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Estimating the Municipality Level Attention to Physical Distancing During the Second Half of 2020

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In the fall of 2020 during the corona pandemic, many countries sought to control the onset of the second wave of infections with the coronavirus by initiating local restrictions and lockdowns when outbreaks were detected. Those local restrictions sought to change the behavior of citizens and, in particular, to motivate physical distancing to reduce the transmission rates of the coronavirus. From a behavioral perspective, this situation raises two important questions. First, what is the underlying nature of the motivations with which citizens engage in physical distancing? To what degree is compliance with distancing extrinsically motivated, i.e., motivated by the presence of local restrictions and the possible sanctions for non-compliance? And to what extent is compliance with distancing advice intrinsically motivated, i.e., motivated by an assessment of the severity of the pandemic and, hence, the self-assessed need to change behavior? Second, what guides perceptions of pandemic severity and, hence, behavior change? Is it the rise of infections in the local area or is it rather the rise of infections at the national level, implying that when infections increase in one local area, people in other areas will increase their attention to protective advice as well? Recent research on the psychology of compliance and public support during the corona pandemic suggest that sociotropic and society-oriented concerns are central for compliance (Jørgensen et al., 2021a; Pfattheicher et al., 2020; Van Bavel et al., 2021). This may suggest that national level infections are key and that people in general rally around the pandemic.

To examine these questions, we use large-scale surveys and multi-level modelling to predict the attention that citizens in each Danish municipality paid to the health authorities' distancing advice throughout the second half of 2020. Subsequently, we examine whether these local levels of distancing attention are predicted by (a) the existence of local restriction, (b) the daily number of local infection cases and (c) the daily number of national infection cases.

Data

We utilize daily, nationally representative public opinion surveys (approximately N=500 per day) collected by the survey agency, Kantar Gallup. More information about the data collection can be found in Jørgensen et al. (2021b). For the present purposes, we are using data collected from June 8 until December 25, 2020. June 8 is the date of the most advanced stage of reopening after the first wave of infections with the coronavirus and December 25 is when Denmark reentered complete national lockdown due to the second wave of infections. Hence, the data covers the period in which the country used restrictions implemented at the local level to control the onset of the second wave of infections. This time period provides a total N of 131,862 survey respondents.

As our outcome measure, we created a battery of questions that tap respondents' attention to the advice from the Danish Health Authority regarding physical distancing. This includes avoiding crowded places, avoiding physical contact with others, and paying special attention to distancing when around elderly or vulnerable groups. For each specific advice, respondents provided information on how much attention they paid to this advice on the previous day. Specifically, respondents were asked: "To what degree did you yesterday pay attention to? Avoid physical contact. / Keep away from elderly and chronically ill people. / Keep 1–2 m distance to other people. / Minimize going to places, where many people typically are going. / Minimize activities where you have contact to other people.". Answers were recorded on a scale from 1 ("Not at all") to 7 ("To a high degree"). A "Don't know" category was also included. The final additive index was rescaled to vary between 0 and 1, with 1 indicating a high level of attention. For further discussion of this measure, see Jørgensen et al. (2021b).

Modelling

To obtain local estimates for the attention to physical distancing for each municipality on each week, we follow recent literature (Ghitza & Gelman, 2013; Lax & Phillips, 2021) and utilize multilevel regression and poststratification (MrP). In the first stage of the procedure, we build a Bayesian multilevel model predicting distancing attention based on demographic variables as varying intercepts: age [11 categories], sex, their interactions, education [7 categories], geographic variables [municipality of residence, 98 categories, nested in 5regions], a time dummy [number of week, 29 categories] and the interaction between municipality and week. We also add three other predictors to the models as "smoothers", to aid the model's partial pooling across time and location. These are national infection numbers, local infection numbers and whether the municipality was under local lockdown on a given week.

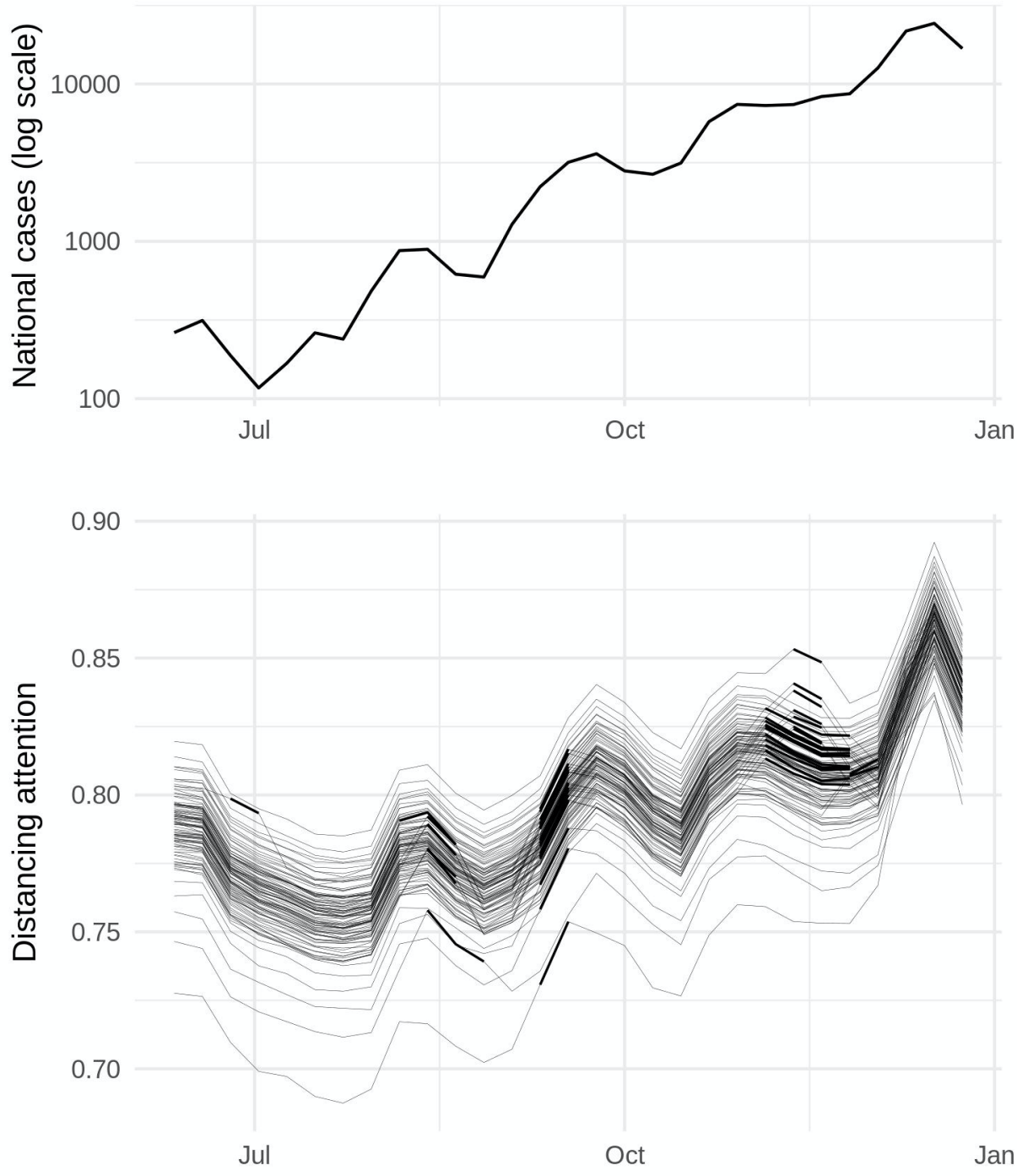

Figure 1. *The development in national-level infections and municipality-level attention to health advice regarding physical distancing over the second half of 2020 in Denmark. The top panel depicts national infection counts (on a log-scale). The bottom panel displays the estimates for all municipalities for the entire study period. The thick lines denote municipalities under local restrictions.*

In the second stage, we predict the distancing attention of all 15,092 types of respondents our data can identify from a young female respondent with elementary school education living in Aabenraa, to an elderly man with an MA living in Vordingborg. We repeat this process for each of the 29 weeks we study. Next, we post-stratify the frequency of each of these hypothetical respondents using census data, and aggregate to municipality-weeks. The bottom panel of Figure 1 displays our estimates for all municipalities for the entire study period. The top panel depicts national infection counts (on a log-scale). The thick lines denote municipalities under local lockdown. As can be seen from this figure, there is only little variation in distancing attention over time.

To understand the effects of local restrictions, local infections and national effects, we subsequently regress the local attention estimates on three independent variables: local restrictions (dummy), local infection count, and national infection count. Specifically, we run two types of models. To estimate the effect of local lockdowns, and of local infections, we rely on two-way fixed effects models, which include both municipality and week fixed effects (i.e. dummies). By zooming in on deviations over and beyond stable geographic differences and national (a.k.a. common) time trends, these models control for all time- or geographically invariant confounders. Meanwhile, to estimate the effect of national infection counts, and to simultaneously estimate the effect of local and national infection counts, we use municipality fixed effects, thus discard all stable (time invariant) differences across municipalities, and seek to explain changes within municipalities. In these analyses, infection counts are standardized and, hence, the coefficients reflect the effect on distancing attention from a one standard deviation change in local (140) and national infections (6400), respectively. The local restrictions variable is a dummy variable and, hence, the coefficient reflects the effect of introducing local restrictions in a municipality.

Results

The results are shown in Table 1. An initial observation is the large amount of variation in distancing attention explained in the models. The bulk of this explained variance is from the fixed effects of municipality and (for Models 1 and 2) time. This suggests that there is, in fact, not much local variation to explain. Nonetheless, Model 1 shows that there is a significant effect of the introduction of local restrictions. In absolute terms, the effect size is very small but it is substantial in relative terms when compared to the overall level of over-time variation in distancing attention. Furthermore, Model 2 shows that there is a significant but essentially non-existing effect of rising local infections on distancing attention in the local municipality. In contrast, Models 3 and 4 show that there is a significant and relatively substantial effect of rising national infections. Thus, a one standard deviation increase in national infections increases the attention with 0.02, which essentially corresponds to the average increase over a month of rising infections in the fall of 2020.

	Dependent variable:			
	Local attention to distancing			
	(1)	(2)	(3)	(4)
Local restrictions	0.015***			
	(0.0001)			
Local infections		0.001***		0.001***
		(0.0001)		(0.0002)
National infections			0.024***	0.023***
			(0.0002)	(0.0003)
Municipality FE	Yes	Yes	Yes	Yes
Week FE	Yes	Yes	No	No
Observations	2,842	2,842	2,842	2,842
Adjusted R^2	0.998	0.991	0.812	0.814
Residual Std. Error	0.001 (df = 2715)	0.003 (df = 2715)	0.013 (df = 2743)	0.013 (df = 2742)
Note:				*p<0.05; **p<0.01; ***p<0.001

Table 1. *Determinants of municipality-level attention to physical distancing advice in Denmark during the second half 2020.*

Conclusion

Overall the present results suggest that intrinsic motivations related to the severity of the pandemic play a significant role when citizens increase their attention to the health authorities' advice during an epidemic. According to the present models, these intrinsic motivation changes are mostly related to changes in the national severity of the pandemic rather than the local level. This could reflect that citizens are trying to not only protect themselves through changed behavior but society as such. The results also show that local restrictions add to the level of attention paid to distancing advice. Some portion of this will be driven by extrinsic motivations, e.g., the sanctions related to non-compliance. However, the introduction of local restrictions will often be associated with significant communication campaigns and, hence, some of the effect of the introduction of local restrictions are likely also driven by intrinsically motivated behavior changes.

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