	Children
Start date	20 Apr 2021	06 May 2021	08 Jun 2021	25 May 2021	23 Jun 2021	08 Jul 2021	26 Jul 2021	10 Aug 2021	10 Aug 2021
End date	28 Apr 2021	14 May 2021	15 Jun 2021	08 Jun 2021	03 Jul 2021	22 Jul 2021	03 Aug 2021	17 Aug 2021	23 Aug 2021
Participants	1547	1314	297	1111	947	805	683	579	299
Contacts	9014	8577	4066	8900	6323	3938	3915	2477	1827

**Table 1. Survey wave summary.** Survey wave start and end dates, number of participants, and number of contacts.

**Figure 1: Survey responses by date.**



## Participant demographics

Category	Group	Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7	Wave C1	Wave C2
All		1547	1314	1111	947	805	683	579	297	299
Age	0-4	NA	NA	NA	NA	NA	NA	NA	50 (16.8%)	56 (18.7%)
	5-17	NA	NA	NA	NA	NA	NA	NA	247 (83.2%)	234 (78.3%)
	18-29	242 (15.6%)	189 (14.4%)	166 (14.9%)	123 (13.0%)	48 (6.0%)	70 (10.2%)	81 (14.0%)	NA	NA
	30-39	270 (17.5%)	237 (18.0%)	197 (17.7%)	166 (17.5%)	81 (10.1%)	121 (17.7%)	113 (19.5%)	NA	NA

Category	Group	Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7	Wave C1	Wave C2
	40-49	255 (16.5%)	225 (17.1%)	182 (16.4%)	165 (17.4%)	123 (15.3%)	112 (16.4%)	98 (16.9%)	NA	NA
	50-59	286 (18.5%)	233 (17.7%)	200 (18.0%)	174 (18.4%)	171 (21.2%)	116 (17.0%)	101 (17.4%)	NA	NA
	60-69	271 (17.5%)	237 (18.0%)	201 (18.1%)	162 (17.1%)	193 (24.0%)	138 (20.2%)	99 (17.1%)	NA	NA
	70+	223 (14.4%)	193 (14.7%)	165 (14.9%)	157 (16.6%)	189 (23.5%)	126 (18.4%)	87 (15.0%)	NA	NA
	NA/Other/Missing	NA	NA	NA	NA	NA	NA	NA	NA	9 (3.0%)
Gender	Female	854 (55.2%)	725 (55.2%)	599 (53.9%)	500 (52.8%)	450 (55.9%)	361 (52.9%)	284 (49.1%)	185 (62.3%)	194 (64.9%)
	Male	687 (44.4%)	584 (44.4%)	509 (45.8%)	444 (46.9%)	354 (44.0%)	322 (47.1%)	294 (50.8%)	112 (37.7%)	105 (35.1%)
	NA/Other/Missing	6 (0.4%)	5 (0.4%)	3 (0.3%)	3 (0.3%)	1 (0.1%)	NA	1 (0.2%)	NA	NA
Household size	1	383 (24.8%)	320 (24.4%)	282 (25.4%)	249 (26.3%)	230 (28.6%)	197 (28.8%)	158 (27.3%)	NA	NA
	2	664 (42.9%)	568 (43.2%)	489 (44.0%)	409 (43.2%)	358 (44.5%)	295 (43.2%)	244 (42.1%)	22 (7.4%)	19 (6.4%)
	3-5	476 (30.8%)	405 (30.8%)	324 (29.2%)	277 (29.3%)	210 (26.1%)	184 (26.9%)	170 (29.4%)	256 (86.2%)	262 (87.6%)
	6+	24 (1.6%)	21 (1.6%)	16 (1.4%)	12 (1.3%)	7 (0.9%)	7 (1.0%)	7 (1.2%)	19 (6.4%)	18 (6.0%)

**Table 2. Participant demographics by wave for age, gender, and household size.**

Children sample school attendance

<b>School attendance</b>	<b>Wave C1, by age</b>			<b>Wave C2, by age</b>		
	<b>(0-17y)</b>	<b>(0-4y)</b>	<b>(5-17y)</b>	<b>(0-17y)</b>	<b>(0-4y)</b>	<b>(5-17y)</b>
<b>NA/Missing</b>	<b>20 (6.7%)</b>	<b>16 (32.0%)</b>	<b>4 (1.6%)</b>	<b>21 (7.2%)</b>	<b>14 (25.0%)</b>	<b>7 (3.0%)</b>
<b>No</b>	<b>104 (35.0%)</b>	<b>22 (44.0%)</b>	<b>82 (33.2%)</b>	<b>241 (83.1%)</b>	<b>25 (44.6%)</b>	<b>216 (92.3%)</b>
No, but it was open for my child	66 (22.2%)	14 (28.0%)	52 (21.1%)	25 (8.6%)	14 (25.0%)	11 (4.7%)
No, it was a weekend/holiday/day off	29 (9.8%)	4 (8.0%)	25 (10.1%)	125 (43.1%)	6 (10.7%)	119 (50.9%)
No, it was closed	7 (2.4%)	2 (4.0%)	5 (2.0%)	87 (30.0%)	4 (7.1%)	83 (35.5%)
<b>Yes</b>	<b>175 (58.9%)</b>	<b>14 (28.0%)</b>	<b>161 (65.2%)</b>	<b>32 (11.0%)</b>	<b>18 (32.1%)</b>	<b>14 (6.0%)</b>

**Table 3. School attendance of children on the day before survey by age**

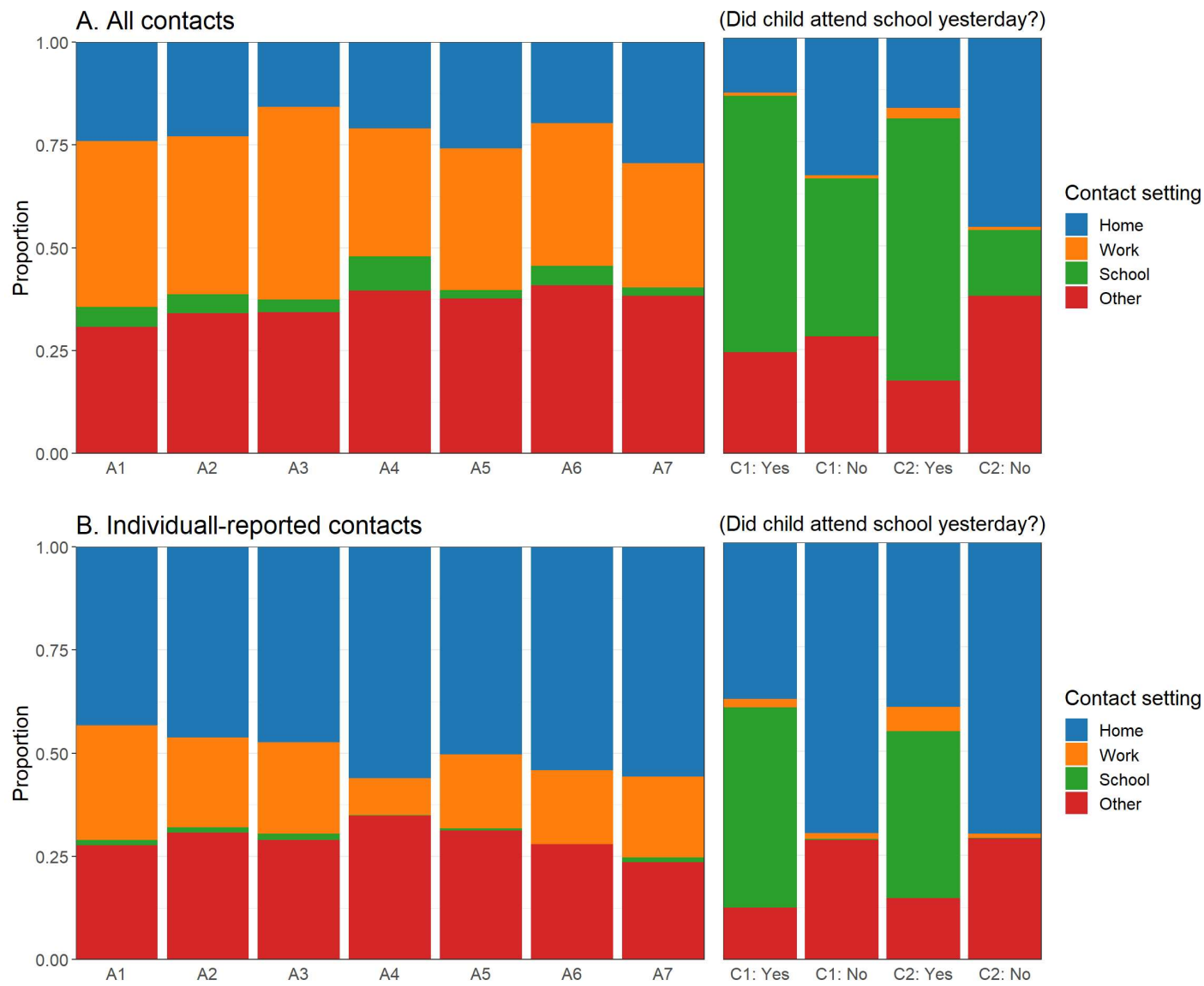
## Contact characteristics

### Contact setting

**Figure 2. Proportion of contacts by setting and wave.**

A. All contacts (both individually-reported and reported in aggregated contact questions);

B. individually-reported contacts only.

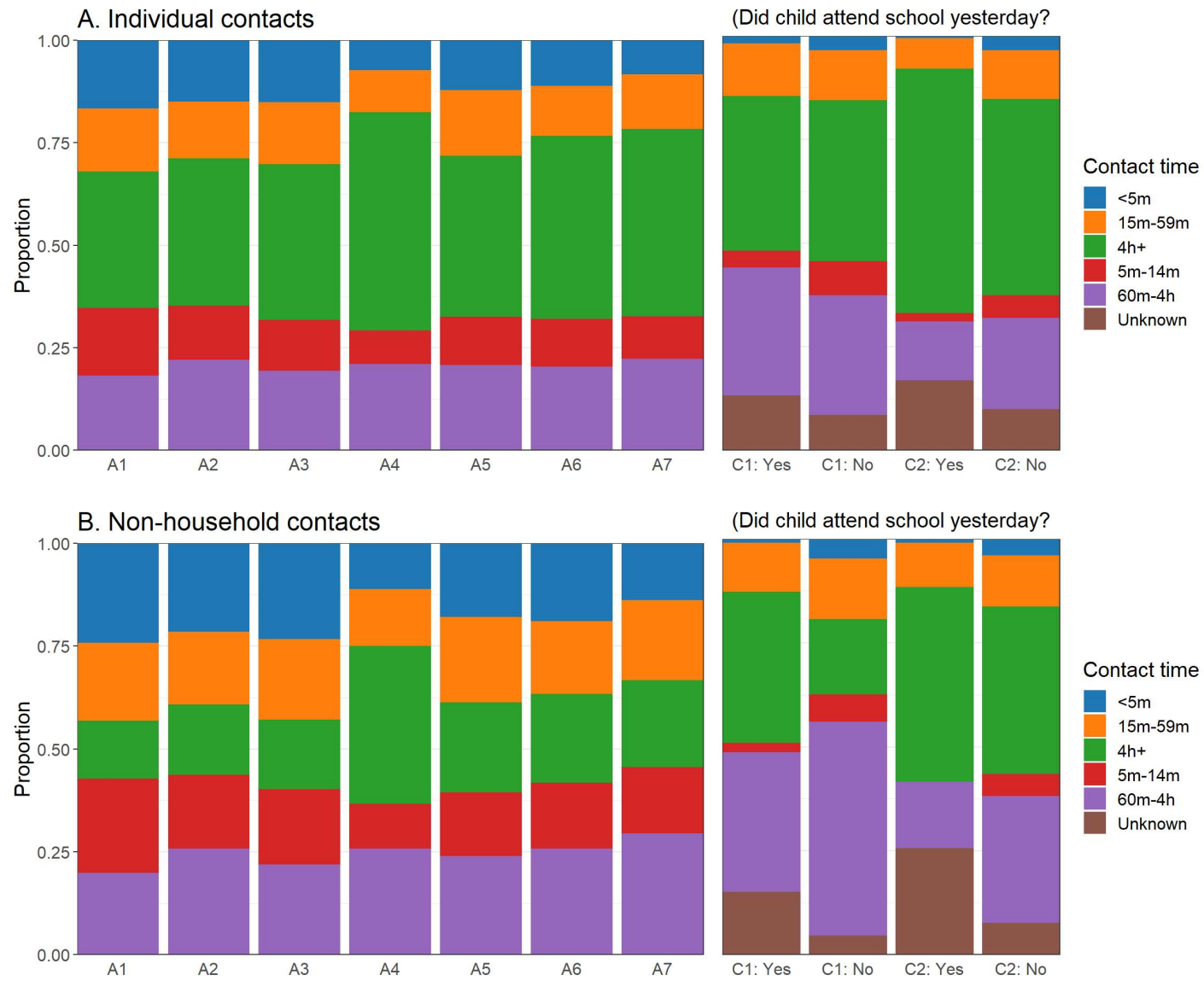


## Contact duration

**Figure 3. Proportion of contacts by duration of contact and wave.**

A. All individually-reported contacts;

B. individually-reported contacts, excluding the participant's household members.



									Did child attend school yesterday?			
Category	Group	Wave	Wave	Wave	Wave	Wave	Wave	Wave	Wave	Wave	Wave	Wave
		C1: Yes	C1: No	C2: Yes	C2: No	C1: Yes	C1: No	C2: Yes	C2: No	C1: Yes	C1: No	C2: Yes

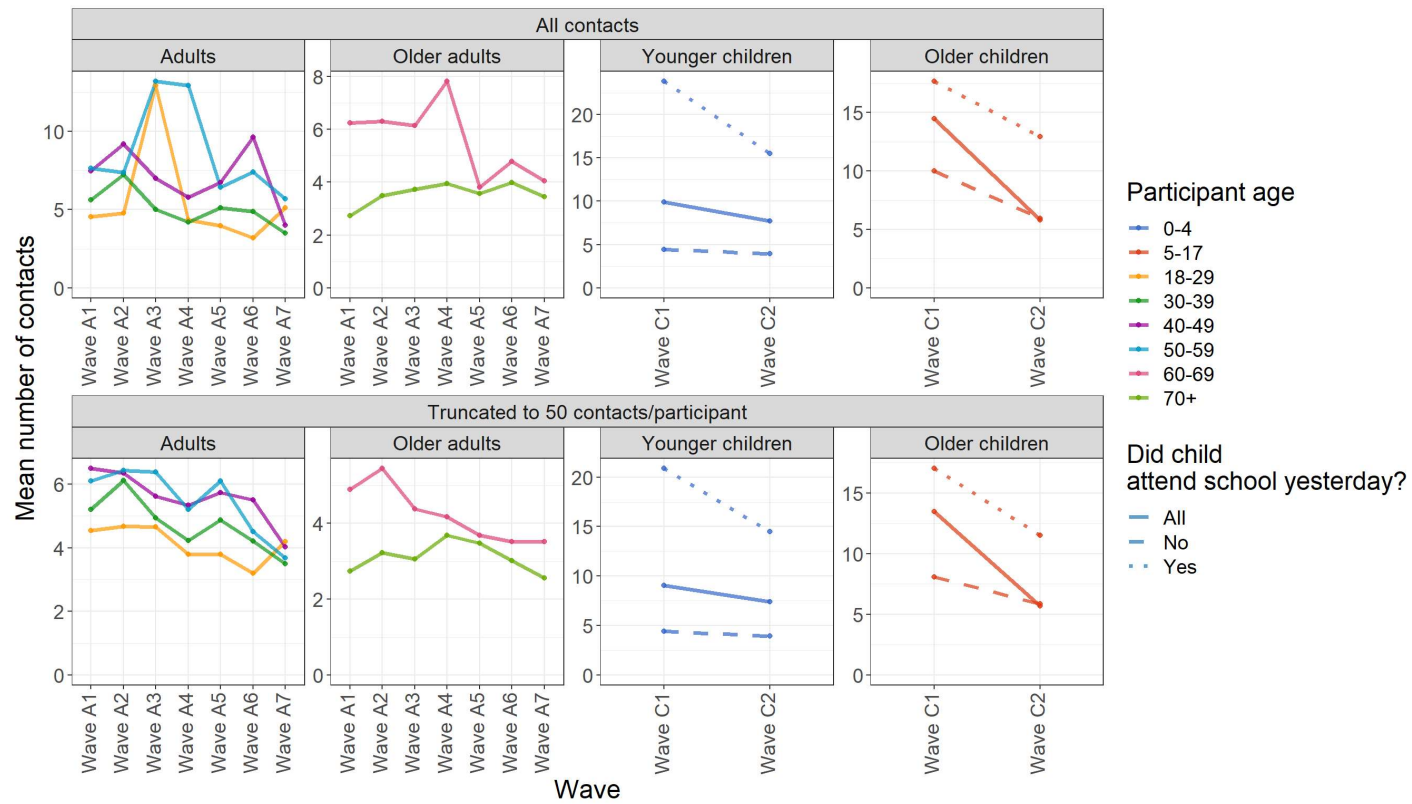
Category	Group	Did child attend school yesterday?										
		Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7	Wave C1: Yes	Wave C1: No	Wave C2: Yes	Wave C2: No
Contact setting	Home	2175 (24.1%)	1967 (22.9%)	1405 (15.8%)	1328 (21.0%)	1019 (25.9%)	772 (19.7%)	729 (29.4%)	408 (13.2%)	287 (33.1%)	75 (16.9%)	588 (45.5%)
	Other	2777 (30.8%)	2921 (34.1%)	3060 (34.4%)	2499 (39.5%)	1482 (37.6%)	1601 (40.9%)	949 (38.3%)	752 (24.4%)	244 (28.1%)	78 (17.6%)	490 (38.0%)
	School	432 (4.8%)	395 (4.6%)	272 (3.1%)	526 (8.3%)	83 (2.1%)	181 (4.6%)	50 (2.0%)	1904 (61.7%)	330 (38.1%)	280 (63.1%)	204 (15.8%)
	Work	3630 (40.3%)	3294 (38.4%)	4163 (46.8%)	1970 (31.2%)	1354 (34.4%)	1360 (34.7%)	749 (30.2%)	22 (0.7%)	6 (0.7%)	11 (2.5%)	9 (0.7%)
Contact time	<5m	840 (16.7%)	640 (15.0%)	448 (15.1%)	175 (7.4%)	247 (12.2%)	160 (11.2%)	110 (8.4%)	19 (1.7%)	14 (3.4%)	1 (0.5%)	29 (3.4%)
	15m-59m	770 (15.3%)	589 (13.8%)	449 (15.1%)	242 (10.2%)	324 (16.0%)	172 (12.1%)	173 (13.2%)	138 (12.7%)	50 (12.1%)	14 (7.4%)	99 (11.7%)
	4h+	1671 (33.2%)	1527 (35.9%)	1128 (38.0%)	1260 (53.2%)	794 (39.2%)	637 (44.7%)	597 (45.6%)	408 (37.5%)	160 (38.8%)	112 (58.9%)	400 (47.4%)
	5m-14m	829 (16.5%)	561 (13.2%)	370 (12.5%)	193 (8.2%)	239 (11.8%)	166 (11.6%)	136 (10.4%)	44 (4.0%)	34 (8.3%)	4 (2.1%)	46 (5.5%)
	60m-4h	918 (18.3%)	941 (22.1%)	574 (19.3%)	498 (21.0%)	420 (20.8%)	291 (20.4%)	292 (22.3%)	336 (30.9%)	119 (28.9%)	27 (14.2%)	185 (21.9%)

**Table 4. Contacts by setting and duration of contact and wave.** Number and percentage of contacts by category for all contacts (individually-reported and reported in aggregated contact questions).

## Contact means

**Figure 4. Crude mean contacts by participant age group and wave.** Reported by all contacts and contacts truncated to 50 per participant per day.





Contacts	Participant age									Did child attend school yesterday?					
		Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7	Wave C1: All	Wave C1: Yes	Wave C1: No	Wave C2: All	Wave C2: Yes	Wave C2: No	Wave C2: All
All contacts	All	5.83	6.53	8.01	6.68	4.89	5.73	4.28	13.69	18.15	8.76	6.11	14.32	5.83	5.83
	0-4	NA	NA	NA	NA	NA	NA	NA	9.90	23.79	4.41	7.70	15.47	3.54	3.54
	5-17	NA	NA	NA	NA	NA	NA	NA	14.46	17.65	10.00	5.82	12.93	5.82	5.82
	18-29	4.54	4.79	12.95	4.33	3.98	3.19	5.12	NA	NA	NA	NA	NA	NA	NA
	30-39	5.62	7.25	5.02	4.22	5.10	4.88	3.50	NA	NA	NA	NA	NA	NA	NA

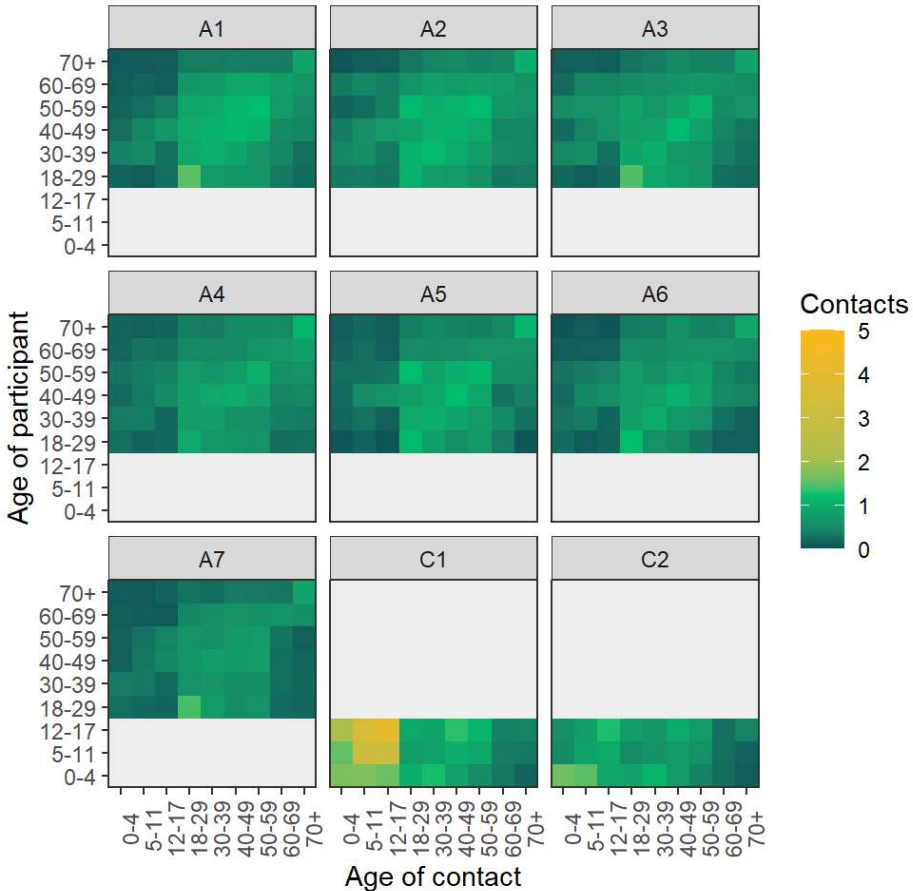
Contacts	Participant age	Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7	Did child attend school yesterday?					
									Wave C1: All	Wave C1: Yes	Wave C1: No	Wave C2: All	Wave C2: Yes	Wave C2: No
	40-49	7.49	9.20	7.00	5.78	6.72	9.62	4.02	NA	NA	NA	NA	NA	NA
	50-59	7.64	7.36	13.19	12.94	6.43	7.41	5.68	NA	NA	NA	NA	NA	NA
	60-69	6.24	6.31	6.14	7.81	3.81	4.78	4.04	NA	NA	NA	NA	NA	NA
	70+	2.74	3.48	3.73	3.94	3.56	3.99	3.44	NA	NA	NA	NA	NA	NA
Truncated to 50 contacts/participant	All	5.07	5.46	4.89	4.44	4.59	4.01	3.58	12.72	17.32	7.26	5.95	13.13	5.07
	0-4	NA	NA	NA	NA	NA	NA	NA	9.08	20.86	4.41	7.39	14.47	3.05
	5-17	NA	NA	NA	NA	NA	NA	NA	13.45	17.01	8.08	5.69	11.50	5.07
	18-29	4.54	4.68	4.66	3.80	3.79	3.19	4.20	NA	NA	NA	NA	NA	NA
	30-39	5.20	6.11	4.94	4.22	4.88	4.21	3.50	NA	NA	NA	NA	NA	NA
	40-49	6.49	6.35	5.62	5.34	5.73	5.51	4.02	NA	NA	NA	NA	NA	NA
	50-59	6.10	6.43	6.39	5.20	6.10	4.50	3.68	NA	NA	NA	NA	NA	NA
	60-69	4.89	5.44	4.37	4.17	3.68	3.51	3.52	NA	NA	NA	NA	NA	NA
	70+	2.74	3.22	3.05	3.68	3.47	3.02	2.55	NA	NA	NA	NA	NA	NA

**Table 5. Crude mean contacts by participant age group for each wave.** Children data is disaggregated by school attendance status.

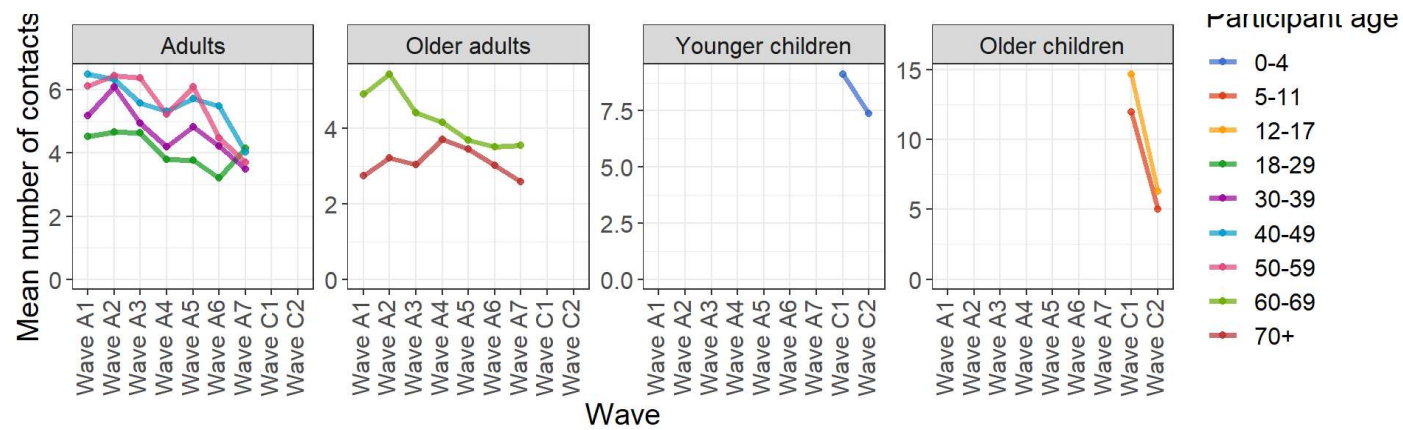
# Contact Matrices

All contacts

**Figure 5. Contact matrices by wave.** Contacts truncated to 50 per participant per day, adjusted for day of week.



**Figure 6. Adjusted contact means by participant age group.** Contacts truncated to 50 per participant per day, adjusted for day of week.



Participant age	Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7	Wave C1	Wave C2
0-4	NA	NA	NA	NA	NA	NA	NA	9.12	7.39
5-11	NA	NA	NA	NA	NA	NA	NA	11.93	5.00
12-17	NA	NA	NA	NA	NA	NA	NA	14.64	6.29
18-29	4.53	4.68	4.64	3.79	3.78	3.21	4.15	NA	NA
30-39	5.19	6.10	4.95	4.20	4.84	4.23	3.50	NA	NA
40-49	6.49	6.33	5.59	5.33	5.73	5.48	4.04	NA	NA
50-59	6.12	6.46	6.40	5.22	6.09	4.47	3.71	NA	NA
60-69	4.89	5.42	4.40	4.16	3.68	3.50	3.54	NA	NA
70+	2.74	3.21	3.04	3.69	3.44	3.02	2.57	NA	NA

**Table 6. Adjusted contact means by participant age group.** Contacts truncated to 50 per participant per day, adjusted for day of week.

Combined contacts

**Figure 7. Symmetric combined matrices by wave.** Adult survey waves each combined with

A. children who attended school,

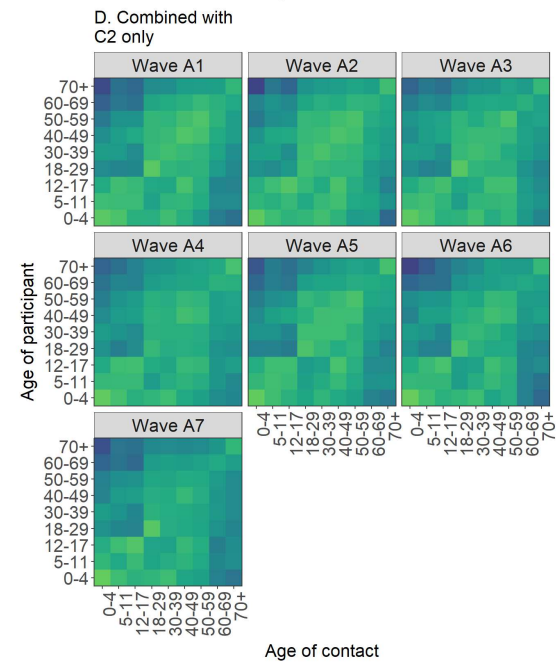
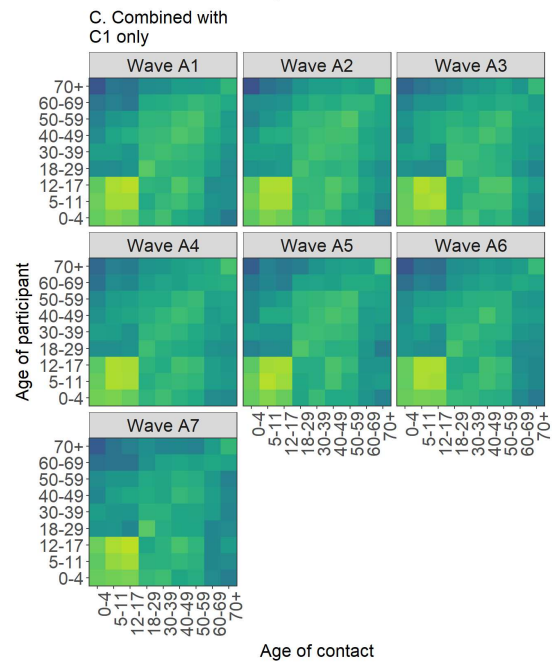
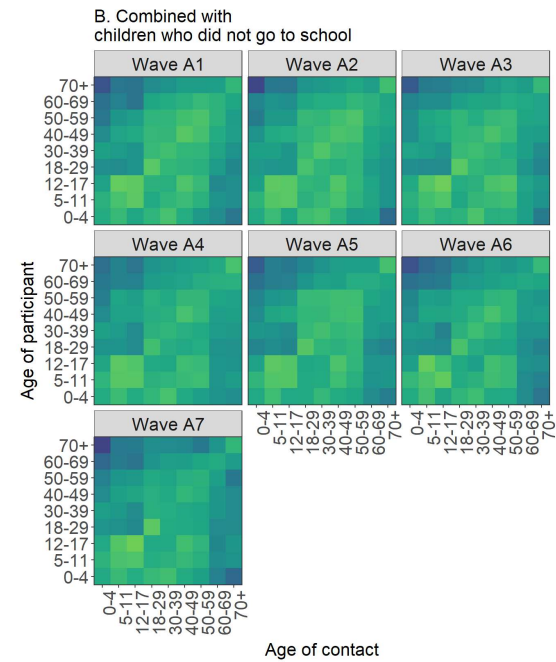
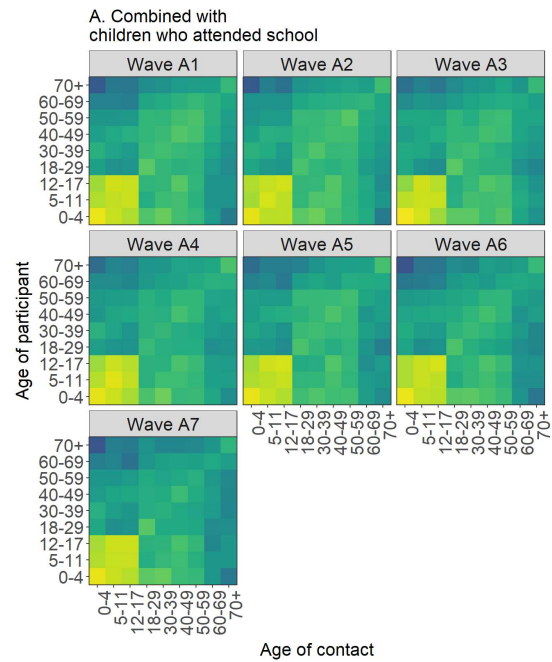
B. children who did not attend school to provide an estimate of overall contacts,

C. Wave C1 (Wave C1 data collected between 08 June 2021 and 15 June 2021), and

D. Wave C2 (Wave C2 data collected between 10 August 2021 and 23 August 2021).

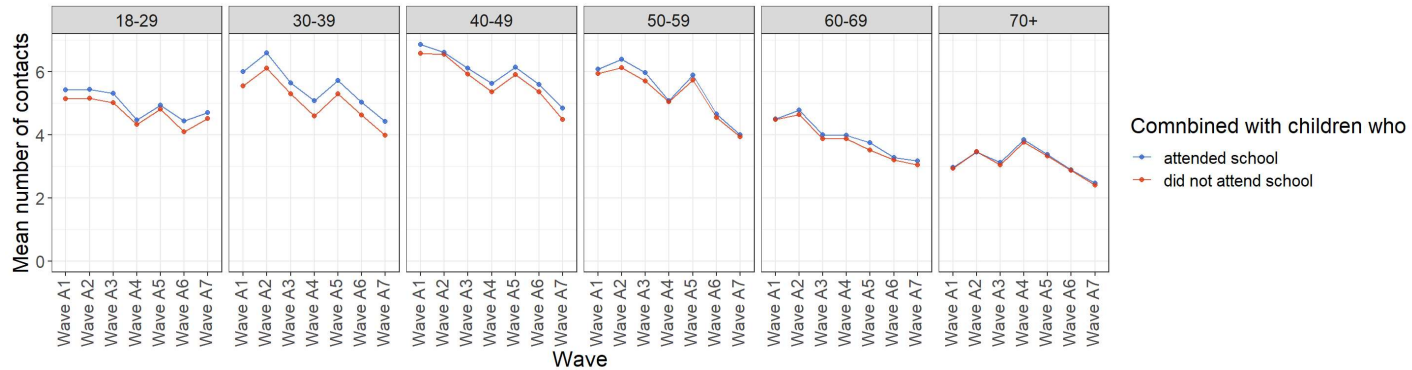
Sub-plots A and B are specific to the different contexts of school attendance, and sub-plots C and D are specific to the data collection periods of Wave C1 and Wave C2, respectively.

Contacts truncated to 50 per participant per day, adjusted for day of week and country population by age using the World Population Prospect population data.



NA and contacts <0.01 are shown in black

**Figure 8. Combined contact means by wave.** Contact means as calculated from symmetric, combined symmetric matrices. Adult survey waves each combined with  
A. children who attended school, and  
B. children who did not attend school.  
Contacts truncated to 50 per participant per day, adjusted for day of week and country population by age using the World Population Prospect population data.



Participant age	A. Combined with children who attended school							B. Combined with children who did not attend school						
	Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7	Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7
0-4	20.24	20.51	21.50	19.96	19.59	20.30	20.37	5.35	5.90	6.10	5.74	5.08	5.49	5.45
5-11	16.66	17.71	18.43	18.42	16.55	16.04	16.58	6.96	7.90	7.23	7.71	7.01	7.36	6.69
12-17	17.19	17.90	16.21	15.91	17.38	17.54	17.07	7.71	7.94	8.47	6.97	7.06	6.71	7.33
18-29	5.43	5.44	5.32	4.48	4.94	4.44	4.71	5.15	5.16	5.03	4.34	4.82	4.11	4.52
30-39	6.01	6.60	5.66	5.09	5.72	5.05	4.43	5.56	6.11	5.30	4.60	5.30	4.63	4.00
40-49	6.86	6.61	6.12	5.64	6.14	5.61	4.85	6.59	6.55	5.93	5.36	5.91	5.37	4.50
50-59	6.09	6.40	5.97	5.08	5.90	4.66	4.00	5.94	6.14	5.72	5.06	5.74	4.56	3.94
60-69	4.51	4.80	4.00	3.99	3.75	3.29	3.18	4.49	4.65	3.88	3.88	3.53	3.21	3.05

Participant age	A. Combined with children who attended school							B. Combined with children who did not attend school						
	Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7	Wave A1	Wave A2	Wave A3	Wave A4	Wave A5	Wave A6	Wave A7
70+	2.98	3.46	3.13	3.85	3.38	2.90	2.48	2.94	3.47	3.05	3.77	3.33	2.88	2.41

**Table 7. Participant contact means by wave.** Contact means as calculated from symmetric, participant to contact symmetric matrices. Adult survey waves each combined with  
A. children who attended school, and  
B. children who did not attend school.  
Contacts truncated to 50 per participant per day, adjusted for day of week and country population by age using the World Population Prospect population data.

## References

1. Jarvis CI, Van Zandvoort K, Gimma A, Prem K, CMMID COVID-19 working group, Klepac P, et al. Quantifying the impact of physical distance measures on the transmission of COVID-19 in the UK. BMC Med. 2020;18: 124.
2. Coletti P, Wambua J, Gimma A, Willem L, Vercruysse S, Vanhoutte B, et al. CoMix: comparing mixing patterns in the Belgian population during and after lockdown. Sci Rep. 2020 Dec;10(1):21885.
3. Mossong J, Hens N, Jit M, Beutels P, Auranen K, Mikolajczyk R, et al. Social contacts and mixing patterns relevant to the spread of infectious diseases. PLoS Med. 2008;5: e74.
4. Sebastian Funk (2020). socialmixr: Social Mixing Matrices for Infectious Disease Modelling. R package version 0.1.7.