The Contextual Determinants of Social Contacts During the Corona Pandemic

The HOPE project (www.hope-project.dk)

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Introduction

To understand the underlying motivations of protective behavior during the COVID-19 pandemic, it is useful to distinguish between *intrinsic* and *extrinsic* motivations (Reiss, 2012). Intrinsic motivations reflect that citizens see protective behavior as an important matter. This can be due to either personal motivations to protect oneself or as a societal obligation to protect the society as a whole. Extrinsic motivations, on the other hand, reflect that protective behavior during the COVID-19 pandemic is regulated by rewards and costs that are often material in nature. With regards to the COVID-19 pandemic, this is especially seen as sanctions related to a lack of compliance with the restrictions put in place by authorities and governments.

Both intrinsic and extrinsic motivations will vary over time. Intrinsic motivation might be affected by factors that signal an increasing severity of the epidemic, such as rising infection numbers or a rising number of deaths. Furthermore, The World Health Organization (2020) has also pointed out that intrinsic motivation can decrease over time due to fatigue and a lack of wellbeing caused by the restrictions (see also Lindholt et al. (2021) and Petersen et al. (2021)). Thus, strong extrinsic motivations driven by severe restrictions can, as time goes by, crowd out intrinsic motivations.

In this report, we therefore analyze how contact behavior is affected by time, stringency and severity of the pandemic.

Methods and Materials

Data

We fielded quota-sampled surveys in eight countries (N = 128,012) from April 9, 2020 until July 20, 2021: Denmark, France, Germany, Hungary, Italy, Sweden, the United Kingdom, the United States. These countries were chosen to represent a diversity of national responses to the COVID-19 pandemic as well as a diversity in the severity of the local epidemic. Data are collected one or two times per month in rounds of 500 respondents per country. In each of the eight countries, the survey company Epinion sampled adult respondents using online panels. The survey was conducted in accordance with the guidelines of the Danish National Committee of Health Research Ethics for survey research that do not involve human biological material and all participants provided informed consent. Survey respondents were quota sampled to

match the population margins on age, gender, and geographic location for each of the eight countries.

Measurement

We measure contact behavior using the following question: *"We are interested to hear how many people you have been physically close to in the past 24 hours. Physically close is understood here as closer than 2 meters for at least 2 minutes. Please give us your best estimate. If you were not close to anyone, then please write 0 in the fields below".* Respondents were asked to indicate the number of contacts in the past 24 hours with both friends, family, colleagues and strangers. Table 1 provides an overview of question wordings for these measures of contact behavior.

Table 1. Measures of contact behavior

	Questions	**Values**
Friends	How many friends and acquaintances (people whose name you know) have you been physically close to?	Numeric
Family	How many family members, which you do not live together with, have you been physically close to?	Numeric
Colleagues	How many colleagues have you been physically close to?	Numeric
Strangers	How many strangers have you been physically close to?	Numeric

Note: Physically close is understood here as closer than 2 meters for at least 2 minutes in the past 24 hours.

In the recoding of our contact measures, we do the following: (1) we ceil off each of the underlying measures at the 99.9th percentile to exclude respondents who might be misreporting their actual behavior[1], and (2) recode these contact measures into indicator variables (0 for 0 contacts; 1 for more than 0 contacts). Dichotomizing these measures reduces noise and makes it possible to focus on whether people follow a strict interpretation of the recommendation about minimizing the number of social contacts. Finally, we also create a measure of total contacts. This measure is also recoded into an indicator variable (0 for 0 contacts in all contact categories; 1 for more than 0 contacts in at least one of the four categories). Thus, the measure

[1] Since the contact measures are the only questions in the survey where people are asked to give a numeric input, this is a most likely case for identifying so-called "survey trolls" in our survey (Lopez & Hillygus, 2018).

of total contacts captures the share of respondents who has at least one contact at a given point in time.

Correlates of contact behavior

To assess macro-level correlates of contact behavior, we measured the stringency of government COVID-19-policies using the Oxford Covid-19 Government Response Tracker (Hale et. al, 2020). The index is a composite measure of the number of non-pharmaceutical interventions taken in a specific country (e.g., school and workplace closings, curfews and restrictions on international travel). The index is scaled from 0 to 1, with higher values indicating a higher level of stringency of the government response. To measure the severity of the local epidemic, we use the registered count of daily deaths and case counts per capita. These numbers are also taken from the Oxford Government Response Tracker dataset. These measures are rescaled from 0 to 1, with higher values indicating a higher level of daily deaths and case counts per capita. 0 reflects the minimum observed value and 1 the maximum observed value. Our measure of time is also rescaled from 0 to 1, where 0 corresponds to the first week of the data collection (April 9, 2020) and 1 corresponds to the last week of the data collection (July 20, 2021).

Statistical analysis

In the analysis we present an aggregated model that investigates how time, stringency, and severity of the pandemic predict contact behavior. In this model we use country-level fixed effects. Furthermore, we also present a set of robustness tests in the appendix.

All variables in the analysis below are scaled from 0-1. Given that both the outcome and predictors are scaled to range between 0-1, the size of the estimated coefficients reported below reflects the percentage points change in the outcome variables when we compare the minimum and maximum values for each of the correlates, respectively.

Results

In Table 1 below, we present the aggregated model that investigates the contextual determinants of social contacts.

Table 1. Contextual determinants of social contacts.

	Friends	Family	Colleagues	Strangers	Total contacts
Week	0.154** (0.038)	0.108** (0.023)	0.130** (0.030)	0.081* (0.029)	0.130** (0.036)
Stringency	-0.458*** (0.046)	-0.329*** (0.044)	-0.282*** (0.028)	-0.366** (0.068)	-0.474*** (0.039)
New cases per. capita	-0.009 (0.081)	0.017 (0.075)	0.070 (0.055)	-0.022 (0.055)	0.079 (0.101)
New deaths per. capita	-0.255* (0.081)	-0.255** (0.058)	-0.074 (0.041)	-0.056 (0.066)	-0.272* (0.094)
Constant	0.627*** (0.031)	0.612*** (0.029)	0.413*** (0.024)	0.508*** (0.042)	0.956*** (0.029)
Observations	1615	1615	1615	1615	1615
R^2	0.426	0.332	0.287	0.254	0.424

Note: $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. Standard errors in parentheses. Estimates are fixed on country. Contact items are indicator variables, where 1 indicate more than 0 contacts in the past 24 hours. The daily COVID-19 cases and deaths per. capita along with the stringency index are retrieved from Oxfords COVID-19 Government Response Tracker (Hale et al., 2020).

From Table 1 we see that level of stringency significantly reduces the number of social contacts. Furthermore, the number of social contacts decrease as the number of COVID-19 related deaths increases, but not when infection number increases. However, the effect of deaths per capita is only present for social contacts with friends and family. Lastly, we also observe a small effect of time on social contacts. Specifically, the number of social contacts increases as time goes by. Thus, we do observe signs of a fatigue effect as the number of contact increases over time for a given level of stringency and severity of the pandemic. However, this effect is dominated by the adaptive behavior to restrictions and the number of COVID-19 related deaths per capita. For contacts with friends and family, we observe almost equal effect sizes of restrictions and COVID-19 related deaths, while the effect of restrictions is dominating with regards to social contacts with strangers and colleagues. Further analyses show that the effect of restrictions on social contacts is driven by school closings, cancelling of public events, stay-at-home requirements, and movement restrictions (see Table A1 in the appendix).

Finally, it is important to note that the results described above are likely to suffer from autocorrelation. Therefore, we report the same model with a lagged dependent variable in the appendix (see Table A2 in the appendix). These results indicate similar associations between time, stringency, severity of the pandemic and social contacts. However, the size of the coefficients are significantly smaller compared to the results in Table 1, indicating that the models in Table 1 to some degree suffer from autocorrelation. Despite of this, we do still observe substantial effects of time, restrictions, and COVID-19 related deaths on social

contacts. Furthermore, the results are essentially the same when the number of fully vaccinated people per capita is included in the models (see Table A3 in the appendix).

Conclusion

In this report, we have instigated the contextual determinants of social contacts during the COVID-19 pandemic. Specifically, we examine how contact behavior is affected by time, stringency and severity of the pandemic.

We find that social contacts significantly decrease with restrictions and COVID-19-related deaths, but also increase as time goes by. Thus, we do observe signs of a fatigue effect as the number of contact increases over time for a given level of stringency and severity of the pandemic. However, this effect is dominated by the adaptive behavior to restrictions and number of COVID-19 related deaths per capita.

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Appendix

Table A1. Analysis of subcomponents.

	Schools	Workplaces	Public events	Gatherings	Public transport	Stay at home	Movement	International travel	Campaigns
Subcomponent	-0.046* (0.015)	-0.043 (0.025)	-0.061* (0.022)	-0.070 (0.030)	-0.030 (0.034)	-0.083** (0.024)	-0.065** (0.013)	0.053 (0.023)	0.000 (.)
Week	0.145** (0.033)	0.167** (0.034)	0.161** (0.032)	0.183** (0.037)	0.165** (0.035)	0.177** (0.042)	0.144** (0.033)	0.164** (0.035)	0.171** (0.035)
New cases per. capita	0.112 (0.134)	0.168 (0.103)	0.137 (0.125)	0.174 (0.108)	0.108 (0.129)	0.140 (0.132)	0.126 (0.117)	0.101 (0.131)	0.115 (0.136)
New deaths per. capita	-0.476* (0.154)	-0.511* (0.166)	-0.484* (0.156)	-0.449* (0.159)	-0.508* (0.148)	-0.359* (0.125)	-0.516** (0.144)	-0.528* (0.158)	-0.530* (0.158)
Constant	0.694*** (0.017)	0.686*** (0.018)	0.701*** (0.018)	0.687*** (0.023)	0.674*** (0.021)	0.667*** (0.014)	0.707*** (0.014)	0.609*** (0.015)	0.654*** (0.014)
Observations	1616	1616	1616	1616	1616	1616	1616	1616	1616
R^2	0.320	0.313	0.326	0.339	0.310	0.362	0.338	0.308	0.302

*Note: The table shows estimates for each of the Stringency subcomponents, along with week, deaths and cases per. capita on a dichotomous contact-variable. On this variable 0 is no contacts in the past 24 hours, where 1 is minimally 1 contact to either friends, strangers, colleagues and family in the past 24 hours. Standard errors in parentheses. *** $p<0.0001$. Estimates are fixed on country. All variables are scaled from 0-1. The daily COVID-19 cases and deaths per. capita along with the stringency-measures are retrieved from Oxfords COVID-19 Government Response Tracker (Hale et. al, 2020)}. All subcomponents are dichotomous with 1 indicating lockdown in the specific area:* ***School closing****: 0 = No measures/recommended closing, 1 = Required closing some/all levels.* ***Workplace closing****: 0 = No measures/recommended closing, 1 = Required closing some sectors/all but not essential.* ***Public events****: 0 = No measures/recommended cancelling, 1 = Required cancelling.* ***Gatherings:*** *0 = No restrictions/restrictions down to 11 people, 1 = Restrictions on gatherings on 10 people or less.* ***Public transport:*** *0 = No measures, 1 = Recommended/required closing public transport.* ***Stay at home****: 0 = No measures/recommended not leaving house, 1 = Required not leaving with exception/minimal exceptions.* ***Movement****: 0 = No measures, 1 = Recommend or restricted not to travel between regions.* ***International travel:*** *0 = No restrictions/screening/quarantines, 1 = Ban arrivals from some or all regions.* ***Campaigns****: 0 = No Covid-19 public information campaign/public officials urging caution about Covid-19, 1 = Coordinated public information campaign.*

Table A2. Lagged DV.

	Friends	Family	Colleagues	Strangers	Total contacts
Week	0.082** (0.016)	0.074** (0.015)	0.065* (0.025)	0.056* (0.020)	0.059* (0.021)
Stringency	-0.238*** (0.034)	-0.217*** (0.029)	-0.219*** (0.020)	-0.276*** (0.037)	-0.278*** (0.019)
New cases per. capita	-0.029 (0.076)	0.056 (0.048)	0.090* (0.037)	0.017 (0.045)	0.154** (0.038)
New deaths per. capita	-0.152* (0.049)	-0.194** (0.042)	-0.025 (0.033)	-0.048 (0.059)	-0.172* (0.062)
Lagged contact-variable	0.452*** (0.074)	0.299*** (0.028)	0.371*** (0.044)	0.280** (0.059)	0.471*** (0.037)
Constant	0.337*** (0.047)	0.420*** (0.019)	0.292*** (0.018)	0.374*** (0.022)	0.527*** (0.035)
Observations	1456	1456	1456	1456	1456
R^2	0.514	0.374	0.360	0.329	0.547

Note: $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. Estimates are fixed on country. Contact items are indicator variables, where 1 indicate more than 0 contacts in the past 24 hours. The daily COVID-19 cases and deaths per. capita along with the stringency index are retrieved from Oxfords COVID-19 Government Response Tracker (Hale et al., 2020). There is control for respective lagged control-variables in the models.

Table A3. Model including fully vaccinated per capita.

	Friends	Family	Colleagues	Strangers	Total contacts
Week	0.170* (0.050)	0.128** (0.034)	0.158** (0.038)	0.078 (0.036)	0.162* (0.056)
Stringency	-0.462*** (0.042)	-0.335*** (0.040)	-0.289*** (0.027)	-0.365** (0.068)	-0.482*** (0.034)
New cases per. capita	-0.072 (0.065)	0.036 (0.052)	0.044 (0.062)	-0.024 (0.032)	0.117 (0.054)
New deaths per. capita	-0.258* (0.085)	-0.259** (0.060)	-0.079 (0.044)	-0.056 (0.067)	-0.277* (0.097)
Fully vaccinated per. capita	-0.035 (0.048)	-0.044 (0.036)	-0.059 (0.041)	0.005 (0.026)	-0.068 (0.051)
Constant	0.628*** (0.031)	0.612*** (0.028)	0.413*** (0.024)	0.508*** (0.042)	0.956*** (0.028)
Observations	1615	1615	1615	1615	1615
R^2	0.427	0.334	0.293	0.254	0.430

Note: $^{*}p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$. Estimates are fixed on country. Contact items are indicator variables, where 1 indicate more than 0 contacts in the past 24 hours. The daily COVID-19 cases and deaths per. capita along with the stringency index are retrieved from Oxfords COVID-19 Government Response Tracker (Hale et al., 2020). The number of fully vaccinated per capita are retrieved from Our World in Data (Mathieu et al., 2021). This measure is also rescaled from 0 to 1, with higher values indicating a higher level of fully vaccinated per capita.