

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

## Report 10

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### Results

We estimate  $R_0$  to be 0.63 (95% CI 0.36 to 0.94) for the UK, 0.57 (95% CI 0.32 to 0.86) for England, between the 28<sup>th</sup> May and 4<sup>th</sup> June. Prior to the 11<sup>th</sup> of May we estimated  $R_0$  to be around 0.5 in the UK (Table 1). The interquartile range remains 1 to 3 for the number of contacts per person. The mean contacts are 3.23 in the UK overall, which is consistent with results since lockdown easement, and a slight decrease in the mean for England to 2.76.

Children's contacts have been described separately from the adult contacts in Table 2. Most reported contacts occurring outside the home are at school, with all contacts closely aligned with household size for children most children not attending school. Roughly a third of parents (10 to 17) who reported their child's school was open reported sending their child to class. Reported class sizes vary from 2 to 50 students, with a mean between 14.8 and 23.3.

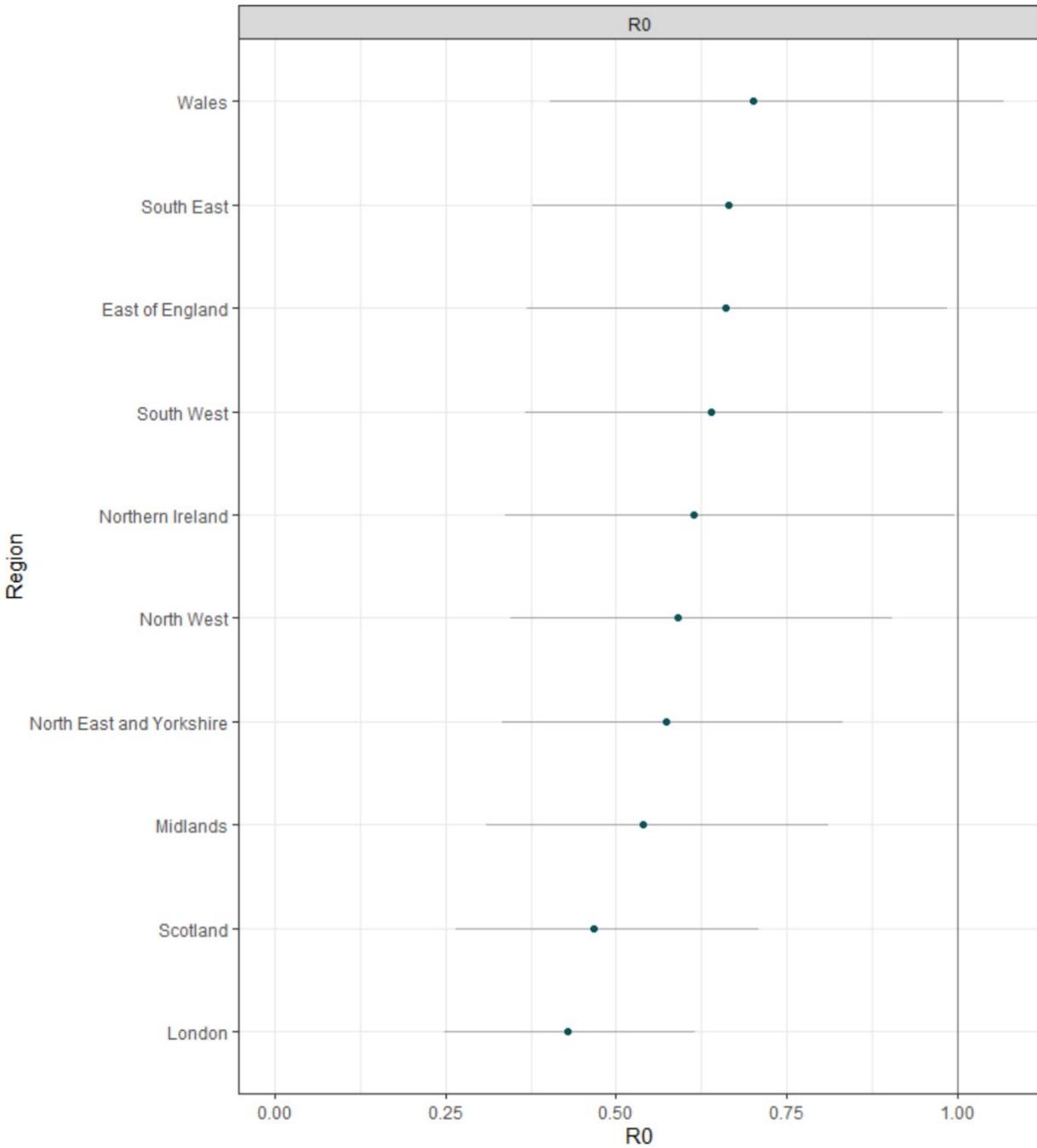
The  $R_0$  estimates for the different regions and countries of the UK are still consistently below one. London and Scotland have the lowest estimate with medians of 0.43 and 0.47. The upper bound for Wales is slightly above one at 1.07, but most of the mass is below one. Despite the variation in the point estimates of the region the values are quite similar when the uncertainty of the estimates is taken into consideration. Furthermore, the study was not designed to give estimates of  $R_0$  by region but to detect differences in contacts between different weeks.

**Table 1. Numbers of participants, reported contacts and reproduction numbers.** Numbers of participants in each panel, their average number of contacts reported and the estimate of the reproduction number,  $R_0$ .

Group	Week	Panel	Dates	Observations	Contacts	Mean (IQR)	HHsize	$R_0$ mean (95% CI)
UK	1,2	A & B	24/03 to 10/04	3,376	8,943	2.64 (1 to 3)	2.72	0.53 (0.33 to 0.75)
UK	9	A	21/05 to 28/05	1,415	4,565	3.29 (1 to 3)	2.44	0.67 (0.38 to 0.98)
UK ( $< 100$ contacts)	9	A	21/05 to 28/05	1,412	4,134	2.93 (1 to 3)	2.45	0.62 (0.35 to 0.91)
England	9	A	21/05 to 28/05	1,208	4,205	3.48 (1 to 3)	2.46	0.71 (0.41 to 1.06)
England ( $< 100$ contacts)	9	A	21/05 to 28/05	1,205	3,683	3.06 (1 to 3)	2.46	0.66 (0.38 to 0.96)
UK	10	B	28/05 to 04/06	1,082	3,498	3.23 (1 to 3)	2.38	0.63 (0.36 to 0.94)
UK ( $< 100$ contacts)	10	B	28/05 to 04/06	1,079	2,733	2.53 (1 to 3)	2.39	0.54 (0.31 to 0.79)
England	10	B	28/05 to 04/06	907	2,252	2.76 (1 to 3)	2.40	0.57 (0.32 to 0.86)
England ( $< 100$ contacts)	10	B	28/05 to 04/06	906	2,506	2.49 (1 to 3)	2.40	0.53 (0.30 to 0.79)

**Table 2. Summary of participants and contacts in child contact survey.** Numbers of participants reporting on behalf of a child in their household in each panel, their average number of contacts reported overall and not home, and class size mean, minimum and maximum.

Description	Week	Participants	Contacts	All contacts Mean (IQR)	Not Home Contacts Mean (IQR)	Class Size Mean (Min to Max)
All	7	564	1740	3.09 (2 to 4)	0.2 (0 to 0)	
	8	507	1650	3.25 (2 to 4)	0.62 (0 to 0)	
	9	512	1992	3.89 (2 to 4)	0.79 (0 to 0)	
	10	359	1407	3.92 (2 to 4)	1.26 (0 to 0)	
Attended school	7	10	53	5.3 (3.25 to 6.75)	2.6 (0 to 3.75)	17.8 (10 to 40)
	8	17	100	5.88 (2 to 7)	4.06 (0 to 4)	16.6 (2 to 50)
	9	10	56	5.6 (3 to 7)	2.9 (0 to 4.75)	23.3 (20 to 30)
	10	16	171	10.69 (2.75 to 15.25)	8.56 (0 to 11.75)	14.8 (4 to 50)



**Figure 1.  $R_0$  estimates by region in the UK.** Combined data from weeks 9 and 10.  $R_0$  assumed that the baseline  $R_0$  estimate followed a normal distribution with mean 2.6 and standard deviation 0.54 everywhere.

**Table 3  $R_0$  estimates by region in the UK.**  $R_0$  scaled assumed that the baseline  $R_0$  estimate followed a normal distribution with mean 2.6 and standard deviation 0.54 everywhere.

Area	$R_0$ Median (95%)
Wales	0.70 (0.40 to 1.07)
South East	0.67 (0.38 to 1.0)
East of England	0.66 (0.37 to 0.99)
South West	0.64 (0.37 to 0.98)
Northern Ireland	0.61 (0.34 to 1.0)
North West	0.59 (0.35 to 0.90)
North East and Yorkshire	0.57 (0.33 to 0.83)
Midlands	0.54 (0.31 to 0.81)
Scotland	0.47 (0.27 to 0.71)
London	0.43 (0.25 to 0.62)

## Methods

CoMix is a behavioural survey, with a study sample recruited to be broadly representative of the UK adult population. It was launched on 24<sup>th</sup> of March 2020 and this analysis includes data collected up to the 4<sup>th</sup> of June. Data is collected weekly, using two different panels each for adults and children who are interviewed using the same questionnaire in alternate weeks. The questionnaires for children are completed by a parent within their household as a proxy. 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, which is used as a baseline for social mixing in the UK under normal conditions<sup>2</sup>. In two panels, 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. The panels started with a sample size of 1,816 in Panel A, 1,560 in Panel B. Final data for Panel B Wave 5 (week 10 of the study) has 1,082 participants and Panel D has .

We calculated the average number of contacts in the settings home, work, school, and other. We sample uniformly between the minimum and maximum age reported for the contact, as we do not record exact ages for contacts. We use the reciprocity of contacts to impute child-adult

contacts from adult-child contacts. We set the age bands for under 18s to 0-4, 5-12, 13-17 to be consistent with the BBC Pandemic study. When excluding children's survey data, we impute child-child contacts using the POLYMOD UK data, setting school-contacts to 0 and adjusting contact in other settings (e.g. home) as observed for adults, and we impute child-adult contacts by reciprocating adult-child reported contacts.<sup>1,3</sup> We take the mean of reciprocated contacts to form symmetric matrices.

We assume that  $R_0$  prior to physical distancing measures were in place follows a normal distribution with a mean of 2.6 and sd of 0.54. We then apply a scaling factor of the ratio of dominant eigenvalues between CoMix and Polymod contact matrices to estimate  $R_0$  under the observed contacts patterns in our study following the approach found in Wallinga et al.<sup>4</sup>. This assumes that all other elements of the Next Generation Matrix remain constant, such as transmissibility by age group, which may not be the case. Uncertainty in the estimates of reduction in  $R_0$  is obtained using 2,000 bootstrap samples of the CoMix and POLYMOD contacts matrices, and applying these ratios to 2,000 sampled values of  $R_0$ .

#### *Estimating $R_0$ by region*

We combined the latest weeks of Panel A (week 9; 1,412 participants) and B (week 10; 1,082 participants) to get estimates in each region. Estimates for child-child contacts were imputed from national POLYMOD data<sup>3</sup>, but scaled accordingly in each region. We used BBC Pandemic data<sup>3</sup> in each region as the baseline of contacts prior to the lockdown. We either assumed  $R_0$  followed a normal distribution with mean 2.6 and standard deviation 0.54 in all regions. The  $R_0$  values were then scaled by the difference between BBC and POLYMOD to allow for direct comparison with the overall POLYMOD  $R_0$  estimate.

## References

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