CoMix report - 1 Dec 2021

The SIMID COVID-19 Modelling group
www.simid.be
www.socialcontactdata.org

Short description

The CoMix survey has been collecting data on behavioral changes in Belgium since April 2020 in a representative sample of the Belgian population. After a break in data collection in summer 2020, the CoMix survey has run non-stop since November 2020, with bi-weekly rounds of data collection. The sample was selected from existing panels of individuals frequently participating in online surveys and selected to be representative of the Belgian population using quotas on age, gender and region of residence. Participants' age, education level and occupation were recorded, together with information regarding their socio-economic status, health status, whether they experienced symptoms, attitude towards and adherence to intervention measures. During the survey day, participants were asked to report all contacts made on a given day between 5 am that day until 5 am of the next day. A contact was defined as an in-person conversation of at least a few words, or a skin-to-skin contact. Information on the location was collected using pre-specified locations (home, work, school, leisure activities, other places) and specifying whether the contact took place in open air or indoors.
Additional information about the CoMix survey in Belgium can be found in Coletti et al. [2] and information on the CoMix survey in Europe can be found in Verelst et al. [4].

Survey main results

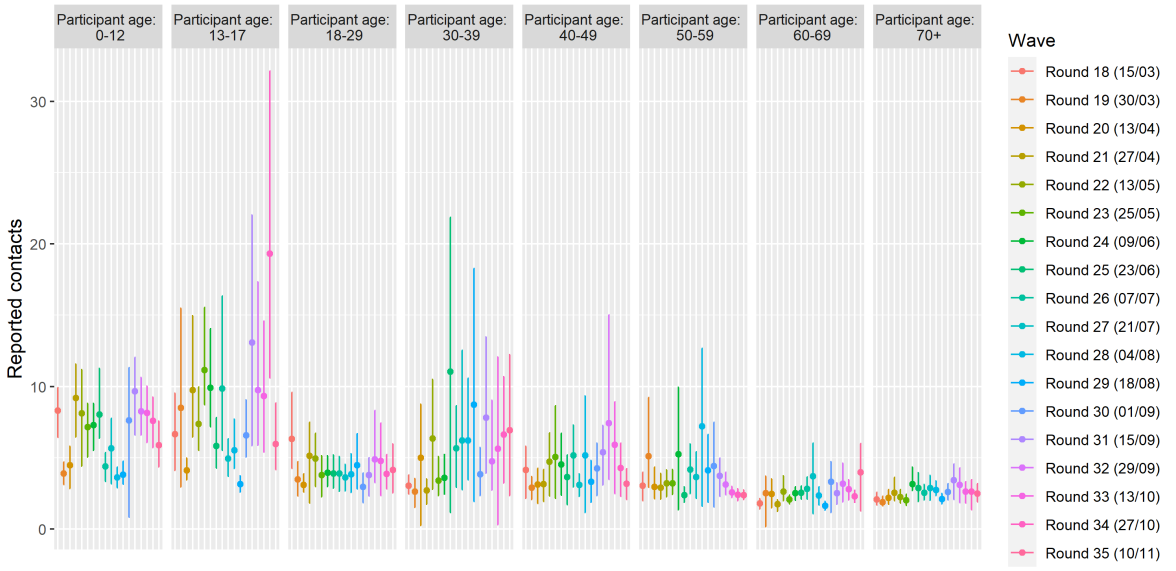

Figure 1: Visualisation of weighted averages of all contacts with time for the last 18 waves for different age-groups.

Some exploratory data analysis was conducted on some important variables to see the association between each covariate and the number of contacts made, in order to gain a better understanding of

the CoMix survey data.

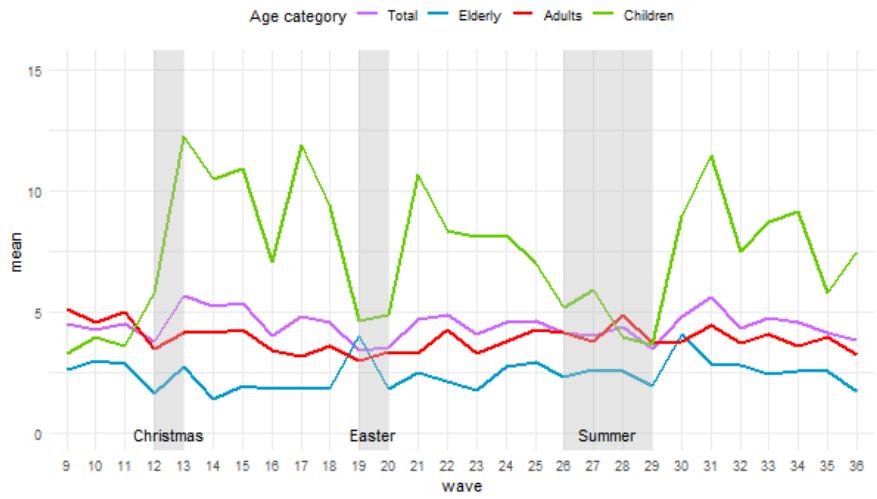

Figure 2: Mean number of contacts in Belgium for all participants, elderly only (>70 year), adults only (18-69 year), and children only (<18 year) and visualized in *purple*, *blue*, *red*, and *green*, respectively.

Figure 2 shows the mean number of contacts for the survey's participants split by three categories, namely, elderly, adult and children. It can be observed that on average, children have more contacts in comparison with adults and elderly. It can also be observed that adults have less variability in the mean number of contacts over time in comparison to children and elderly. When looking at the Easter and Summer holiday, it is worth noticing that the summer holiday had a large impact on the mean number of contacts of children.

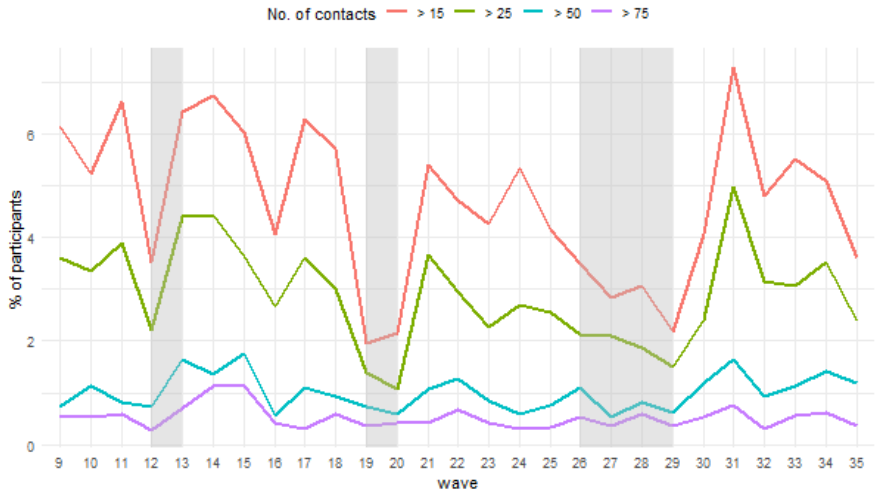

Figure 3: Percentage of individuals reporting high numbers of daily contacts over time

The percentage of individuals reporting more than 15 contacts in a day varied and is shown in Figure 3. It can be seen that the percentage of individuals that report a high number of contacts is always below 10%. The percentages of individuals reporting many contacts are decreasing during the beginning of Christmas, Easter and during summer holiday, and it has increased in waves 31-32.

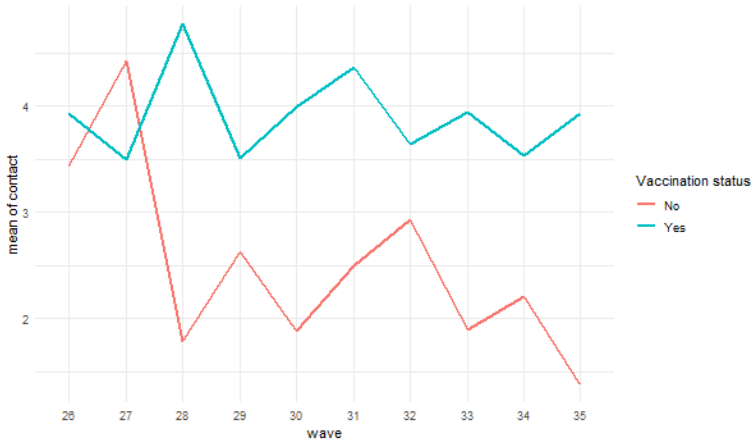

Figure 4: Mean of contacts in Belgium for vaccinated (*blue*) and unvaccinated individuals (*red*).

The mean number of contacts for vaccinated and unvaccinated survey participants (leaving out children) is shown in Figure 4, i.e., from July onwards. Note that the number of vaccinated and unvaccinated individuals in the study ranges from roughly 800 to 1000 and 75 to 150 participants, respectively. It can be seen that the number of contacts for vaccinated individuals is higher than for unvaccinated individuals. Preliminary modelling results acknowledging different potential confounders show that this effect is significant.

Figure 5: Mean number of contacts for survey participants wearing mask *(blue)* and not wearing mask *(red)* the day before the survey.

Figure 5 depicts the mean number of contacts for children, adults and elderly who wore masks the day before the survey and those who did not. Especially adults wearing masks made more contacts compared with adults who did not.

COVID-19 risk perception was also investigated in this study by giving the participants 3 questions. The questions are whether (1) Coronavirus would be a serious illness for me, (2) I am likely to catch coronavirus, and (3) If I do not follow the government's advice, I might spread coronavirus to someone who is vulnerable. The participants had to answer to what extent they agree or disagree with the given statement. The answers were divided into 6 categories: do not know (only for waves 9-11), strongly agree, tend to agree, neither agree nor disagree, tend to disagree, and strongly disagree. In these analyses, for each question, the responses were re-classified into disagree (from tend to disagree

and strongly disagree), neither agree nor disagree (don't know and neither agree nor disagree), agree (from tend to agree and strongly agree).

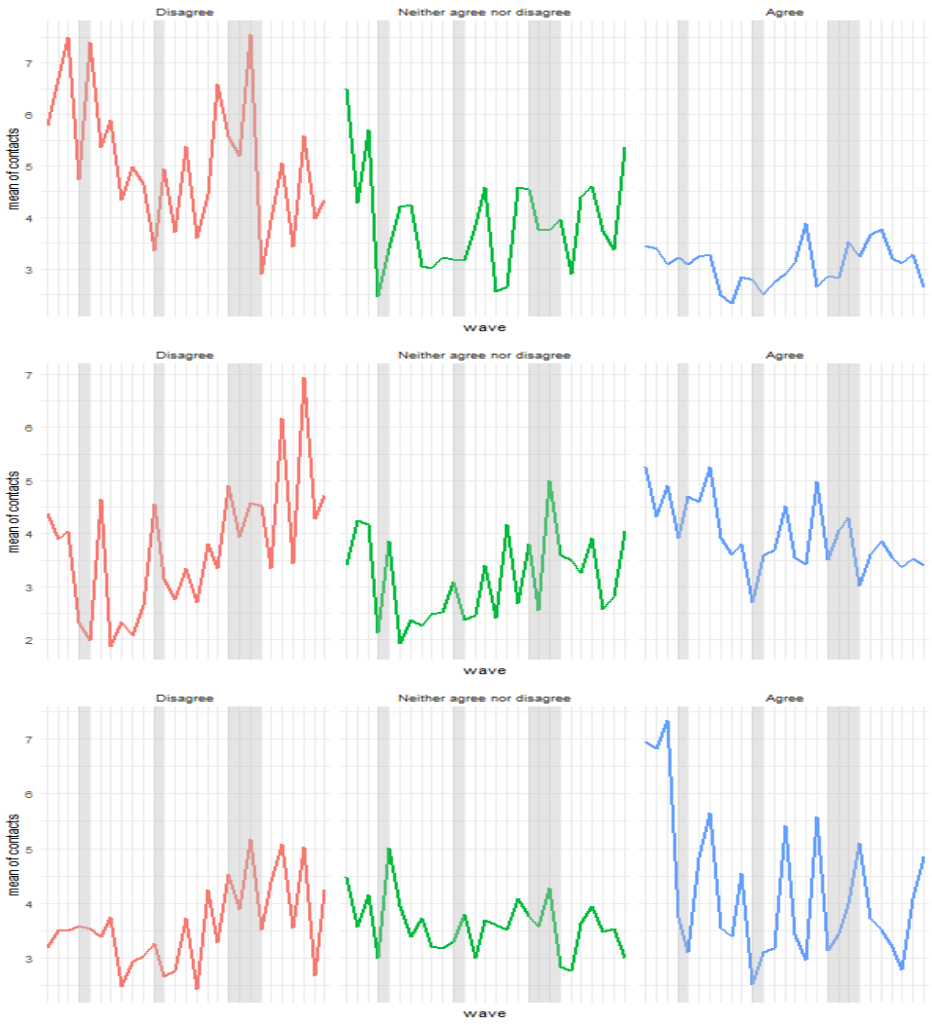

Figure 6: First row: mean number of contacts for individuals whose answer the question "*Coronavirus would be serious illness for me*". Second row: mean number of contacts for individuals whose answer the question "*If I don't follow the government's advice, I might spread coronavirus to someone who is vulnerable.* Third row: mean number of contacts for individuals whose answer the question "*I am likely to catch coronavirus*"

Figure 6 (first row) shows a mean of contact for the individuals attitude, in which considering that coronavirus would be a serious illness with three levels of responses. It can be observed that individuals who believe the coronavirus will not cause serious illness have a higher mean of contact, followed by neither agree nor disagree and agree. Figure 6 (second row) depicts the participants' reactions to the government's advice on keeping the disease from spreading to the vulnerable group. It can be seen that the mean of contacts for people disagreeing or having a neutral perception of the latter statement is increasing, whereas the number of contacts made by the people who agree with the statement is stable with little fluctuation. Figure 6 (third row) time shows that the average number of contacts from individuals who disagree that they will likely catch coronavirus is increasing, whereas the number of contacts from those who have a neutral response decreases (especially in the later wave's of the study period). Moreover, the average number of contact from attendance agreeing that they are likely to catch coronavirus is highly fluctuating around 4 contacts throughout the study period.

Link to modelling work

Stochastic model

The social contact data of the Belgian CoMix survey has been pivotal in the SARS-COV-2 transmission model we developed to study the first lockdown in 2020 and possible exit-strategies [1]. Temporal contact patterns are the core of this stochastic age-structured model, which is calibrated on early sero-prevalence data and continuously updated based on daily hospital data. We have been using this model to perform many scenario analyses on social contact behaviour starting from the observed patterns within CoMix. Results have been published in Technical Notes and made publicly available on the covid-en-wetenschap website. For each wave, we estimate age-specific q-parameters (i.e., proportionality factors) to translate social contact data into transmission rates, with estimated social contact rates used as a proxy for effective contacts enabling disease transmission and proportionality factors adjusting for other factors that influence this relation. This captures, among other things, age-specific susceptibility and risk behavior during social contacts.

Next generation approach

Franco et al. [3] used the next generation approach to estimate age specific effects. An update of their results is shown in Figure 7.

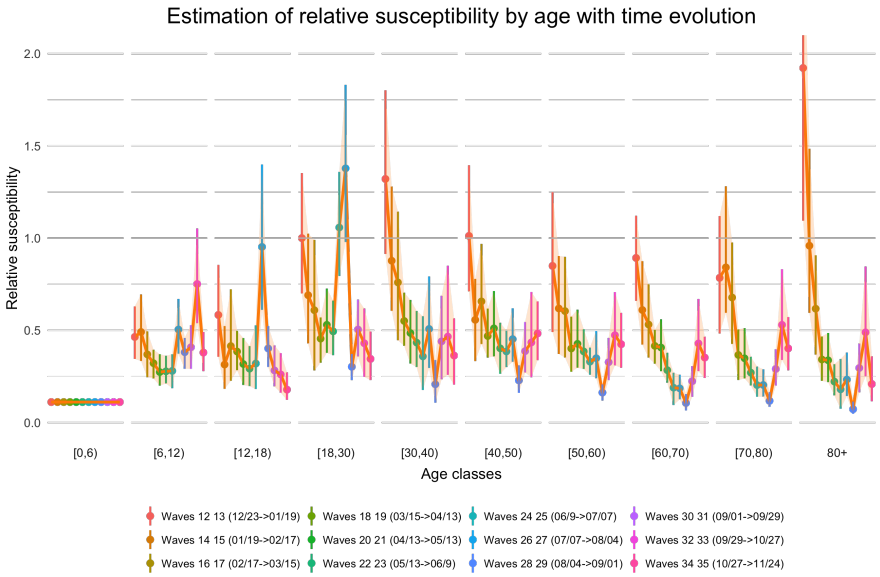

Figure 7: Susceptibility estimated by comparison between CoMix social contact data (using next generation approach) and positive PCR tests. Susceptibility means here a factor influencing transmission not limited to clinical susceptibility but including effects like risk behavior and vaccination. Results are relative numbers normalised against the [0,6) age-class. Limitation: incidence calculated based on cases by PCR are subject to biases.

Figure 7 shows the evolution of relative susceptibility (relative probability of acquiring an infection during contact) by age groups over CoMix waves. Initially, adults were dominant but their relative susceptibility dropped well below that of [6,12) simultaneously with the vaccination campaign. From around September 2021, the relative susceptibility of the older age groups increased as an indication of waning of immunity. Waves 34-35 show a first potential sign of a 3rd dose being administered (larger drop in 80+).

Acknowledgements

This project has received funding from the European Union's Horizon 2020 research and innovation programme - project EpiPose (Grant agreement number 101003688) and from Sciensano (R-11625).

The SIMID CoMix group consists of James Wambua, Neilshan Loedy, Lisa Hermans, Nicolas Franco, Pietro Coletti, Lander Willem and Sarah Vercruysse Philippe Beutels & Niel Hens.

We gratefully acknowledge the CoMix working group at the London School of Hygiene and Tropical Medicine for the collaboration within EpiPose.

References

[1] Steven Abrams, James Wambua, Eva Santermans, Lander Willem, Elise Kuylen, Pietro Coletti, Pieter Libin, Christel Faes, Oana Petrof, Sereina A. Herzog, Philippe Beutels, and Niel Hens. Modelling the early phase of the belgian covid-19 epidemic using a stochastic compartmental model and studying its implied future trajectories. *Epidemics*, 35:100449, 2021.

[2] Pietro Coletti, James Wambua, Amy Gimma, Lander Willem, Sarah Vercruysse, Bieke Vanhoutte, Christopher I. Jarvis, Kevin Van Zandvoort, John Edmunds, Philippe Beutels, and Niel Hens. Comix: comparing mixing patterns in the belgian population during and after lockdown. *Scientific Reports*, 10(1):21885, Dec 2020.

[3] Nicolas Franco, Pietro Coletti, Lander Willem, Leonardo Angeli, Adrien Lajot, Steven Abrams, Philippe Beutels, Christel Faes, and Niel Hens. Inferring age-specific differences in susceptibility to and infectiousness upon sars-cov-2 infection based on belgian social contact data. *medRxiv*, 2021.

[4] Frederik Verelst, Lisa Hermans, Sarah Vercruysse, Amy Gimma, Pietro Coletti, Jantien A. Backer, Kerry L. M. Wong, James Wambua, Kevin van Zandvoort, Lander Willem, Laurens Bogaardt, Christel Faes, Christopher I. Jarvis, Jacco Wallinga, W. John Edmunds, Philippe Beutels, and Niel Hens. Socrates-comix: a platform for timely and open-source contact mixing data during and in between covid-19 surges and interventions in over 20 european countries. *BMC Medicine*, 19(1):254, Sep 2021.