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Study protocol

Adherence to restrictions in social gathering size to curb the spread of SARS-CoV-19

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Abstract

Limitations on the size of private gatherings is extensively used to limit the spread of SARS-CoV-2, the virus that causes COVID-19. This measure is typically implemented in conjunction with other restrictions, and evaluated jointly with these, using measures of SARS-CoV-2 spread and illness as outcomes. Little is known about the actual adherence to changes in recommendations and regulations restricting the size of social gatherings. In September 2020, the permitted size private gatherings was reduced from 20 to 10 in the Norwegian capital Oslo, while it remained unchanged at 20 in the rest of the country. We estimate the effect of this change on students' propensity to meet with at least 20 peers in a private gathering, using data from the biweekly "Corona Campus" study. A difference-in-difference design allows us to net out shared time trends and baseline regional differences, eliciting causal estimates of change in guidance on the frequency of private gatherings of more than 20 peers.

Background

Social distancing restrictions have been crucial in attempts to reduce the spread of SARS-CoV-2, the virus that causes COVID-19, based on observational evidence and logical arguments (Chu et al. 2020, Fong et al. 2020, Fretheim et al. 2020, Jefferson et al. 2020). In periods of high transmission, countries across the world have recommended or regulated a cap on the number of people that can meet privately. When transmission rates are high, governments tend to implement multiple measures simultaneously. This approach seems to have an effective approach to reducing the spread of disease, based on observational data from countries in the early stages of the pandemic (Jüni et al 2020). The emergency response was typically a combination of public health measures, making it difficult, to disentangle the relative contribution of each component (Jüni et al 2020). The observed effects are likely a direct result of changes in behaviour, as indicated by mobile data analyses showing that such restrictions reduce overall mobility (Gupta et al. 2020). Again, distinguishing the effect of each component has proven more difficult. Dave et al. (2020) suggests, also based on mobile data, that shelter-in-place orders increased the time spent at home, and reduced the spread of SARS-CoV-2 with 19 to 24 per cent.

Large private gatherings are important drivers of the COVID-19 pandemic, and a cap on the number of people that can meet privately could potentially control spread significantly. In particular, motivating young adults to uphold social distancing measures is an important challenge in curbing the spread of the virus. Young adults perceive risk of infection as low, and find their newfound autonomy restricted by distancing measures (Nagata, 2020). Mechanisms for compliance with restrictions, and changing restrictions, are poorly understood. Leary et al. (2020) found no effect on self-reported behaviour in a randomized trial of a web campaign for social distancing, though they suggest that a more credible source might have yielded a higher impact.

In Norway, national recommendations advise against gatherings of more than 20 people privately (Directorate of health, 2020). September 22nd this year, the authorities in the capital city, Oslo, instituted local regulation banning private gatherings of more than 10 people (Norsk Lovtidend, 2020). For most other parts of Norway, national guidance still applied.

We want to assess whether the regulation in Oslo reduced the propensity of university and college students to gather in groups of 20 or more.[1] A difference-in-difference design with pre measurements and unaffected regions as controls allows us to account for important confounders in trying to elicit the causal effect behaviour change.

We also explore the nature and consequences of social distancing. Knowing that social gatherings are linked to alcohol use among young adults, we test if the stronger social distancing rules have reduced the frequency of binge drinking. Furthermore, previous studies have shown social distancing to have negative consequences for mental health and wellbeing (Banks & Xu, 2020; Oosterhof et al. 2020). In our sample, we assess these effects by estimating effects on a measure of quality of life using the same difference-in-difference design.

[1] https://www.aftenposten.no/osloby/i/rgLX60/byraadet-strammer-inn-her-er-de-nye-smitteraadene-for-oslo; https://www.nrk.no/nyheter/innforer-tiltak-i-oslo-1.15169388; https://www.dagbladet.no/studio/nyhetsstudio/5?post=43281

Methods and data

The leadership at 14 higher learning institutions in Norway agreed to take part in a study to assess the association between in-person instruction and SARS-CoV-2 risk (the Campus & Corona study, Fretheim et al. 2020). All students at institutions that have agreed to participate receive an SMS (alternatively an e-mail) inviting them to take part in the study. The invitation includes a link that directs them to a web-based informed consent-form and questionnaire. We prepared an English version of the questionnaire for students who prefer English over Norwegian. For more details on the survey, see Fretheim et al. (2020).

We asked participants if they have met with 20 or more people over the last 14 days, as well as other questions related to social interaction, including frequency of heavy drinking (Babor et al. 2001) and a simple measure of life satisfaction. We also inquired about testing and test results for SARS-CoV-2, and other risk factors and background variables that may be included as potential adjustment factors (confounders) in the analyses (see Fretheim et al. 2020, Attachment 1).

Students have been surveyed every two weeks by new invitations by SMS or e-mail. The first invitations were sent Friday 4th of September, followed by a second wave (September 18th), third (October 2nd) and fourth (October 16th) wave. We plan for a study period that lasts for the remainder of 2020.

To identify effects of changing regulations of private gatherings, we utilize the local change in Oslo, effective from September 22nd, banning private gatherings with more than 10 participants (Norsk Lovtidend, 2020). The general advice for Norway, with some limitation for local outbursts elsewhere, was to limit gatherings to 20 people (Directorate of health, 2020).

This change invites evaluation in a simple difference-in-difference design or controlled before-after design, a where we compare the change in the propensity to meet 20 people for those enrolled in higher education in the Oslo area, with the corresponding change in areas with no change in restrictions. Areas with other local restrictions (e.g. Bergen and Østfold) will be excluded from the control group. Wave 1 will constitute the pre-measurement, and Wave 2 the post measurement. Until further substantial changes occur in the treatment or control group, we can use data from subsequent waves to investigate if the change is persistent. The basic difference-in-difference estimator is (Angrist & Piscke, 2009):

$$Outcome_{i,t} = \beta_1(\mathrm{X_{Oslo,i,t}} * \mathrm{X_{Wave2,i,t}}) + \beta_2 X_{Wave,i,t} + \beta_3 X_{Oslo,i,t} + e_{i.t}$$

Where $X_{Wave,i,t}$ is a dummy variable set to 1 for the second wave (netting out shared time trends), $X_{Oslo,i,t}$ is a dummy variable set to 1 for being enrolled in education in Oslo (netting out base differences in the level). β_1 is the coefficient of interest, capturing the difference in change in behaviour in Oslo relative to areas with unchanged restrictions. We estimate this equation for our main outcome, as well as for related outcomes. We will also include (exogenous) controls and fixed effects for educational institutions (there are more than one institution in Oslo). Standard errors will be clustered at the individual level if possible, alternatively across institution and wave (Cameron & Miller, 2015).

Our outcomes of interest are:

Main outcome:

- Having met with 20 or more people in the last 14 days

Secondary outcomes:

- Life satisfaction ("Overall, how satisfied are you with life right now?")
- Frequency of heavy drinking of alcohol
- Testing positive for SARS-CoV2

The primary outcome is meeting 20 persons or more. Such gatherings were legal adhering to the old rules, but out ruled by the new restrictions in Oslo. If students adhere to the change in regulations, the proportion meeting 20 or more persons should decline more in Oslo than in other areas. Effects on both large gatherings and frequency of heavy drinking would indicate that large gatherings linked to binge drinking are reduced. Furthermore, we test for effects on viral spread (positive SARS-CoV-2-tests), as reducing spread was the ultimate aim of social distancing. With the current rate of COVID-19 incidence, we are unlikely to detect credible effects for this outcome.

Our main results include presenting plots illustrating change in the treatment and control regions, simple mean diff-in-diff (DiD) estimates, and DiD-estimates with added exogenous controls.

We will also estimate the DiD equation for related outcomes, such as quality of life and alcohol use. Significance tests will be conducted at the 5 per cent level. In addition, we will conduct sub group analyses based on gender, age groups, and possibly other background variables depending on availability (e.g. field of study, year of study, sociodemographic background characteristics).

Our data does not allow detailed inspection of pre-trends. In lieu of this, we will conduct robustness tests on the conditional balance of the treatment and control group, estimating the DiD equation on exogenous controls. If sufficient power, we will also estimate "reform effects" for all possible combinations of institutions, giving a combination of reform and "placebo" effects. If a true effect exists, it should be found in the to 5% of this distribution of true and placebo effects. This latter method is based on the logic of synthetic control groups (Abadie, Diamond & Hainmueller, 2010).

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