

# The effect of social distancing on the reproduction number and number of contacts in the UK from a social contact survey

## Report for survey week 31

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### Summary

- The mean number of contacts recorded has reduced in recent weeks, but remains at approximately the same level as was being recorded in August.
- There is evidence that the introduction of the Tier system has helped reduce contacts, though the effect is modest.
- The data suggest that the gradual increase in contacts as lockdown was eased in the early summer accelerated in August and September, largely driven by changes in work and “other” (mostly leisure) contacts, particularly in younger adults.
- Marked changes in contacts made by children was recorded when schools reopened. These additional contacts occurred at school.
- The data suggest that those with lower socio-economic status increased their contacts (particularly work contacts) more as lockdown was eased.

### Results

#### Impact of “Tiers”

To investigate the impact of tiers we compared the number of contacts reported by individuals just before their area entered a tier to the number of contacts reported shortly afterwards. The closest pairs of observations were identified within two weeks before and after an area changed Tier. Data was only compared for increases in Tiers. Table 1 shows the impact. In general the imposition of Tiers led to minor changes in contacts. Indeed, in each case most individuals recorded the same number of daily contacts after the imposition as before, although more respondents reported a decrease in contacts than an increase. The overall effect on the mean number of contacts is therefore small, though the move from Tier 2 to Tier 3 appears to have made the largest impact, reducing the mean number of daily contacts by 1.45 (Table 1)

**Table 1: Change and paired mean difference in all contacts comparing before and after an area has its Tier increased.**

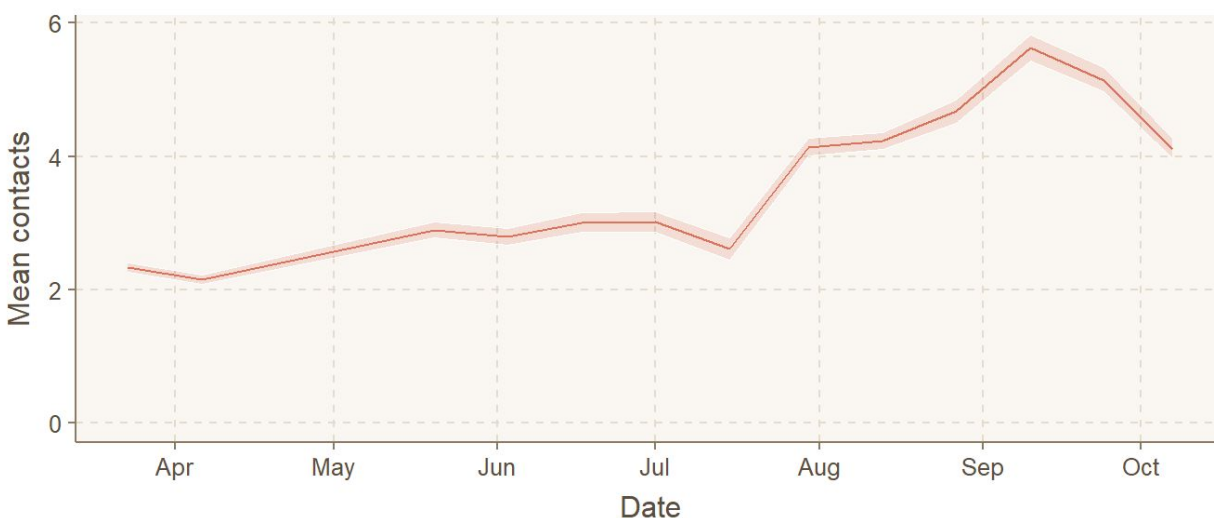
Restriction	Contacts	N	Decreased	Same	Increased	p-value
Tier 1	All	2314	753	899	662	0.008
Tier 2	All	1434	446	663	325	<0.001
Tier 3	All	208	73	91	44	0.005

Restriction	Before	After	Difference	Lower	Upper	p-value
Tier 1	5.07	4.17	-0.90	-1.24	-0.51	<0.001
Tier 2	4.44	3.72	-0.72	-1.16	-0.26	0.002
Tier 3	4.90	3.46	-1.45	-2.67	-0.28	0.01

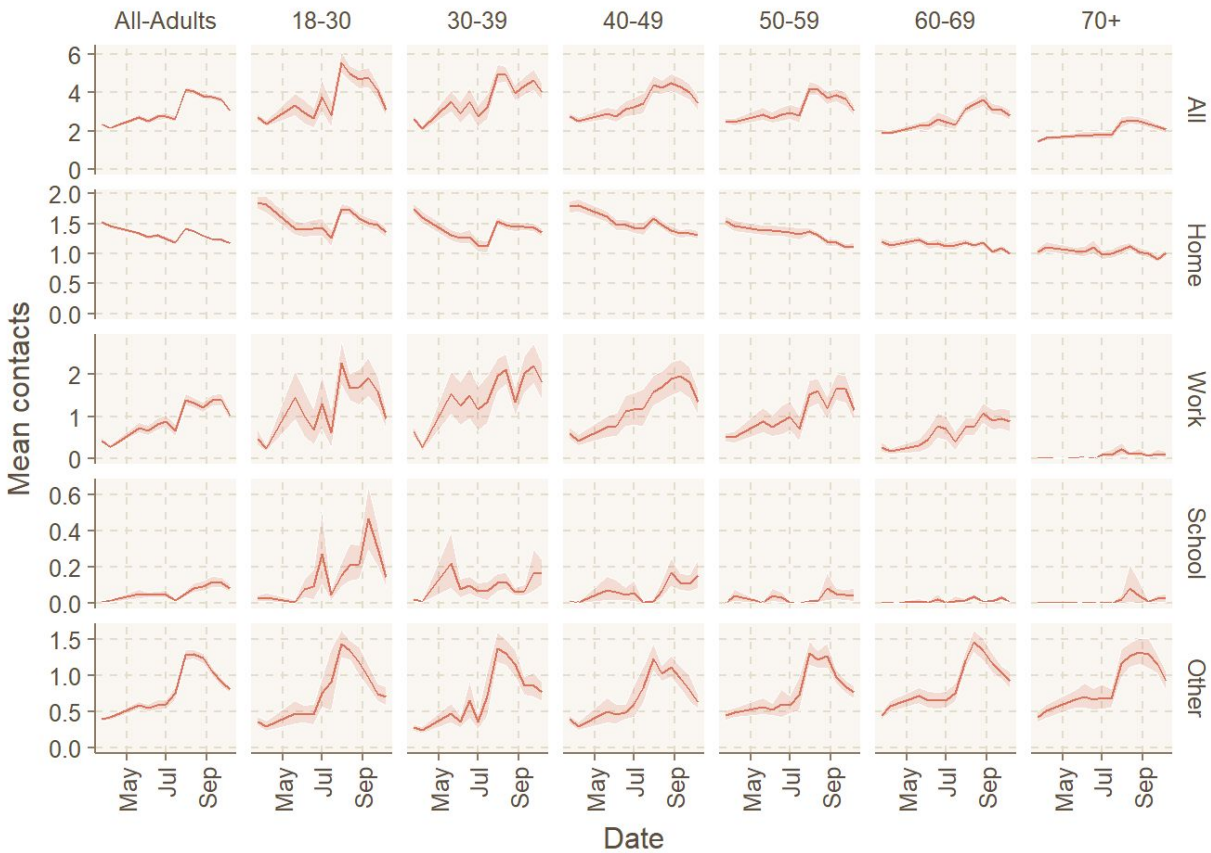
### Changes in mean daily contacts over time

Figure 1 shows how mean overall daily recorded for all age groups has changed since March 2020. Mean contacts increased very gradually from early April to July. Contacts increased more dramatically since July, peaking in mid September. The mean number of recorded contacts has been falling since this point but are still at the levels recorded in August.



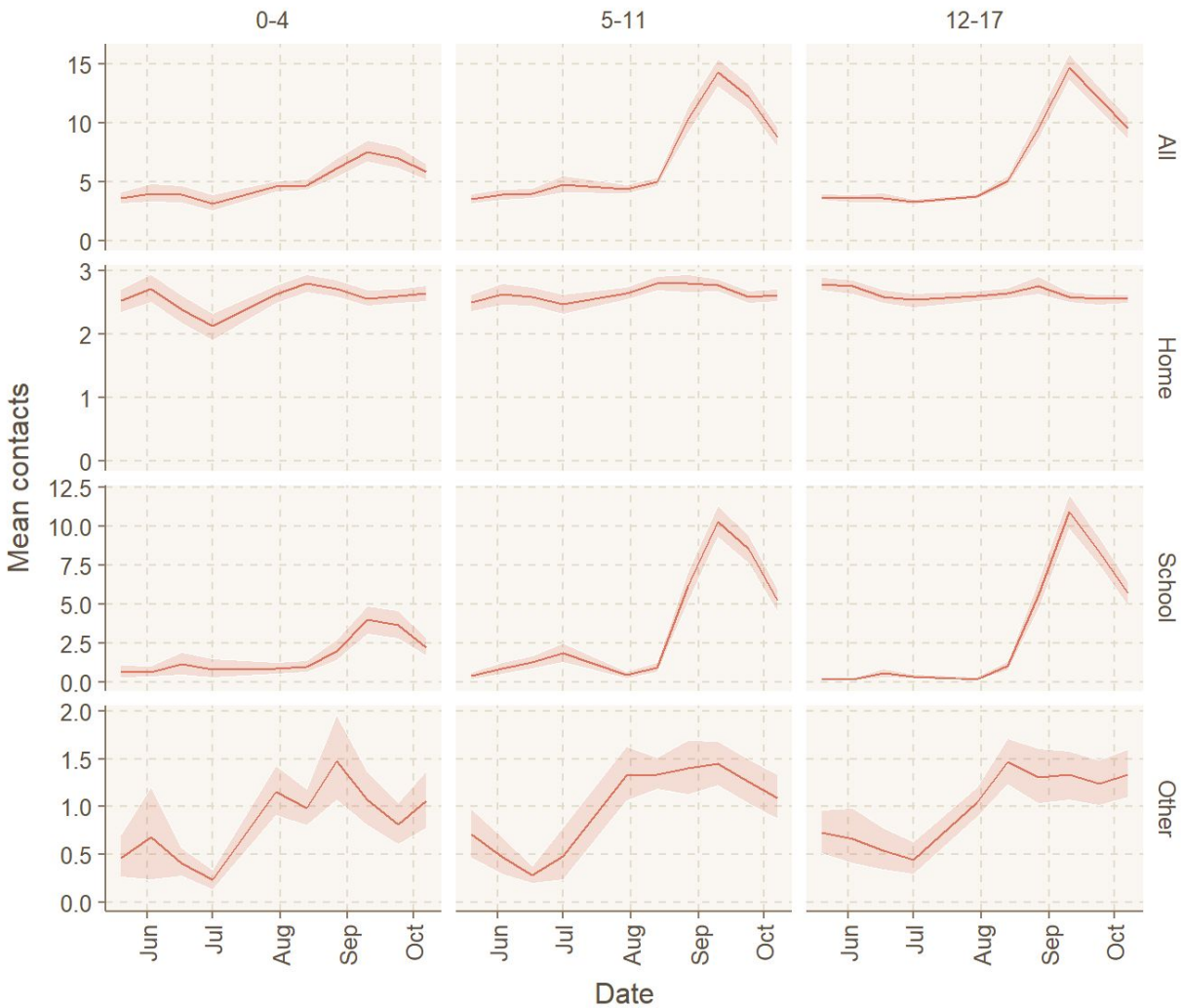
**Figure 1A: Mean contacts in all settings for the UK over time.** Bootstrapped mean contacts weighted to account for weekend effect. Contacts truncated to 50 contacts per participant. Observations are combined to provide one estimate every two weeks.

Figure 2 shows how contacts have changed by setting and age group for adults. The rise in all contacts from August to September is most apparent in younger adult age groups (18-49 years; Figure 2), with a less steep curve for the older age groups. Home contacts have remained stable over time in all age groups. Work contacts have seen small increases driven by ages 18-59. Contacts made in educational settings (marked as “school”) make up a relatively small fraction of adult contacts. Other contacts (which are primarily made up of leisure and entertainment) increased steeply from July onwards and fell during September and October. This pattern is consistent across the age groups.



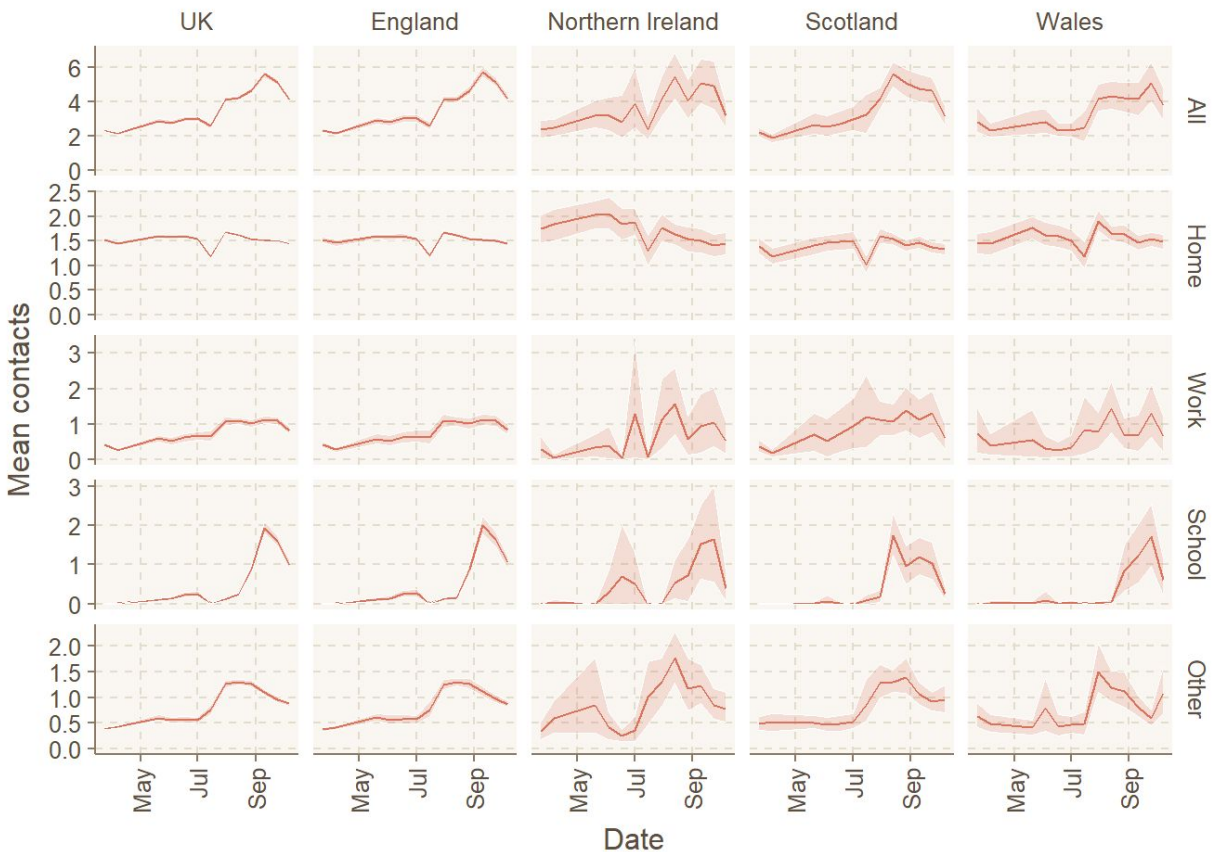
**Figure 2: Setting-specific mean contacts by age group for adults in the UK over time.** The “school” category includes colleges and universities. Bootstrapped mean contacts weighted to account for weekend effect. Contacts truncated to 50 contacts per participant. Observations are combined to provide one estimate every two weeks.

Figure 3 shows the mean contacts over time for individuals less than 18 years. As expected the majority of contacts for children aged 5-17 are at school. School contacts rose to 10 contacts per day on average following schools opening in September. Children's contacts at home have remained stable since June. Other contacts continue to make up a small part of the total contacts children make.



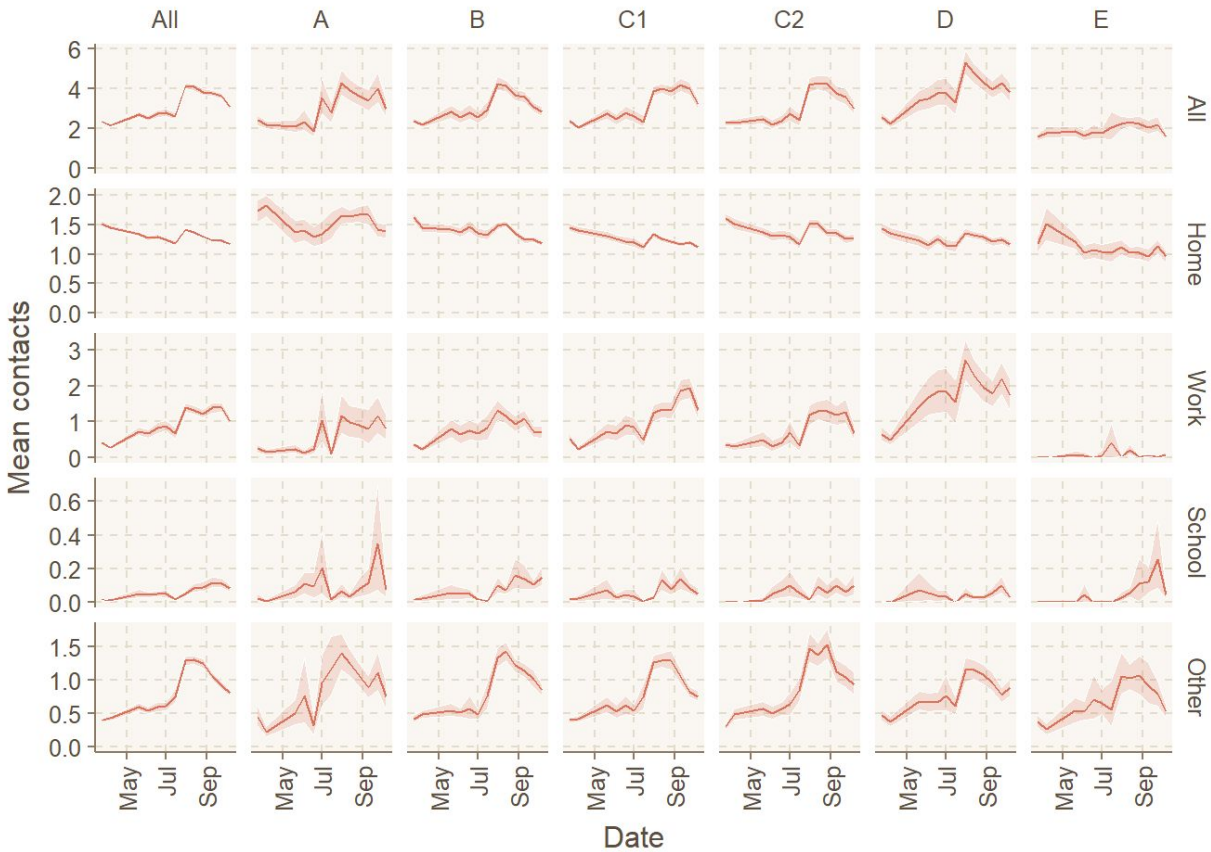
**Figure 3: Setting-specific mean contacts by age group for children in the UK over time.** Children's contacts are reported by a parent as a proxy due to data protection concerns. Bootstrapped mean contacts weighted to account for weekend effect. Contacts truncated to 50 contacts per participant. Observations are combined to provide one estimate every two weeks.

Patterns in all contacts are fairly consistent across the four countries (Figure 4). A low-level of around 2 mean contacts is seen in April through to July, which then increased to nearly six contacts per day. Smaller numbers of observations in Northern Ireland, Scotland, and Wales are seen in the greater level of uncertainty around the estimates.



**Figure 4: Setting-specific mean contacts by country in the UK over time.** Bootstrapped mean contacts weighted to account for weekend effect. Contacts truncated to 50 contacts per participant. Observations are combined to provide one estimate every two weeks.

The number of contacts in all settings has increased since July in all social Grades except Grade E (Figure 5). The largest increase in work contacts can be seen in Grade D. Contacts at home have remained consistent throughout the time period. All grades have reported an increase in other contacts during August, that has declined since September.



**Figure 5: Setting-specific mean contacts for adults by socio-economic status in the UK over time.** Data on mean contacts are presented by NRS Social Grade, which is an occupation-based system. Grade A being Higher managerial, administrative or professional through to Grade D, semi-skilled and unskilled manual workers, and Grade E non-working households. Bootstrapped mean contacts weighted to account for weekends effect. Contacts truncated to 50 contacts per participant. Observations are combined to provide one estimate every two weeks.

## Methods

CoMix is a behavioural survey, launched on 24<sup>th</sup> of March 2020, with a study sample recruited to be broadly representative of the UK adult population. Data is collected weekly, using two different panels each for adults and children who are interviewed using the same questionnaire in alternate weeks. Some survey waves overlap in time due to time required for recruitment and technical factors, but are drawn from different samples. The questionnaires for children are completed by a parent within their household as a proxy. Adult participants are asked to answer the contact questions on behalf of a child in their household, and returning participants will be asked about the same child each week. Participants recorded 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). Further details have been published elsewhere<sup>1</sup>. The contact survey is based on the POLYMOD contact survey<sup>2</sup>. The BBC social contact survey is now used as a baseline for social mixing in the UK under normal conditions<sup>3</sup>.

To investigate the impact of the Tier system, we compare individuals' reported contacts just before their area entered the relevant tier and just afterwards. The closest pairs of observations were identified within two weeks before and after an area changed Tier. Data were only compared for increases in Tiers. If an individual moved from no Tier to Tier 1 to Tier 2 to Tier 3, then for the analysis of Tier 3 only the observations from Tier 2 and Tier 3 were compared. Paired permutation tests were conducted on the differences. We performed two tests, first on the proportion of people who reduced contacts after an increase in Tier, second on the paired mean difference.

We calculated the mean contacts using 1000 bootstrap samples weighted by weekend and weekday and percentile bootstrapped confidence intervals. We applied a weight of 5 for weekday observations and 2 for weekend. We collect data in two panels which alternate weekly, therefore we calculated the mean at 2 week intervals to give a larger number of participants per estimate. We calculated the mean number of contacts in the settings home, work, school (all educational establishments, including childcare, nurseries and universities and colleges), and other. For children (<18 years), any reported work contacts were moved to other. We look at the mean contacts by age, country, gender, and socio-economic status. The mean number of contacts is influenced by a few individuals who report very high numbers of contacts (often in a work context). The means shown here are calculated based on truncating the maximum number of contacts recorded at 50 per individual per day.

We closed the first two panels of the CoMix survey on the 6th of August and started two new panels, Panel E and F. The effect of the change in panels on contacts was explored using Generalised additive models (GAM). The effect of panels, age, and month, are presented in supplementary material.

## References

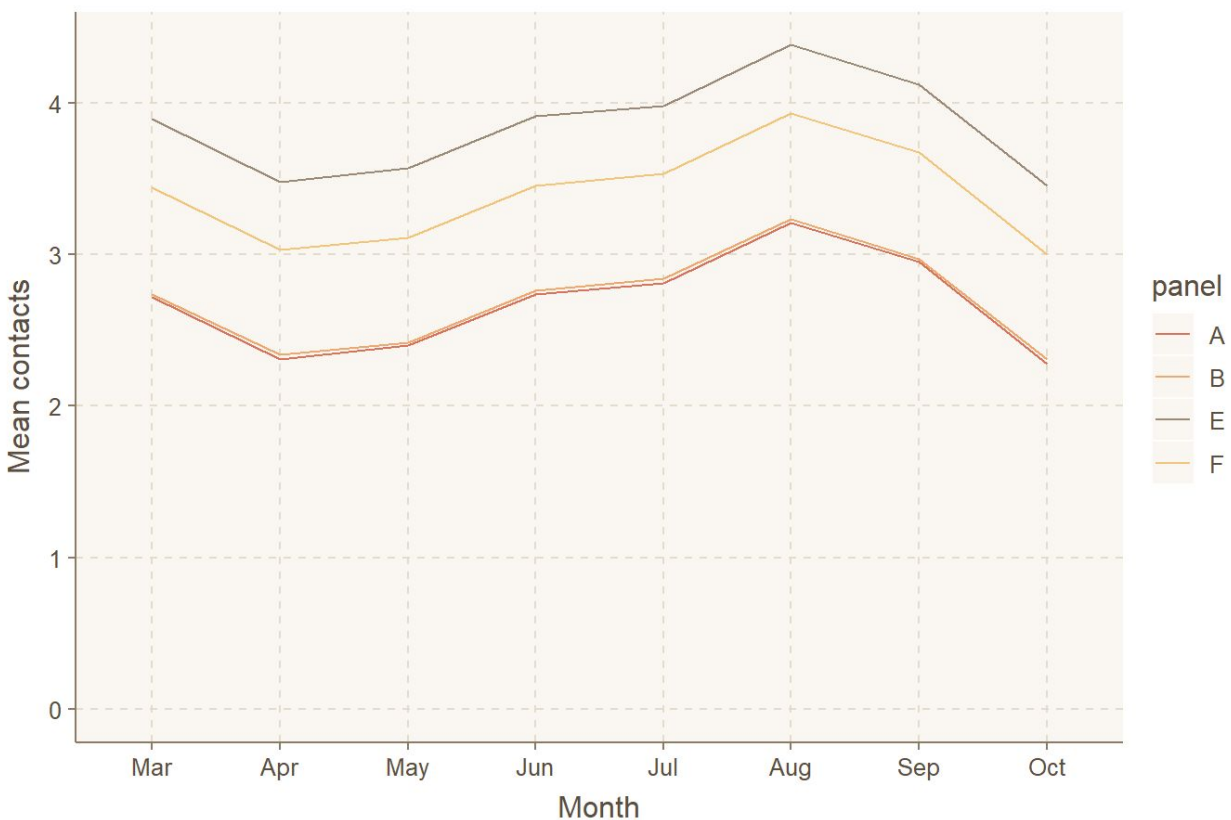
1. Jarvis, C. I. *et al.* Quantifying the impact of physical distance measures on the transmission of COVID-19 in the UK. *medRxiv* (2020) doi:10.1101/2020.03.31.20049023.
2. Mossong, J. *et al.* Social contacts and mixing patterns relevant to the spread of infectious diseases. *PLoS Med.* **5**, e74 (2008).
3. Klepac, P. *et al.* Contacts in context: large-scale setting-specific social mixing matrices from the BBC Pandemic project. *Epidemiology* (2020) doi:10.1101/2020.02.16.20023754.



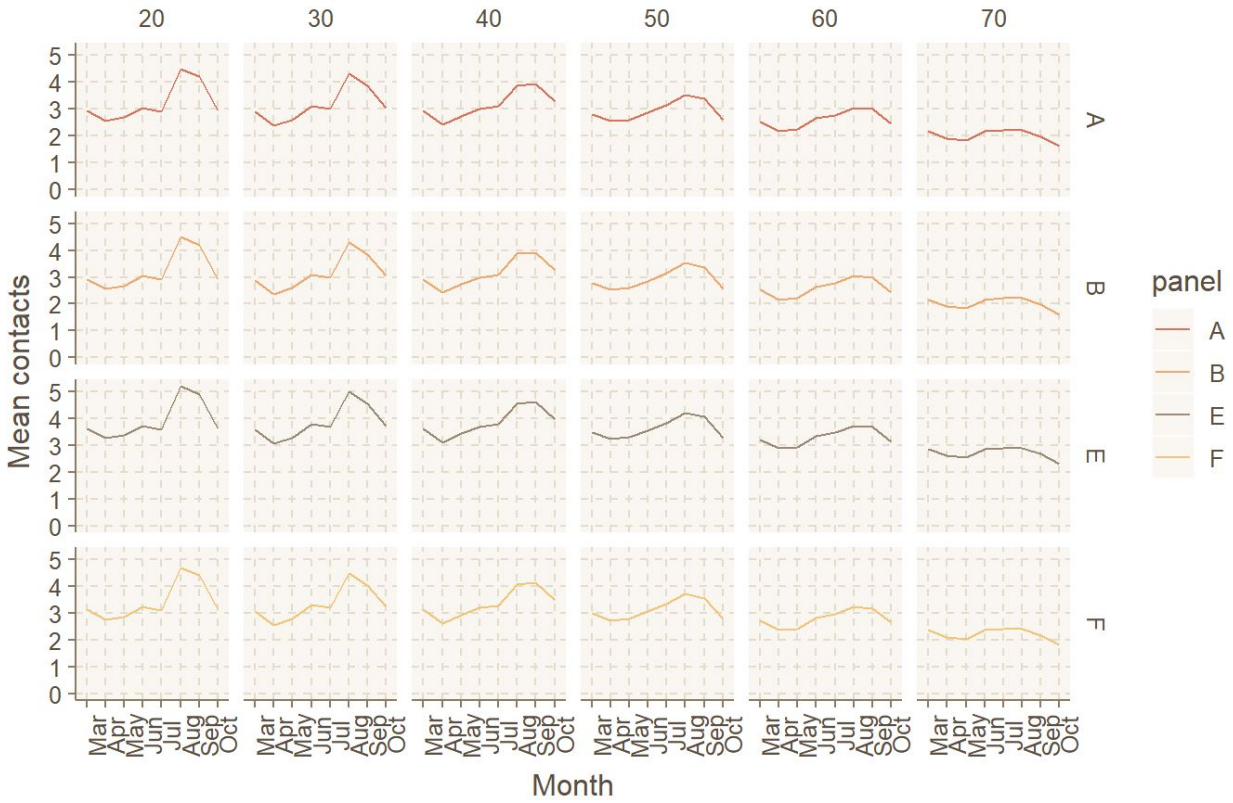
# Supplementary material

## Summary:

- There is an increase of contacts after accounting for the panels effects.
- The relationship between age and number of contacts has changed overtime.
- The increase in contacts seen in overall contacts is only present in ages less than 50 and is most clear in ages 20-29 and 30-39 (labelled 20 and 30 respectively).
- The data are consistent with little difference in contacts between younger and older adults from March to July. In August and September, the data are consistent with younger adults increasing their contacts and a larger difference between younger and older individuals.

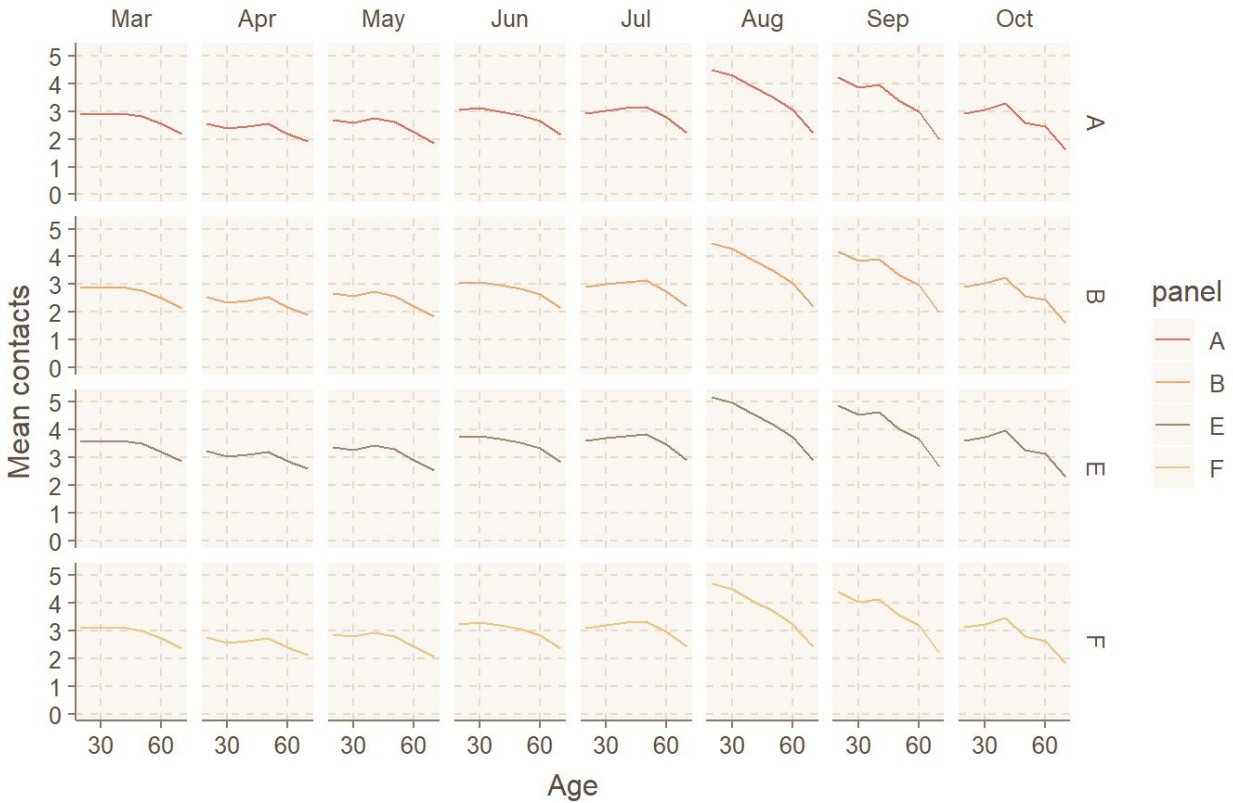


**Figure S1: The effect of CoMix survey panel over time on the mean contacts.** The data were consistent with participants in panel E and F reporting a greater number of contacts compared to panels A and B. Panel A ran from the 23rd of March until the 6th of August, Panel B ran from 1st of April until the 28th of July, Panel E began on the 8th of August, Panel F on the 13th of August. Lines are generated from a GAM model with a random effect for participant a fixed effect for month, and a fixed effect for panel.



**Figure S2: Change in the effect of month on all contacts by age and panel in the UK.**

The data remains consistent with an effect of age and month on mean contacts after allowing or the effect to differ by panel. Contacts were lower in March, with a steeper slope seen in age 20-29 and 30-39 years. Age 70-79 remains quite flat throughout the survey period. The curves were created from a GAM model with hierarchical random effect allowing a different smoothed effect of age within each month, and separate random effects for panel and month.



**Figure S3: Change in effect of age on contacts over time from March to October 2020 in the UK.** The difference in contacts between age groups was largest in the months of August and September. After the 23rd of March through to July the difference in contacts between ages groups was small as can be seen by the flat lines. The marked difference seen in August appears to be flattening in October, suggesting a reduction in contacts in the younger age groups. The curves were created from a GAM model with hierarchical random effect allowing a different smoothed effect of age within each month, and separate random effects for panel and month.