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Brazil's fight against COVID-19: risk, policies, and behaviours

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Abstract

This working paper updates our assessment of the risks faced by subnational units in Brazil from the spread of Covid-19. By presenting a 'Risk of Openness Index' for states and capital cities, we introduce a new tool for decisionmakers to track the changing local risk of removing closure and containment policies. Using mobility data, we report that government response policies are still effective at influencing en-masse behaviour, but that policy fatigue appears over time. Survey data from the second round of an original survey in nine state capitals suggests that, from July to September, poor people in Brazil had less access to testing than the rich, that more support should be given to public schools and their teachers so that they are better able to provide students with appropriate materials to study at home, and that TV public-information campaigns should more clearly articulate and reinforce the appropriate behaviours for self-isolating individuals.

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Data presented in this paper is available via GitHub: https://github.com/OxCGRT/Brazil-covid-policy

Introduction and summary

This is the Oxford COVID-19 Government Response Tracker (OxCGRT) project's second paper about Covid-19 responses in Brazil. When we published our first paper, in June, approximately 50,000 people in the country had died from Covid-19. Now, in late November, this total is estimated to be around 170,000, with more than 6 million infected.

As before, our intention is to provide policymakers with helpful information as they face difficult decisions about how to respond to the pandemic. Today, the dilemmas that they face are more nuanced than they were five months ago. Rather than whether to ease lockdown, the questions that governors, mayors, legislators and their advisors are now grappling with range from whether to keep in place, to ease, or to re-impose policies. As such, this paper is accompanied by individual policy documents for the nine cities, written by team members who have been following the development of the cities policies' for months. OxCGRT will henceforth also publish a real-time dataset of government response policies for many subnational jurisdictions of Brazil. This includes the 26 states, the federal district, and 53 cities—the 26 state capitals and most populous non-capital cities of each state. The data is coded by trained volunteers, and is processed through a review system to further ensure accuracy.

In keeping with the nuanced dilemmas that policymakers face, we have replaced a direct assessment of whether each of the World Health Organization's (WHO) recommendations are met—that is recommendations as to the measures that governments should ensure are in place prior to easing lockdown—with a more general risk assessment that is constructed from these measures. This 'Risk of Openness Index' (RoOI) was originally developed as a tool to draw from the international OxCGRT dataset, and approximately assesses the risk of not having in place closure and containment policies. It draws upon a number of different data sources, which together indicate, for example, the extent to which transmission is controlled, and the risk of imported cases seeding new outbreaks. In later pages, we map, month by month, RoOI scores for Brazilian states, and show how they have gradually changed for state capitals relative to changes in the strength of the policy environment. As anticipated from the ongoing increases in cases and deaths in Brazil, our broad conclusion from this assessment is that the risk of openness is still high across the country. In short, even in areas where the pandemic appears to be decelerating, there remains a risk of it taking off again.

In interpreting these findings, it is important to pay attention to policy fatigue—the extent to which policies may become less effective at influencing people's behaviour over time—especially now that policies have been in place for many months. We present regression analyses of mobile-phone mobility data to assess whether policies remain effective at encouraging people to stay at home, to reduce their travel and the frequency of non-essential trips. Encouragingly, policy strength remains significantly associated with all of these behavioural changes. However, our findings also indicate that citizens do indeed exhibit signs of policy fatigue for policies that are incorporated into OxCGRT's stringency index. While these findings are subject to review as more time passes, currently they broadly suggest that policy fatigue gradually increases for approximately four months, before stabilising.

As with our first OxCGRT paper about Brazil, we also present the results of an original, representative survey that asked residents of several state capital cities about their behaviours, experiences, and attitudes towards Covid-19. This survey was conducted over the phone, with residents of the eight cities previously surveyed— Fortaleza, Goiânia, Manaus, Porto Alegre, Recife, Rio de Janeiro, Salvador, São Paulo. For the second round, we have added Belém, yielding 1,861 response in total. While the first round assessed behaviours during a two-week period between 22 April and 13 May (depending on the date of survey interview), the second, asked respondents about a fortnight between 13 July and 18 September.

Comparing these two survey rounds allows us to conclude that, as testing has increased in these cities, so has the predictive power of getting a test if you are likely to be contagious, or if you are wealthy. Encouragingly though in our first-round survey, probable contagiousness (having had at least one symptom at a time that suggested infectiousness) was not a significant predictor of getting tested, in our second-round survey it was. Less encouragingly, although in the first-round individuals from households with monthly incomes of 10 times the minimum wage or more were 4.7% more likely to get tested, compared to respondents in households with up–to–one minimum wage, in the second round this percentage rose to 12%. Tests appear to be increasingly concentrated among the rich.

We also report changes in the patterns of who is leaving their home and how often, patterns in education delivered during school closures, and patterns in income losses. In the second-round survey, respondents who were likely to be contagious during the previous two weeks were not significantly more likely to stay home than respondents who were relatively unlikely to be contagious. By this and similar estimates, there is a concerning shift in aggregate behaviour since our first survey round. When we consider changes in the quality of learning at home, we see that private-school students have become more likely to study using materials provided by their teacher, but the same improvement has not occurred for public-school students. Gladly, however, there are signs that the financial impact of Covid-19, which our first working paper reported to be hitting the economically vulnerable the hardest, has been softened by the federal government's income support policy.

Our key messages for policymakers are therefore to recognise that the risk of openness is still high, that testing needs to get to the poor, and that more support should be given to public schools and their teachers so that they, in turn, can better support the learning of children and teenagers studying at home.

Finally, in both of our survey rounds we included a battery of questions to probe respondents' understanding of Covid-19 symptoms and of the appropriate behaviours for someone who is 'self-isolating'. Across these rounds there has been almost no change in these assessments: while correct identification of Covid-19 symptoms remains high, many people misunderstand self-isolation. In both survey rounds, most respondents thought that self-isolating people can leave home to buy essential items. Even more worryingly, the proportion of respondents stated that self-isolation means 'you may behave as non-isolated people and should just wear a mask' rose from 69% to 75% of our sample. Clearer messaging within public health campaigns to directly address this issue could help to prevent the continued spread of the disease in Brazil.

The sections of this paper discuss all of the above results in more detail. First, however, as this paper accompanies the publication of the continuously updated OxCGRT subnational dataset for Brazil, we describe that dataset in the hope of encouraging policymakers and other researchers to use our data. Please note that the wording in parts of this paper, such as the mobility and survey analyses and results, is similar to that of our first OxCGRT working paper about Brazil. This reflects the fact that these sections provide an update to our findings in that paper, using more recent data. The results presented here, however, are often different in important ways, and those differences are drawn out and explained in the text.

Data description

The data is part of the Oxford COVID-19 Government Response Tracker (OxCGRT) project, which provides a systematic way to track government responses to COVID-19 across countries and sub-national jurisdictions over time.[1] The Brazilian subnational subset data cover 26 states, the federal district, and 53 cities, including the 26 state capitals and the most populous non-capital cities of each state.[2] While increasingly expanding, the dataset currently includes 12 policy indicators covering closure and containment and health policies from 1 January 2020 to 30 September 2020, including school closings, travel restrictions, bans on public gatherings, contact tracing and other interventions to contain the spread of the virus and support health systems.

The data provide comparable and up-to-date measures of government responses to COVID-19 as a time series, recording the policy in place for a given indicator at each jurisdiction each day. Observations are reported on ordinal scales, allowing for quantitative analysis of strength of response. The codebook has details about each indicator and what the different values represent.[3] Many indicators have a further flag to note if they are "targeted", applying only to a sub-region of a subnational unit, or "general", applying throughout that jurisdiction. Importantly, the indicators record only the existance and degree of government policies, it is not intended to measure how well policies are implemented or enforced. The table below describes the OxCGRT indicators covered in the Brazilian subnational dataset. As of 23 November 2020, the published dataset does not include the economic indicators, as indicated by the ticks in the right-hand column of Table 1, however, these will be made available shortly.

[1] Hale et al. Variation in Government Responses to Covid-19, Version 9.0. BSG Working Paper, November 2020.
[2] In order to ensure geographical representation, when the most populous non-capital city of a given state is part of the metropolitan region of the capital, we code the second most populous non-capital city.
[3] https://github.com/OxCGRT/covid-policy-tracker/blob/master/documentation/codebook.md

Table 1: OxCGRT Indicators

ID	Name	Type	Targeted/ General?	Brazilian cities and states
Containment and closure				
C1	School closing	Ordinal	Geographic	✓
C2	Workplace closing	Ordinal	Geographic	✓
C3	Cancel public events	Ordinal	Geographic	✓
C4	Restrictions on gathering size	Ordinal	Geographic	✓
C5	Close public transport	Ordinal	Geographic	✓
C6	Stay at home requirements	Ordinal	Geographic	✓
C7	Restrictions on internal movement	Ordinal	Geographic	✓
C8	Restrictions on international travel	Ordinal	No	✓
Economic response				
E1	Income support	Ordinal	Sectoral	
E2	Debt/contract relief for households	Ordinal	No	
E3	Fiscal measures	Numeric	No	
E4	Giving international support	Numeric	No	
Health systems				
H1	Public information campaign	Ordinal	Geographic	✓
H2	Testing policy	Ordinal	No	✓
H3	Contact tracing	Ordinal	No	✓
H4	Emergency investment in healthcare	Numeric	No	
H5	Investment in Covid-19 vaccines	Numeric	No	
H6	Facial coverings	Numeric	No	✓
Miscellaneous				
M1	Other responses	Text	No	✓

The Brazilian subnational data is presented in several formats. In the first, the data captures the total set of policies that apply to a given jurisdiction. This is identified by the suffix "_TOTAL" and includes measures adopted at higher levels of government that may supersede local policies, for example, a ban on international arrivals adopted by the federal government that applies to all subnational units.[4] In the second, the data describes government responses adopted by individual levels of government, identified by suffixes "_GOV". Finally, the suffix "_WIDE" indicates that the data includes measures taken by an individual level of government and by lower levels of government within that jurisdication. For example, whereas state data with the suffix _GOV includes only measures enacted by state-level bodies, state data with the suffix _WIDE includes policies enacted by both those bodies and by city governments within that state.

[4] The _ALL observations also capture policies the national government may specifically target at a subnational jurisdiction

Following the OxCGRT methodology, the Brazilian dataset also produce two linear indices that provide a snapshot of the policy responses: the Stringency Index (SI) and the Containment and Health Index (CHI).[5] The table below describes the composition of each index.

Table 2: OxCGRT indices

Index name	C1	C2	C3	C4	C5	C6	C7	C8	H1	H2	H3	H6
Containment and health index	x	x	x	x	x	x	x	x	x	x	x	x
Stringency index	x	x	x	x	x	x	x	x	x			

A team of volunteers based in different parts of Brazil and abroad, all fluent in Portuguese and with good knowledge of the Brazilian context, have worked to collect and update the data in real time. The data sources include official gazettes, government press releases and briefings, and trusted news articles. The original source material using archived links is included in the dataset so that coding can be checked and substantiated.

In order to ensure accuracy and consistency in the interpretation of the sources, all data collectors are required to complete a thorough training process. We also hold weekly meetings to discuss and clarify how to code edge cases, building a shared understanding of the codebook and its interpretation in light of concrete examples. Every data point is reviewed by a second coder, who examines the data entry and the original source, and either confirms the coding choices of the original coder or flags the data entry for escalation. Data may be corrected via this review process or following external feedback. Substantial revisions are rare.

Data-collection occurs in once-a-week cycles and the database will continue to be updated and reviewed to provide accurate real-time information on the Brazilian subnational government response.[6] The data is published in real time and made available immediately on GitHub, via an API and licensed under the Creative Commons Attribution CC BY 4.0 standard.[7]

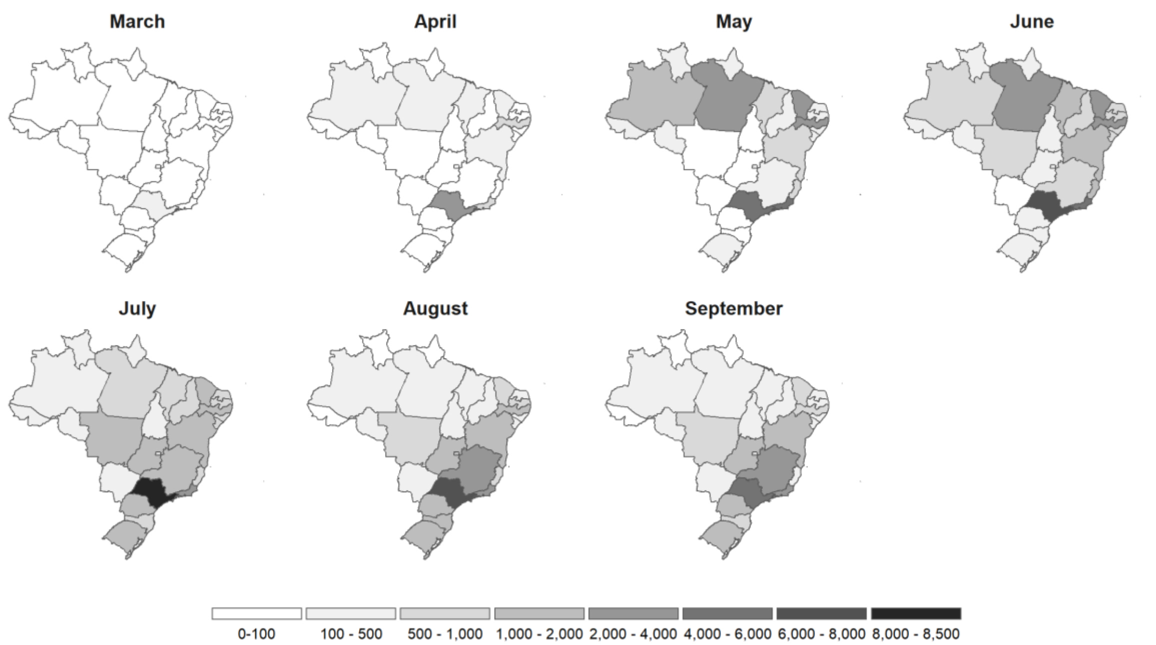
[5] See the appendix for the formula to calculate the indices
[6] However, because not every unit is updated in every cycle, approximately one third of the units in the database may be up to two weeks out-of-date.
[7] See: https://github.com/OxCGRT/Brazil-covid-policy

The Brazilian context

As of late November, 2020, six million Brazilians have been infected with SARS-COV-2, and of these more than 168,000 have perished. Figure 1 shows the rise in monthly total number of deaths in each state through to September, and, Figure 2, the rise in the total number of deaths per 100,000 people in each state.

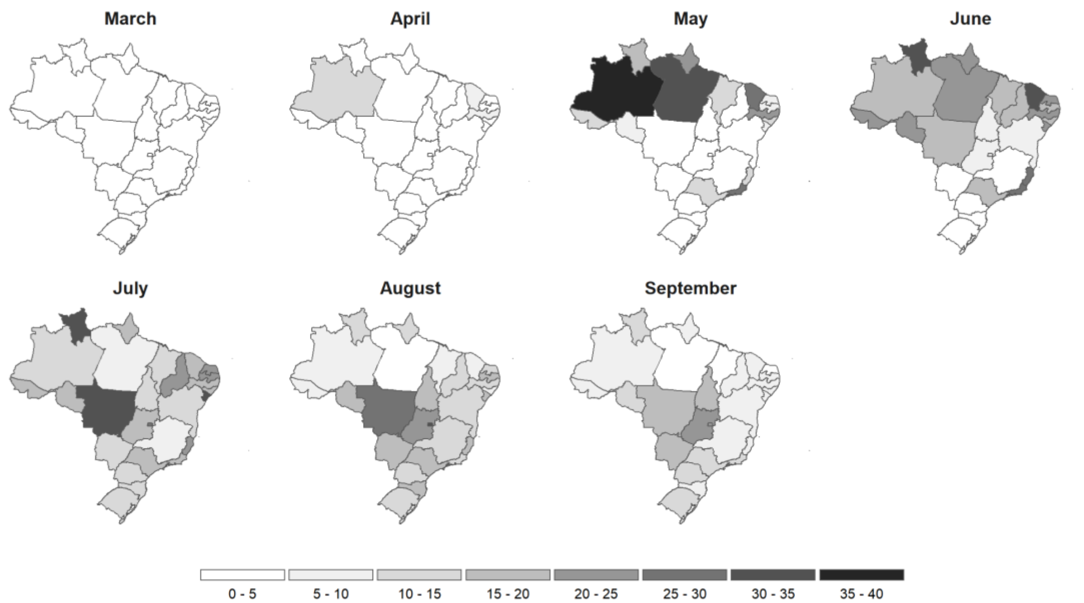
Although more deaths in total have occurred in the states of São Paulo and Rio de Janeiro, Figure 2 shows the there was intense outbreak starting in mid-April in the north of the country, especially in the states of Amazonas and Pará, and in the northeast, especially in the states of Ceará and Pernambuco. Since July, outbreaks have grown in the western parts of the country, for example in the state of Mato Grosso.

Figure 1. The monthly total number of confirmed deaths for each state



Data source: Epidemiological bulletins released by health secretariats of the Brazilian states. The data were collected on 20 October based on the compilation collected by Brasil.io.

Figure 2. The monthly total number of confirmed deaths per week, per 100,000 people



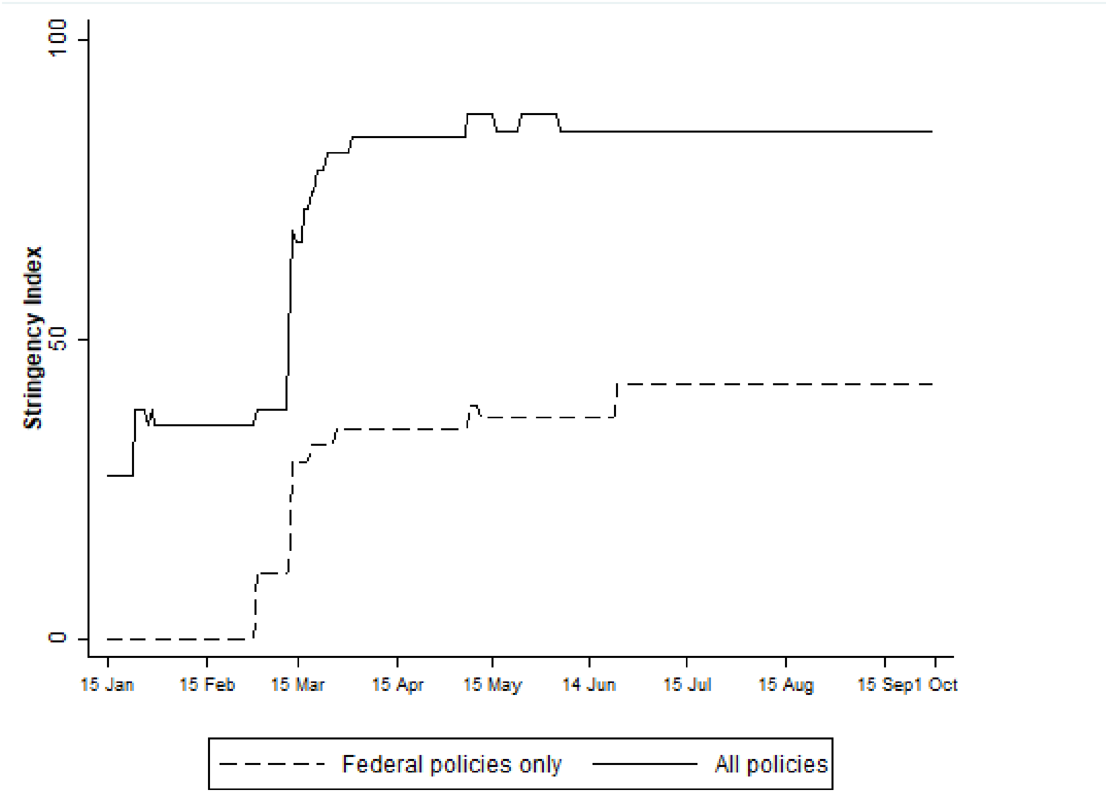
Data source: Epidemiological bulletins released by health secretariats of the Brazilian states. The data were collected on 20 October based on the compilation collected by Brasil.io.

<u>Responses at the federal level</u>

As discussed in the first OxCGRT working paper about Brazil, much of the policy response to Covid-19 in the country has been initiated by subnational levels of government, as indicated by the figure below.

Figure 3 shows, _TOTAL coding at the federal level, which incorporates policies that apply to both the whole country and to subnational jurisdictions, as well as policies enacted by subnational institutions. The figure compares this _TOTAL coding to _GOV coding at the federal level, the latter capturing only policies enacted by the federal level of government. Note the large gap between the two, indicating the extent of subnational government policy activity. Note also that there has been little if any reduction in the stringency scores recording by both of these coding schemes since the initial ramping up of policies, even though for many Brazilians it appears self-evident that rules and recommendations are less strong than a few months ago, at least in their particular location. The absence of a drop in the stringency index is primarily due to the way that the stringency index weights policies that are targeted to a specific geographical region. The coding captures the strongest policy even if it applies to a limited geographical area, with a small, downward adjustment to indicate that a policy is not nationwide. The next section shows how stringency has dropped to different extents in different states of Brazil.

Figure 3. The Overall Strength of National and Federal Covid-19 Response Policies in Brazil



Brazil's federal authorities did, however, put in place public information campaigns early on in the pandemic, which remain available as the Ministry of Health's website. This website continues to display information on prophylactic measures as well as the evolution of the disease throughout the country. It also provides policy guidance, for example, by publishing on 18 September advice about the physical distancing and hygiene measures that should be followed during school reopening[8]. The decision to reopen schools, however, is left to local governments.

The federal government's mobile phone application, the Coronovírus SUS, has a feature that notifies users if they are likely to have come in contact with the virus in the last 14 days[9]. The intention is that this complements the TeleSUS platforms, which provide remote medical consultations. The consultations can now be accessed through an app, a chat on the Ministry of Health's website, or via a phone call. While this initiative had 67 million

[8] Available at: https://www.gov.br/pt-br/noticias/saude-e-vigilancia-sanitaria/2020/09/guia-traz-orientacoes-para-retorno-seguro-as-aulas-presenciais

[9] See Trindade, Rodrigo. App Coronavírus SUS agora vai avisar quando usuário foi exposto; entenda. Tilt, Uol, 31 July 2020. Available at: https://www.uol.com.br/tilt/noticias/redacao/2020/07/31/app-coronavirus---sus-adiciona-rastreamento-de-contatos-entenda.htm

user interactions in April and May, usage dropped considerably in June, down to 7.1 million interactions[10].

In additional to public information campaigns, the federal government has focused on restricting internal movement within Brazil, on establishing international travel controls, and has provided guidance on mask wearing.

On 18 March, the National Land Transportation Agency (Agência Nacional de Transportes Terrestres - ANTT) suspended international land transportation and established hygiene measures for interstate transportation[11]. This policy has been extended twice and is expected to remain in place until 31 November[12]. Following a Brazilian Supreme Court decision, the federal government has also established criteria for sanitary barriers to protect indigenous communities from the coronavirus[13].

Though Brazil's borders remain closed, on 29 July, the Ministry of Justice began to ease restrictions on foreigners arriving in the country via air transportation, by establishing new requirements in terms of health insurance documentation, proof of not having COVID-19, and not having as a final destination a location with a high number of cases[14].

Over time, messaging around mask-wearing has become stronger. In May, the National Health Agency created a campaign recommending citizens to wear masks[15]. In June, this message was reframed with an Instagram post recommending masks as an important prophylactic measure[16]. Then, in July, wearing masks (including home-made facial coverings) in public and private spaces "with public access" became a legal requirement (Federal Law No. 14019/2020, sanctioned on 2 July 2020)[17]. Local

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[10] See ISTOÉ, Número de atendimentos do TeleSUS despenca em meio ao avanço da covid-19, 9 July 2020. Available at: https://istoe.com.br/numero-de-atendimentos-do-telesus-despenca-em-meio-ao-avanco-da-covid-19/

[11] See Lis, Laís. ANTT suspende transporte rodoviário internacional de passageiros, 18 March 2020. Available at: https://web.archive.org/web/20201020031745/https://g1.globo.com/economia/noticia/2020/03/18/antt-suspende-transporte-rodoviario-internacional-de-passageiros.ghtml

[12] Available at: https://web.archive.org/web/20201020035132/https://anttlegis.antt.gov.br/action/UrlPublicasAction.php?acao=abrirAtoPublico&cod_modulo=161&cod_menu=6614&num_ato=00005904&sgl_tipo=RES&sgl_orgao=DG%2FANTT%2FMI&vlr_ano=2020&seq_ato=000

[13] Available at: https://web.archive.org/web/20201021022042/http://www.planalto.gov.br/ccivil_03/_Ato2019-2022/2020/Mpv/mpv1005.htm. Also, see Machado, Renato. Ministro do STF determina que governo acelere construção de barreiras sanitárias para proteger índios, Folha de São Paulo, 1 September 2020. Available at: https://web.archive.org/web/20201021022512/https://www1.folha.uol.com.br/equilibrioesaude/2020/09/ministro-do-stf-determina-que-governo-acelere-construcao-de-barreiras-sanitarias-para-proteger-indios.shtml

[14] Available at: http://www.planalto.gov.br/ccivil_03/Portaria/PRT/Portaria-1-20-cc-mjsp-minfra-ms.htm

[15] Available at: https://web.archive.org/web/20201012051401/https://www.gov.br/pt-br/noticias/saude-e-vigilancia-sanitaria/2020/05/campanha-da-ans-reforca-uso-de-mascara-de-protecao-contra-o-coronavirus

[16] Available at: https://www.instagram.com/p/CBDogNIlp-k/ [see the print screen at the OxCGRT folder]

[17] Available at: https://web.archive.org/web/20201015133951/https://www.gov.br/planalto/pt-br/acompanhe-o-planalto/noticias/2020/07/lei-que-torna-obrigatorio-o-uso-de-mascara-e-sancionada

governments were left with the task of regulating its enforcement and establish fines in case of violation.

However, four days after the federal law was introduced, President Bolsonaro vetoed articles of it that demanded the wearing of masks in "commercial and industrial establishments, religious temples, educational establishments, and other closed venues", as well as parts that stated that the policy should apply to public officials. In the veto justifications (Razões de Veto)[18], he argued that imposing such policy on closed venues violated the constitutional protection of intimacy and inviolability of one's home - therein comparing commercial establishments to homes. As for the public officials' exception, Bolsonaro argued that this change was needed in order to avoid creating an obligation on federative units without indicating how it would be financed.

The president's attempts to veto these parts of the law were ultimately unsuccessful. On 3 August, in a provisional decision, Brazilian Supreme Court Justice Gilmar Mendes indicated that the articles vetoed by Bolsonaro were redundant[19]. As a result, even after Bolsonaro's veto, the new law made it mandatory to wear masks in both public spaces and private spaces accessible to the public. Later that month, Bolsonaro's veto was formally overturned by the Brazilian Congress[20] and the Brazilian Supreme Court, in a final decision[21]. On 11 September, a Tweet that appeared on the federal government's official Twitter handle featured people wearing masks, though without any explicit message recommending that Brazilians should follow this example[22].

[18] Available at: https://web.archive.org/web/20201021012116/http://www.planalto.gov.br/ccivil_03/_ato2019-2022/2020/Msg/VEP/VEP-374.htm

[19] Falcão, Márcio, Fernanda Vivas. Mesmo com vetos de Bolsonaro, máscara é obrigatória em todo lugar público, diz Gilmar Mendes, Portal G1, 3 August 2020. Available at: https://web.archive.org/web/20201021005408/https://g1.globo.com/politica/noticia/2020/08/03/mesmo-com-vetos-de-bolsonaro-mascara-e-obrigatoria-em-todo-local-publico-diz-gilmar-mendes.ghtml

[20] Senado Notícias. Derrubado veto de Bolsonaro ao uso obrigatório de máscara na pandemia, 19 August 2020. Available at: https://web.archive.org/web/20201020074536/https://www12.senado.leg.br/noticias/materias/2020/08/19/derrubado-veto-de-bolsonaro-ao-uso-obrigatorio-de-mascara-na-pandemia

[21] According to Brazilian Supreme Court Justice Gilmar Mendes, the constitutional right to health emcopasses both indivial and collective actions. See Valente, Fernanda, STF mantém derrubada de vetos de Bolsonaro em lei sobre uso de máscara, ConJur, 29 August 2020. Available at: https://web.archive.org/web/20201021012545/https://www.conjur.com.br/2020-ago-29/stf-mantem-derrubada-vetos-lei-uso-mascaras

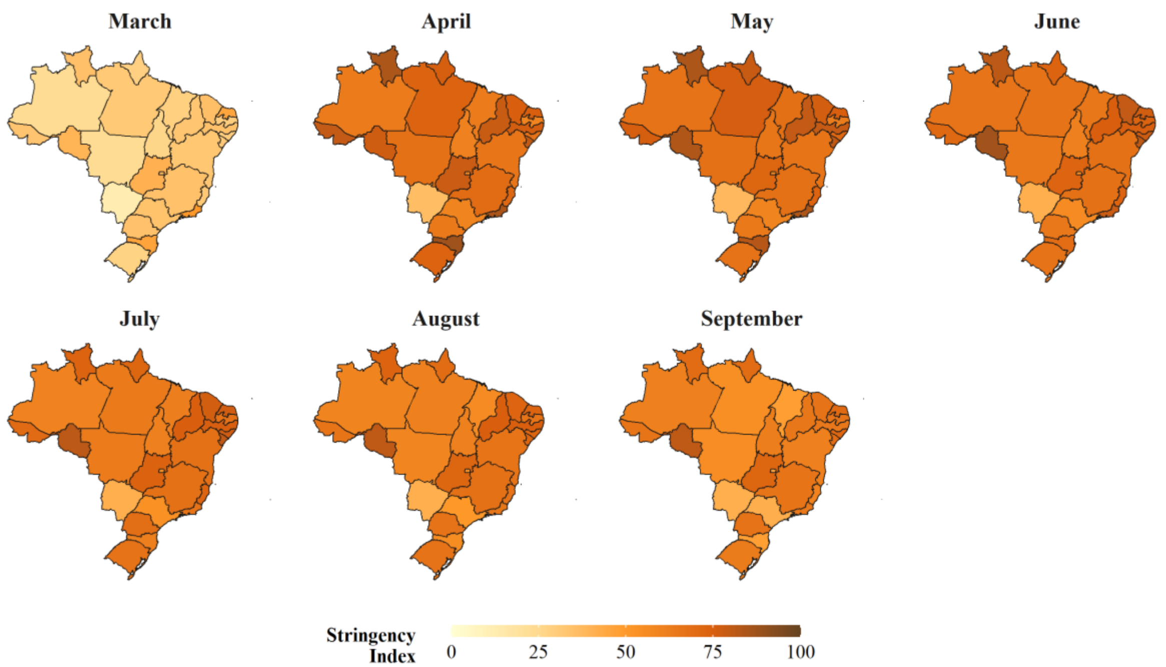
[22] Available at: https://web.archive.org/web/20201020042606/https://twitter.com/govbr/status/1304849767483289600

Subnational jurisdictions

State-level government response policies

Figure 4, below, summarises the strictness of policy responses over time at the state level. The depth of colour indicates the stringency index score of state-level policies (STATE_TOTAL), averaged across the days of each month. Since mid-March, state-level policies first quickly and strongly increased in overall strength, and subsequently lessened over time in some parts of the country more than others.

Figure 4. The development of state-level polices over time, presented as monthly averages of the stringency index

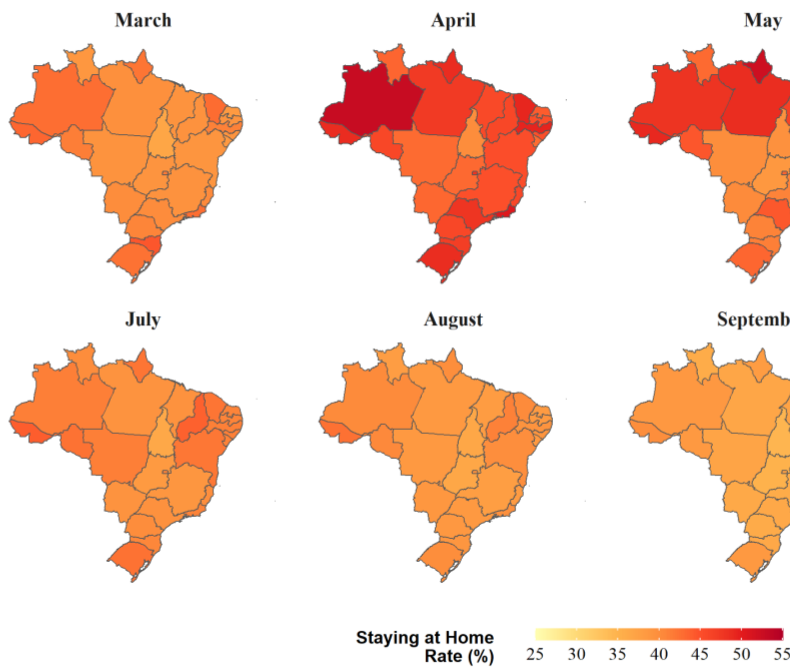


Source: OxCGRT

Mobility trends

We use three measures of mobility from InLoco, a location analysis company that tracks approximately 60 million smartphone users across Brazil. These mobility data are regarded as precise, with a location-measurement estimated standard error of 2.8 metres. The aggregate state-level mobility measures are based on data for all municipalities in each state with sufficient data to permit calculations of aggregate movement. Figure 5 reports the percentage of mobile phones that remain at the same geographical location during the day (6am to 10pm) as during the night (10pm to 6am). It shows that people stayed at home more in April and May, overall, than in subsequent months, which have seen a steady decline in this measure of home permanence. In September, some states even experienced higher mobility, by this measure, than in March.

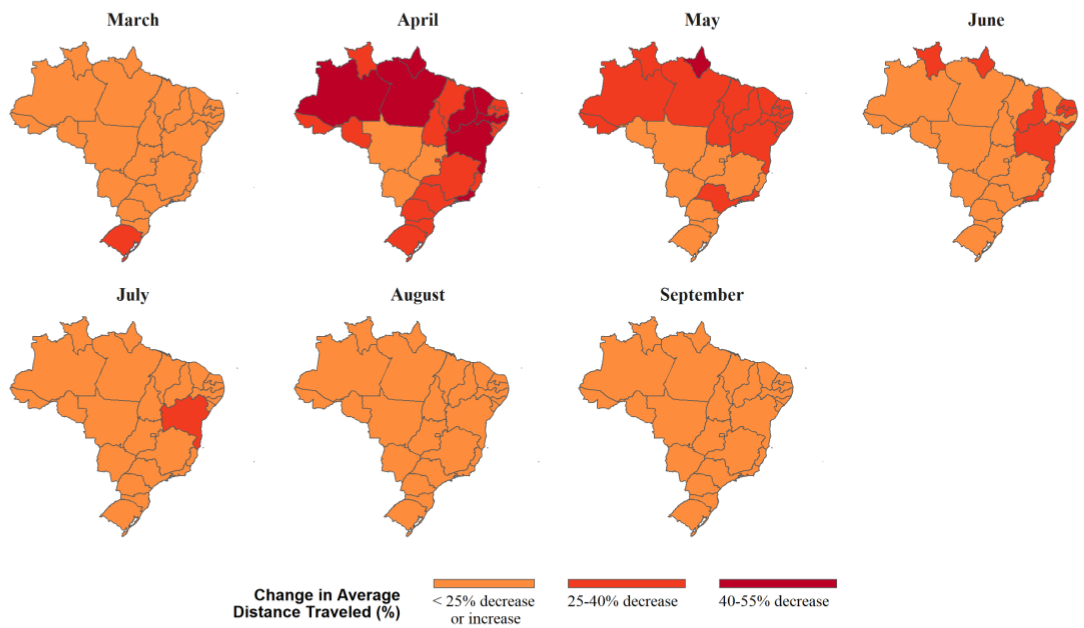
Figure 5. Monthly average scores by state, of the daily percentage of smart phone users remaining at home during the day



Source: Inloco

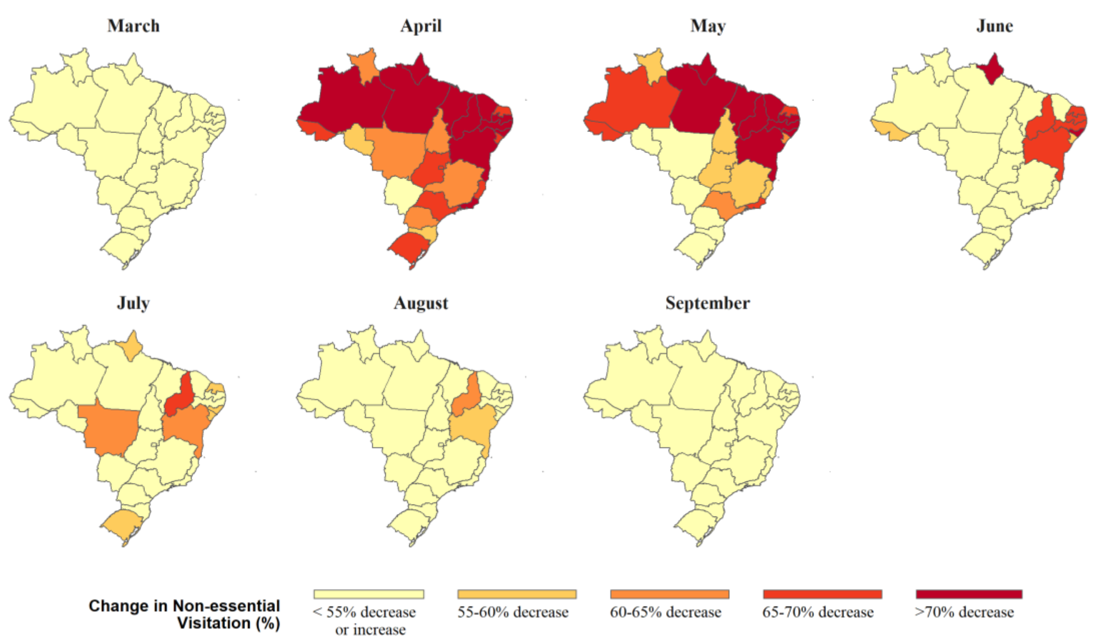
Figures 6 and 7 show average weekly changes relative to this baseline period for all states with respect to two additional mobility measures. These are the average number of kilometres travelled and the average number of non-essential trips, both relative to baselines that were established from data recorded during the first five weeks of 2020.[21] Figure 5 reports the change in the number of daily kilometres travelled. Figure 6 reports the change in the daily number of non-essential trips[20].

Figure 6. Daily distances travelled relative to baseline, averaged over each month



Source: Inloco

Figure 7. Daily number of non-essential trips made by smart phone users relative to baseline, averaged over each month.



Source: Inloco

These changes in mobility as the months have gone by are important for interpreting the extent to which policies are affecting citizens' behaviour, as discussed in the next section. First, however, we introduce a tool called the 'Risk of Openness Index' (RoOI), which provides a means of assessing the strength of policy relative to the risk that each part of the country faces. It is based on World Health Organization's advice.

The Risk of Openness Index

In April 2020, the WHO's technical guidance recommended six criteria for evaluating countries' readiness for easing response policies.[23] In a previous work, we have discussed whether these criteria were met in Brazil at the time subnational governments were considering lifting restrictions.[24] Briefly, the recommendations were:

1. COVID-19 transmission is controlled to a level of sporadic cases and clusters of cases
2. Sufficient public health workforce and health system capacities are in place
3. Outbreak risks in high-vulnerability settings are minimized
4. Preventive measures are established in workplaces
5. Manage the risk of exporting and importing cases from communities with high risks of transmission
6. Communities are fully engaged

As the disease continues to spread in Brazil, the same set of WHO criteria can be used to assess the risk that cities and states are exposed to as they relax physical distancing measures. Based on the WHO recommendations, we have constructed a Risk of Openness Index (RoOI) which roughly describes the risk of not having closure and containment measures in place. Importantly, the RoOI cannot say precisely the risk faced by each subnational unit, although it can be used to support decision-making as governments seek to calibrate policy response to changes in context.

We combine OxCGRT Brazil subnational data with other publicly available sources of information to speak to four of the six WHO recommendations. The table below provides a brief description of the calculation for each of the sub-indices that constitute the RoOI for subnational units[25].

[23] World Health Organization. COVID-19 Strategy update 14 April 2020, p3. Available at: https://www.who.int/publications/i/item/strategic-preparedness-and-response-plan-for-the-new-coronavirus.
[24] Anna Petherick, Rafael Goldszmidt, Beatriz Kira, and Lorena Barberia. (June 2020). *Do Brazil's Covid-19 Government Response Measures Meet the WHO's Criteria for Policy Easing?* Blavatnik School of Government Working Paper.
[25] Further details of how the RoOI is calculated are available on GitHub.

Table 3. Calculation of the Risk of Openness Index for Brazilian Subnational Units

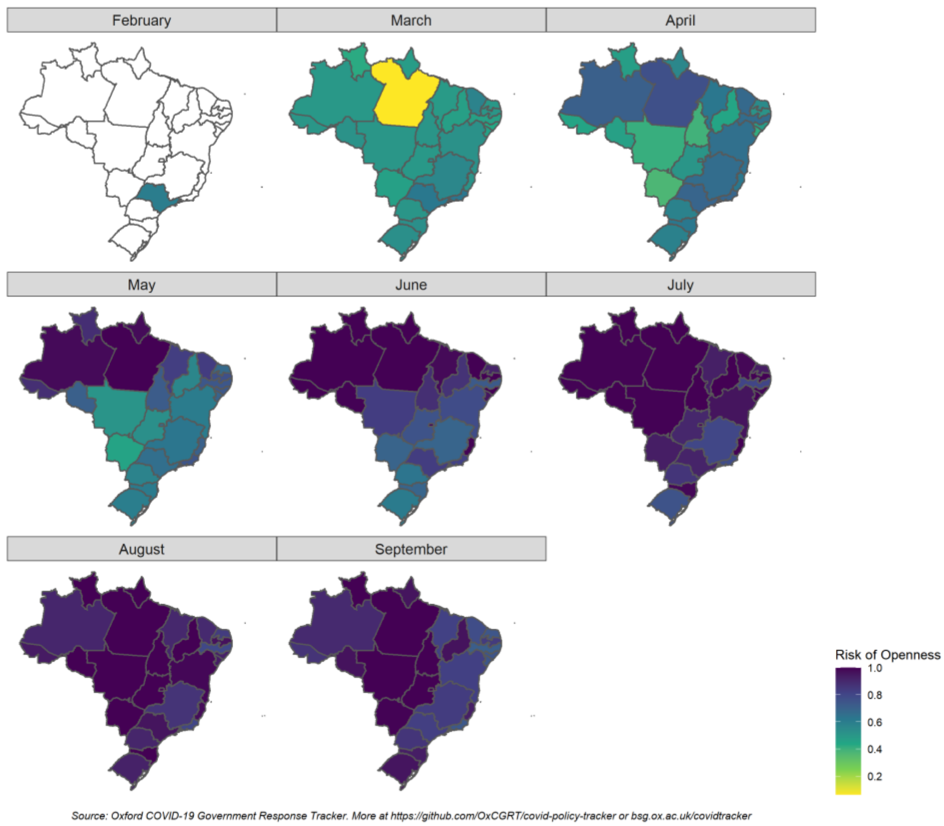
WHO Recommendation	Data Sources	Sub-Index Description
Transmission controlled (recommendation 1)	Epidemiological data published by the state secretaries of health, made available by Brasil.io	A metric between 0 and 1 based on new confirmed cases ($\Delta cases_t$) each day Cases controlled is automatically set to 1 if $\Delta cases_t \geq 50$
Test / trace / isolate (recommendation 2)	Testing policy (indicator H2) and contact tracing policy (indicator H3) Number of tests per case conducted in each state or city, made available by SIVEP Gripe[26]	A metric between 0 and 1, half based on testing and contact tracing policy, and half based on the number of tests a state or city has conducted (does not measure isolation)
Manage the risk of imported cases (recommendation 5)	International travel controls (indicator C8) Restrictions on internal movement (indicator C7)	A metric between 0 and 1, half based on the stringency of international travel arrivals, and half based on restrictions on internal movement within and between states/cities (does not measure risk of exporting cases)
Communities understanding and behaviour change (recommendation 6)	Availability of public information campaigns (indicator H1) Data from Apple and Google on travel and mobility	A metric between 0 and 1 based on whether a city or state has a public information campaign and the level of mobility reduction, weighted for current transmission risk

Lastly, the RoOI includes a check subnational units experiencing a very high level of transmission over the past week, through the introduction of an endemic factor. Jurisdictions experiencing population-scale transmission are likely to be too 'high risk',

[26] Sistema de Informação de Vigilância Epidemiológica da Gripe (SIVEP -Gripe). Available at: http://plataforma.saude.gov.br/coronavirus/dados-abertos/. Importantly, this database only reports tests conducted in hospitalised individuals with flu symptoms.

although this isn't effectively captured by the four sub-indices described above. When this is the case, it effectively creates a 'floor' on the risk level no matter how good the other sub-components are. The endemic factor is a measure between 0 and 1, and depends on the total number of new cases in a country, proportioned by population.[27]

Figure 7. Monthly Average Risk of Openness Index Scores of Brazilian States



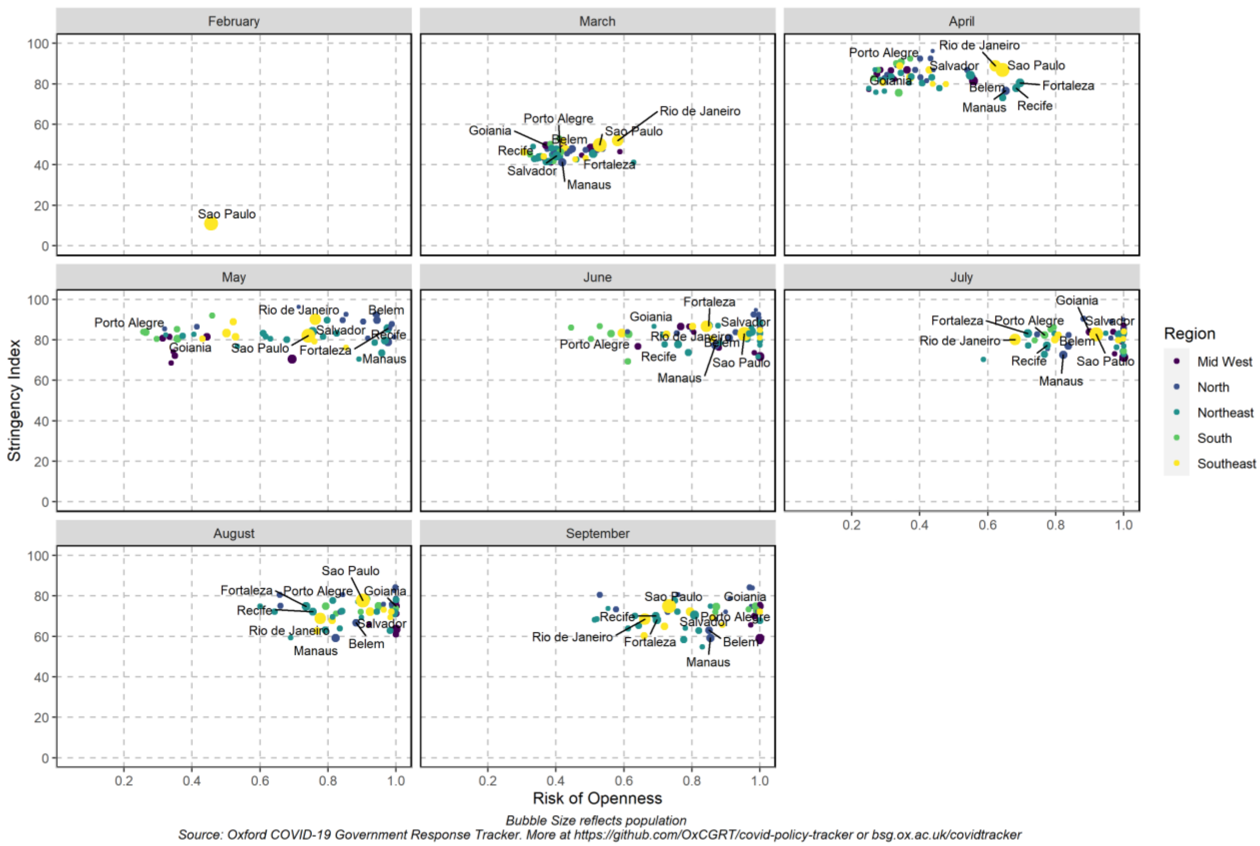
Source: OxCGRT

States' average monthly RoOI scores, as displayed in Figure 7, clearly show how the risk of not having in place closure and containment policies has increased significantly across all Brazilian states since Brazil's first case of Covid-19 was confirmed in São Paulo in February. Although the RoOI has varied between neighbouring states with different policy

[27] Hale et al. Risk of Openness Index: When Do Government Responses Need to Be Increased or Maintained? Version 2.0. 23 October 2020. Available at: https://www.bsg.ox.ac.uk/research/publications/risk-openness-index-when-do-government-responses-need-be-increased-or

regimes as the disease has spread, the risk has grown in all states and, despite a slight drop in a few in September, has generally remained high throughout the country.

Figure 8. The Stringency Index and Average Monthly RoOI for State Capital Cities



Source: OxCGRT

Figure 8 shows how average monthly RoOI in state capitals has changed from February to September, alongside the average monthly stringency index score for each city. We see the risk of openness rising gradually, especially in March, April, May and June, with cities moving from left to right across the scatterplots[28]. Stringency rose also sharply from March to April, and has started loosening especially from August to September. Note that the stringency index displayed in Figure 8 refers to the CITY_TOTAL coding, which captures all policies that apply in individual cities, whichever level of government enacted them. Although cities in Figure 8 have extremely low stringency, two points are worth keeping in mind while interpreting these plots. First, the stringency index incorporates items such as public information campaigns and international travel restrictions, ensuring that cities that have, for example, largely open schools and workplaces, do not score close to zero on this measure. And second, over time, Brazilians' behaviour has changed gradually less in response to any given policy environment, so the fact that stringency index levels have decreased little does not imply that cities are protected from the spread of disease. This policy fatigue is examined further in the next section.

[28] Please note that the case data for the city of Rio de Janeiro, which is used to construct the RoOI contains gaps, and as such we are less confident about the RoOI score for that city.

State-level mobility analyses

To assess the association between state-level response policies and mobility we estimate fixed-effects linear regression models. We employ the three aforementioned mobility measures as dependent variables and OxCGRT indicators as explanatory variables, either aggregated into the stringency index or as measures of the strength of individual policy areas.

All models in Table 4 include dummy variables representing days of the week, dummy variables representing the individual states, and a linear time trend since the first policy implemented. The week-day controls are to account for normal variation in home permanence, non-essential trips, and distance moved between weekend days and the rest of the week. The linear time trend accounts for policy fatigue, for example, a reduction over time in the willingness or capacity of people to stay at home. Finally, state dummies control for all characteristics of the states that do not change in the observed period of time, such as the level of economic development. Robustness checks with dichotomised policy levels, with calendar-month (instead of time linear trend effects), and with the linear time trend treated as dummies can be found in the Appendix.

The results in Table 4 show that the strength of policies overall, as indicated by the OxCGRT stringency index, significantly increased how much people were staying at home during the daytime (the variable previously referred to as home permanence). Model 1 shows that an increase of 10 points of stringency on a scale out of 100 is associated with individuals spending on average 2.3% more of each day at home, relative to the first five weeks of the year. Model 2 shows that the same increase in the stringency index is associated with a 9.7% reduction in the number of non-essential trips per day compared to the baseline period. Model 3 shows that this 10-point change in policy strength is associated with a 5.2% reduction in the daily distance travelled, relative to the first five weeks of 2020.

The link between individual policies and mobility is examined by Models 4, 5 and 6. We excluded international travel controls and public transportation closures from these models because international travel controls are unlikely to affect outcomes, and because according to the Brazilian constitution, public transportation is largely the responsibility of municipal governments. The effects of each policy as reported in Models 4, 5 and 6 should be interpreted as the effects when all the other policies listed in Table 1 are fixed.

Models 4, 5, and 6 suggest that workplace closures, school closure, stay at home requirements, and restrictions on internal movements had significant effects on all three measures of mobility, while cancellation of public events reduced non-essential trips, and increased home permanence. All else equal, public information campaigns increased home permanence. In Models 4 to 6, all individual policies record some significant effects on mobility, in the expected direction, except for restrictions on gatherings of people. However, the results of these models should be interpreted with caution, compared to those of Models 1 to 3, which show clear effects of government-response policies on mobility. Disentangling the effect of individual policies as in Models 4, 5, and 6 is difficult because many individual policies were enacted at roughly the same time. Because of this, we do not recommend that policymakers base their decisions about individual policy areas solely based on the results of Models 4 to 6.

<u>Variation in policy responses over time</u>

Holding policy level constant, our analyses show that mobility has increased over time. This suggests a behavioural fatigue effect in response to policies enacted to counter the spread of Covid-19. These findings are indicated by the coefficients of the linear trend variables—the time since first policy was implemented at the state level—which are significant and negative (implying decreasing policy observance).

In other words, people may be, over time, less willing and/ or less able to comply with the distancing policies. Figure 10 illustrates this effect, by plotting dummy variables for each month after policy implementation. Plotted in this way, fatigue effects seem to be linear for home permanence, yet appear to plateau after the fourth month of policy implementation when assessed using the other measures of mobility. These fatigue effects should be taken into account by policymakers when assessing whether the policy environment is appropriate given the risk of openness.

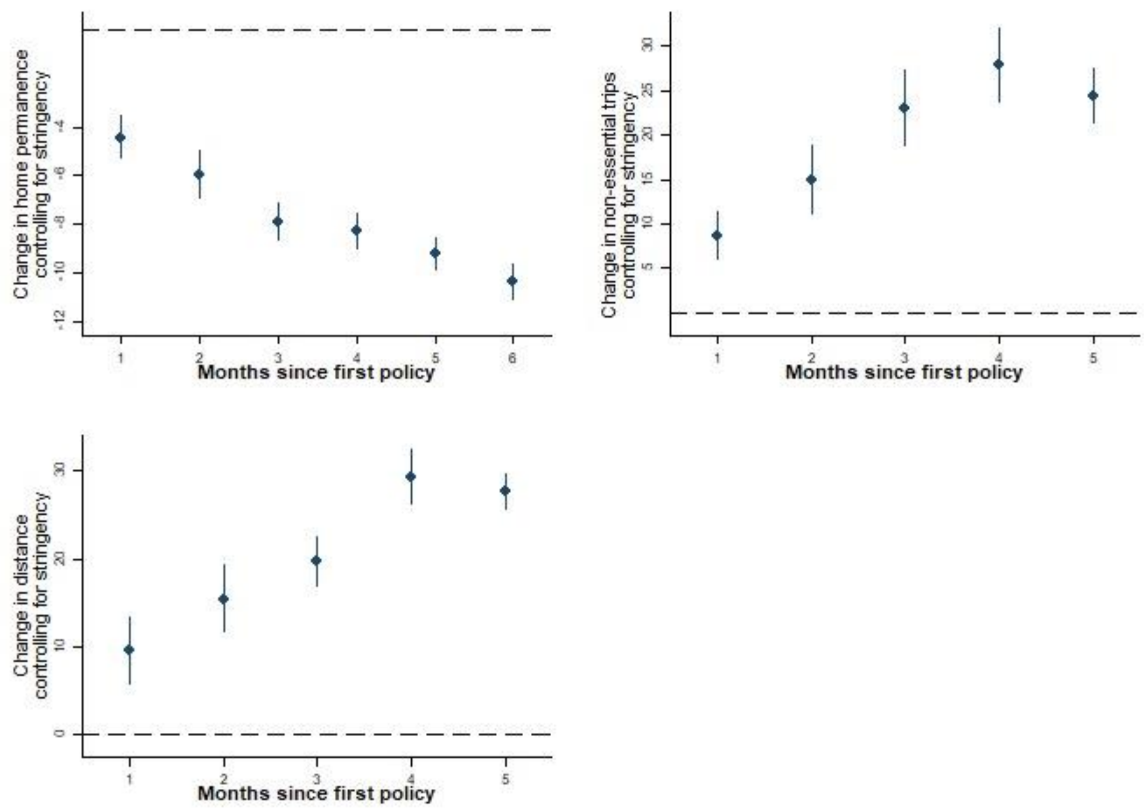
Table 4. The predicted effects of state government response policies on mobility

	Model 1 Home perman. (%)	**Model 2** Change in non-essential trips (%)	**Model 3** Change in distance (%)	**Model 4** Home perman. (%)	**Model 5** Change in non-essential trips (%)	**Model 6** Change in distance (%)
Stringency Index	0.227***	-0.964***	-0.525***			
	(0.00580)	(0.0305)	(0.0239)			
School closing				0.0402***	-0.161***	-0.139***
				(0.0111)	(0.0529)	(0.0433)
Workplace closing				0.0582***	-0.237***	-0.224***
				(0.0101)	(0.0529)	(0.0419)
Cancel public events				0.0316**	-0.218***	0.0416
				(0.0153)	(0.0599)	(0.0479)
Restr. on gatherings				0.00771	-0.0658	0.0173
				(0.0161)	(0.0469)	(0.0520)
Stay at home requirem.				0.0497***	-0.154***	-0.130***
				(0.0122)	(0.0437)	(0.0462)
Restr. on int. movement				0.0233***	-0.0632**	-0.0798***
				(0.00601)	(0.0256)	(0.0238)
Public info. Campaigns				0.0131**	0.0243	-0.0142
				(0.00477)	(0.0190)	(0.0172)
Linear trend	-1.575***	5.506***	5.926***	-1.480***	5.216***	5.525***
	(0.0563)	(0.456)	(0.304)	(0.0734)	(0.569)	(0.354)
Week-day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6372	5697	5697	6372	5697	5697
States	27	27	27	27	27	27
R-squared	0.781	0.788	0.667	0.783	0.800	0.695

Clustered standard errors in parentheses

* p<.10 ** p<.05 *** p<.01

Figure 10. Monthly Changes in Policy Observance, Controlling for Policy Environment



Source: OxCGRT

Next, in this paper, we move on from discussing mobility data to examining the results of our surveys. Although valuable as an objective indicator of behaviour, mobility data can only describe the movements of individuals who own smartphones. As these data are averages of this population, they do not provide information about who is moving around.

A survey of nine state capitals

The survey design

The OxCGRT Brazil surveys were designed to probe how citizens behave during a period of widespread Covid-19 government response policies. They include questions to assess the extent of citizens' understanding of the disease, to gather information about what citizens have observed in their environment, and questions about citizens' wider experiences and opinions. Many questions directly relate to the WHO's advice regarding measures that should be in place before easing government response policies. A list of survey questions can be found on GitHub[29].

The surveys were conducted over the phone by a survey company, which ran a training session for employees who would be interviewing respondents, and which pre-tested the questionnaire for duration and clarity of questions (after which the final version was adjusted). Where appropriate, the order of response options for each question was randomised. Oxford University's ethical review body, CUREC, approved the study.

The survey samples

We restricted our samples to landline and mobile phone numbers registered in state capitals that together are home to 18% of Brazil's urban population. Five of these cities are the capitals of the states with the largest populations in each of Brazil's five geographic regions: São Paulo, Manaus, Salvador, Porto Alegre and Goiânia. The three other cities in our first-round survey, Rio de Janeiro, Recife and Fortaleza, are the capitals of those states that had the largest number of total confirmed Covid-19 when the survey was designed. In the second round, we added Belém due to the steep progression of the pandemic there after the first round was completed. Phone numbers were randomly selected for each city from a sampling frame of hundreds of thousands of landline and cell phone numbers, and the survey company was instructed to call non-respondents back at least twice more before moving on to another randomly selected telephone number. Calls were also made at different times of day and at the weekend to guard against bias in the sample that could have arisen if respondents picking up the phone during the daytime were more risk adverse than others who went out. The sample for each city was stratified by age, sex, education level and income.

The final sample of the first round included at least 200 interviews with residents of each city, and slightly more (250 interviews) in São Paulo, yielding a total of 1,654 responses. Interviews for that round took place between 6 to 27 May 2020. Therefore, when survey questions asked about behaviour in the previous two weeks, it was referring to a fortnight period between 22 April and 13 May, depending on the date of the interview.

[29] https://github.com/OxCGRT/Brazil-covid-policy

Similarly, in the second round, the final sample included at least 200 interviews with residents of each city, and slightly more (251 interviews) from São Paulo, yielding a total of 1,861 responses. Interviews took place between 27 July and 2 October 2020. Therefore, when survey questions in this round asked about behaviour in the previous two weeks, this referred to a fortnight period between 13 July and 18 September, depending on the date of the interview.

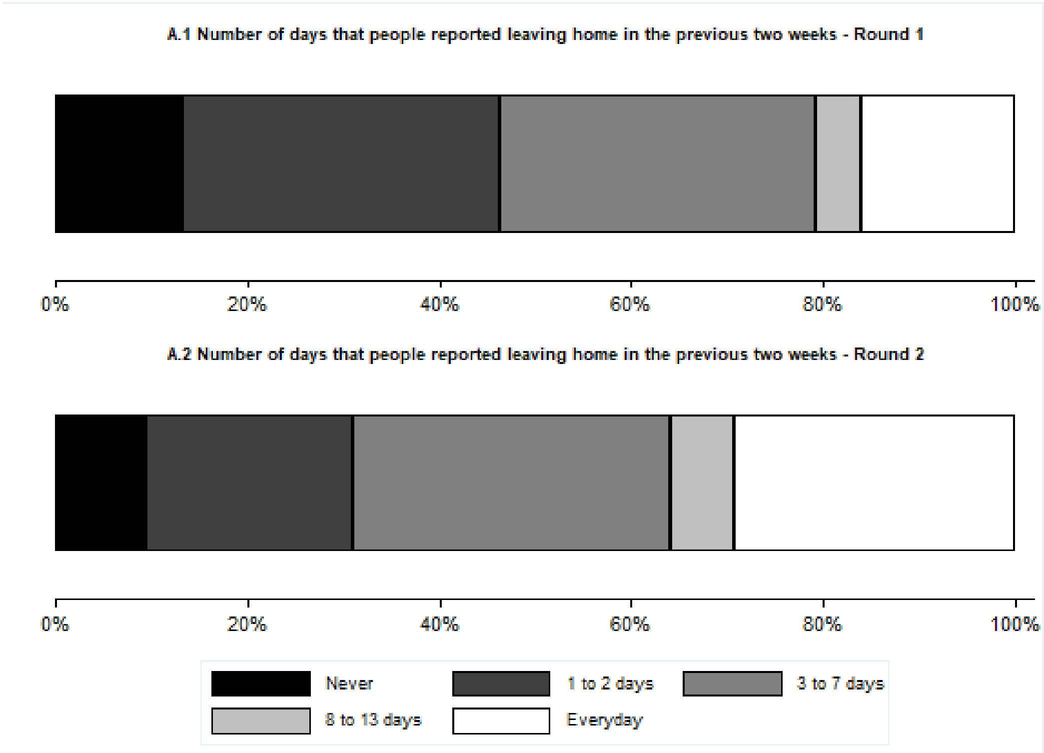
The final samples were similar to the combined population of the nine capitals. Descriptive statistics by city and survey round can be found in the Appendix. In the second round, 14% of respondents were between 18 and 25 years of age, 33% were 25 to 40 years old, 37% were 40 to 60 years old, and 16% were over 60. Women made up 56% of the sample. Based on the level of income in February, just over a third (34%) of respondents received less than 2 minimum wages per month, 46% received 2 to 5 minimum wages, 12% received 5 to 10 minimum wages, and 8% more than 10. Most had either some primary school (29%) or middle school (41%) education, and 30% had enrolled in or graduated from a higher education establishment. Private-company employees made up 27% of the sample, followed by informal entrepreneurs (20%), formal entrepreneurs (10%), civil servants or public company employees (11%), unemployed (8%), retired (9%), homemakers (7%) and students (5%). As in the first round, most formal entrepreneurs were MEIs, or individual micro-entrepreneurs. Almost a fifth (18%) of private-company employees were informal. The composition of the sample was similar for the first round (see Petherick et al, 2020 for details).

Here we report survey results relevant to the WHO recommendations followed by findings that describe the social and economic realities of government response policies to Covid-19. All descriptive results are weighted so that they may be generalised to the combined populations of the eight or nine cities studied, depending on the survey round, using frequency weights based on the population of each city. This is the population to which we refer when we discuss 'people' and 'citizens' in the paragraphs below. We then compare the responses of groups with different characteristics across survey rounds.

Covid-19 response policies and the WHO's recommendations

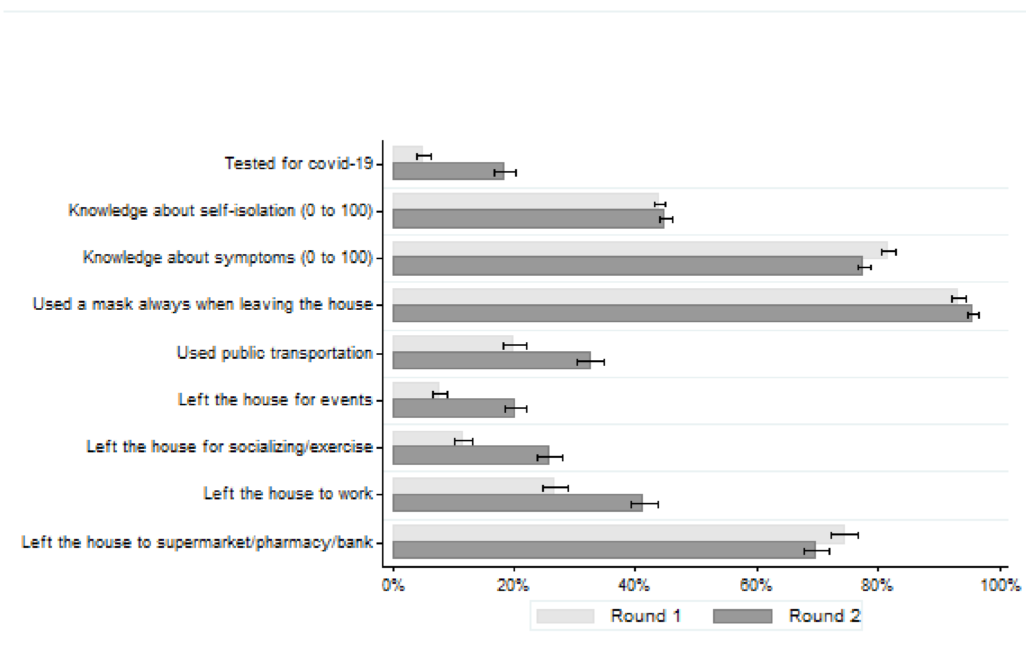
We initially assessed citizen behaviours, knowledge and testing frequency. Figure 11A shows on how many days during the two weeks prior to interview that people in the state capitals tended to leave home. It shows that there were important changes between the survey rounds. While in the first round people left the house on average 5.5 days in the fortnight before the interview, this average increased to 7.4 in the second round. Furthermore 13% of people reported not leaving home in the fortnight before their first-round survey interview, which dropped to 9% in the second round, while the proportion of people leaving the house every day increased from 16% to 29%.

Figure 11. Distancing, knowledge about Covid-19 and testing by exposure to the virus



Source: OxCGRT

B. Testing, knowledge, mask use, and reasons for leaving home (with 95% confidence intervals)



Source: OxCGRT

Figure 11B shows how common testing was among the nine capitals' combined populations, the reasons why people left home, and levels of understanding of Covid-19 across rounds. It indicates that testing was infrequent in the first survey round: only 5% of people reported being tested for Covid-19 at any time, while it was more common in the second round (19%). In the second round, of those who had been tested, 51% reported being tested for Covid-19 RT-PCR, while 38% reported testing for antibodies; 11% did not know which test they had taken. Additionally, of those who had been tested using RT-PCR tests, 24% were positive for SARS-CoV-2 in the second round. Figure 11B also shows that the most common reason for leaving home in both rounds was to make essential trips, to the supermarket, pharmacy or bank. Whereas around 25% of people left their residence most days to go to work in the first round, approximately 40% reported leaving their house to work in the second round (65% and 62% usually left home to work in February, according to the first and second round, respectively). During the period examined in both survey rounds, it was normal to wear a mask on the street. Those who left their home in the previous 14 days estimated that more than 3 out of 4 people were wearing masks when out and about.

We created scores out of 100 for 'knowledge about Covid-19 symptoms' and 'knowledge about self-isolation', in order to assess whether public information campaigns were getting through to people. For the knowledge of symptoms index, the respondents had to identify which symptoms from a list with two correct items (fever and dry-cough) and four incorrect items (rash, ear pain, itch and joint pain) are common symptoms of Covid-19. The score out of 100 is the percentage of correctly spotted symptoms. The score for 'knowledge about self-isolation' was calculated in the same way. In this case, respondents were asked whether a series of behaviours were each consistent with recommended self-isolation practices[30].

These scores did not substantially change across rounds. Knowledge of Covid-19 symptoms (with an average score of 82 out of 100) was stronger than knowledge about the meaning and recommended practices associated with self-isolation (44 out of 100) in the first round. In the second round, the average scores of knowledge of Covid-19 symptoms and knowledge about self-isolation were 78 and 45 out of 100, respectively, indicating an overall lack of improvement in citizens' understanding of the disease and how to behave so as to not spread it.

Specifically, most respondents answered correctly on only two of these yes/no items: 80% in the first and 81% in the second round indicated said that, no, 'not talking to other people' is not a self-isolation practice, and 64% in the first and 59% in the second round correctly identified that, yes, 'not leaving the house and asking other people to bring things you need' is a self-isolation practice. However, 95% of people in the first and 84% of

[30] One described practice was correct (not leaving the house and asking people to bring things you need), and four behaviours listed were incorrect. The incorrect items included self-isolation means 'you should not talk to anyone', and 'you can behave like people who are not self-isolating except that you should wear a mask'. The score for knowledge about self-isolation is the percentage of correct yes or no answers across the five behaviours.

people in the second round incorrectly thought that self-isolation means 'you may leave the house to buy essential items'. Moreover, 57% in the first and 55% in the second round incorrectly thought it means 'you may behave as non-isolated people and should just avoid touching other people', and 69% in the first and 75% in the second round incorrectly stated that self-isolation means 'you may behave as non-isolated people and should just wear a mask', a finding that is particularly instructive for those designing and implementing public health campaigns.

Knowledge and public Information campaigns

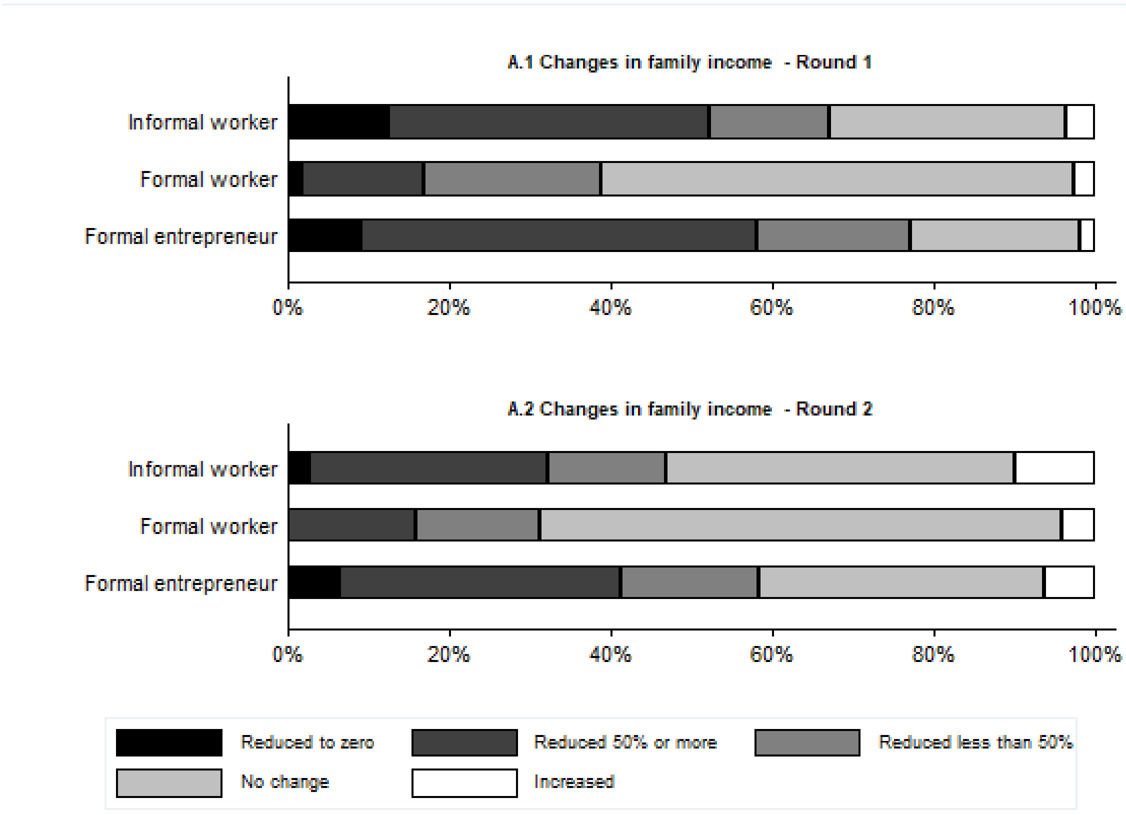
Even though all state and city governments and the federal government have been running public information campaigns about Covid-19, these are not reaching everyone. Most of the population (63% in both rounds) claimed to have seen at least one government campaign, via diverse means— among this group, most in the first round had seen them via TV (85%), followed by newspapers (35%), Twitter/Facebook (30%), radio (27%), blogs (25%) and WhatsApp (21%). In the second round, these patterns remain, though TV even more strongly the predominant route — among those who claimed to have seen at least one government campaign, most had seen them via TV (86%), followed by Twitter/Facebook (20%), newspapers (19%), radio (19%), blogs (16%) and WhatsApp (12%). The majority of these people (64% and 59% in the first and second round, respectively) recalled seeing a public information campaign from the state government specifically; fewer said they had seen one from the federal government (35% and 37% in the first and second round, respectively), or the municipal government (33% and 36% in the first and second round, respectively).

The surveys show that citizens take the risk presented by Covid-19 seriously, with 81% in the first and 75% in the second round, considering it to be much more serious than a common cold. Similarly, to the first round, in the second round almost half of respondents consider the government response measures that apply to them, given their location, them to be less stringent than necessary (49%). More than two fifths in the second round (42%) consider them to be adequate, and 9% view them as more stringent than necessary.

Impacts of government response policies on income and education

The first survey round was undertaken nearly two months after the widespread introduction of physical distancing policies in mid-March, while the second was conducted nearly three months subsequently. They confirm that individuals have experienced large changes in household income since February and that there has also been some recovery in household income levels after May (see Figure 12). Overall, while 53% of respondents in the first round reported a reduction in household income, this percentage dropped to 37% in the second round. In the second round, 35% of citizens said that they had had difficulties paying bills since February, compared to 27% of respondents in the first round. However, among those in the second round who saw their income decrease, 64% (or 24% of the overall population) stated that they had seen a reduction of half or more, and 6% (2% of the total population) reporting a total loss of earnings.

Figure 12. Changes in income compared to February



Source: OxCGRT

Between our first to second-round surveys, there were changes in the proportions of people in the categories in the above figure. Those who were employed as formal workers in February comprised 46% of those with a paid professional activity, a percentage that slipped to 35% during the second round. Conversely, the percentages of informal workers rose, from 38% to 49% of paid workers, from the first to the second round. Individual micro entrepreneurs – MEIs – made up 16% of this group in both rounds.

We included in the survey questions about changes in income as opposed to asking about job losses, in order to pick up variation among the self-employed, and in the number of work hours among employed people. In the first round, only 2% of formal workers reported losing all of their earnings between February and the time of the survey, compared with 9% of MEIs, and 13% of informal workers. In the second round, these percentages reduced: only 0.1% of formal workers reported losing all of their earnings between February and the time of the survey, compared with 6% of microentrepreneurs, and 3% of informal workers. Overall, reductions in income were far less common among formal workers (39% of this group in the first round, and 31% in the second) than among MEIs (76% in the first round, compared to 57% in the second), or informal workers (67% in the first round, compared to 47% in the second). Moreover, difficulties in paying bills were more common among MEIs (47% of those reporting this difficulty in the first round, compared to 39% in the second) than among informal workers (45% in the first round, compared to 28% in the second), or formal workers (23% in the first round, compared to 21% in the second)[31].

These patterns reflect financial assistance policies that were more thoroughly implemented by the second-round survey. On 31 March, the Brazilian national congress passed an income support law (Law No. 13982/2020, sanctioned on 2 April 2020), which stipulated that low-income individuals should receive an emergency cash-transfer of R$ 600 (equivalent to US$110) once per month initially for three months, but with the possibility of extension by the federal government Approximately 22% of the population of the eight cities in the first round had received the first instalment of this income support before their survey interview, 10% applied were deemed eligible but had not received it, and 9% had applied and were not deemed eligible. (In other words, the disbursement was part-way through being implemented at the time of our first survey.) In turn, in the second round, more than a fourth of the population of the nine cities (27%) had received the first instalment of this income support before their survey interview, while only 1% applied were deemed eligible but had not received it, and 8% had applied and were not deemed eligible. A greater proportion (54% and 57% in the first and second round, respectively) of beneficiaries of Bolsa Familia, a pre-existing cash transfer programme, stated that they had received at least part of this emergency support.

A level of income support that respondents considered sufficient to make up at least half of their income reduction since February was reported by 43% of people in the first round, and 52% of people in the second round, among those who had both experienced a loss in income and had received the R$ 600. In the first round, the support measure reached 46% of those with a monthly income below 1 minimum wage, 25% in the 1 to 2 minimum-wage range, 22% of people in the 2-5 minimum-wage bracket, and 10% in the 5-10 minimum-wage range. In the second round, there were improvements in targeting poorer people: it reached 52% of those with a monthly income below 1 minimum wage, 37% in the 1 to 2 minimum-wage range, 25% of people in the 2-5 minimum-wage bracket, and 11% in the 5-10 minimum-wage range.

In the two weeks prior to first-round survey interviews, schools were closed across Brazil. Some but not all schools were closed at the time of the second-round survey. We included survey questions to indicate the quality of the education that children and teenagers were receiving outside of the classroom. Respondents who stated that there was more than one under-18-year-old in their household enrolled in school were

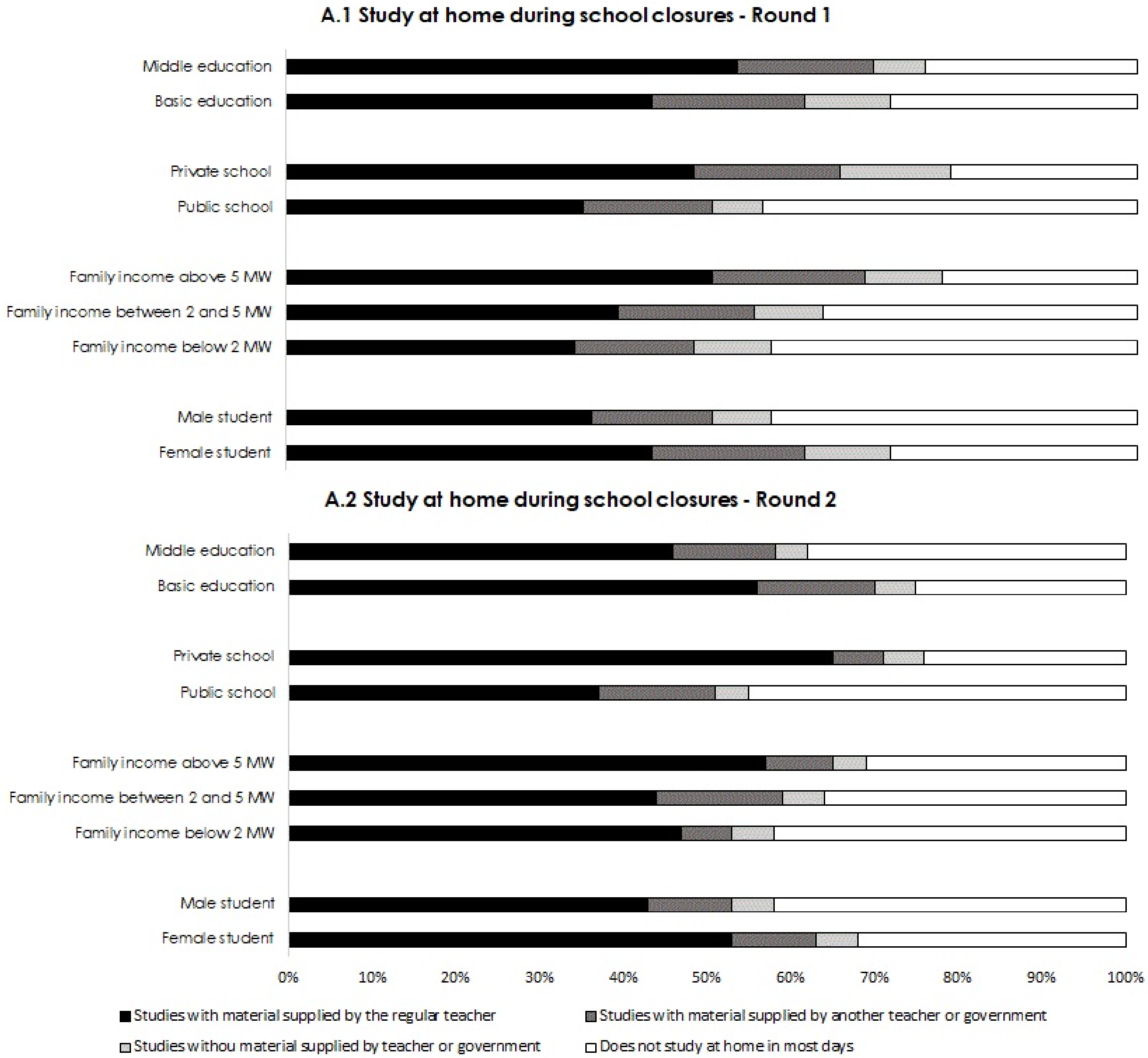
[31] Corresponding results can be seen when changes in income are compared across different income brackets, with the poor experiencing the greatest losses, and again, losses were attenuated at the time of the second round.

randomly assigned to comment on either the youngest or the eldest student. Figure 13 displays the results. Broadly speaking, in both surveys, most individuals stated that children were studying most days (66% and 65% in the first and second round, respectively), and that they did so using materials supplied by their usual teacher, or by another teacher or the government. In fact, a majority of students either studied using materials provided by their usual teacher (40% and 48% in the first and second round, respectively), or by another teacher in their school or the government (16% and 11% in the first and second round, respectively). We consider that these two categories indicate that students have continued to learn from study materials that are likely to be appropriate to them. Studying with materials not supplied by a teacher or by the government may be fruitful, but the quality is harder to assess. We did not ask for how long students were studying each day.

As Figure 13 shows, these figures varied across public and private schools, and by gender. Fewer public-school students (57% in both rounds) than private school students (79% and 80% in the first and second round, respectively) studied at all most days, and fewer boys (59% and 60% in the first and second round, respectively) did so than girls (72% and 70% in the first and second round, respectively).

Our survey results also reveal growing inequality in the quality of education at home, between private and public-school students. In the first round, a higher percentage of students in private schools studied using materials provided by either their teacher (48%) or by another teacher or from the government (17%), compared to students in public schools, of whom 35% studied using material provided by their teacher and 16% used material from another teacher or the government. In the second round, education quality for students enrolled in private schools rises far more than it does for public school students. The results from this round indicate that the percentages of students in private schools studying using materials provided by either their teacher grew to 63%, with 6% using materials from another teacher or the government. Meanwhile just 36% of public-school students studied using material provided by their teacher, with 14% using material from another teacher or the government.

Figure 13. Study at home during school closures



Source: OxCGRT

<u>Models of testing frequency and going out</u>

To look more closely at the results discussed so far, we estimated linear regression models—or linear probability models (or binary dependent variables—with several dependent variables representing testing for the new coronavirus, and others representing frequency of leaving home. The results of these models are reported in Table 5. Model 7 predicts whether the respondent had been tested for coronavirus. Model 8 predicts whether the respondent never left the house during the two weeks prior to interview. Model 9 predicts the number of days that the respondent left home during the previous fortnight, and Model 10, whether the respondent left home on just one or two days in the same period.

Moreover, to further assess citizen behaviour, knowledge, and testing frequency, we divide the samples into three strata according to *probable* contagion risk. These strata are inevitably imperfect. We cannot be sure who was contagious among the respondents during the two weeks prior to interview, which is the period when we ask about behaviours. For one thing, many people infected with SARS-CoV-2 show no signs of infection, and the survey is not able to identify everyone in this group. In the surveys, respondents who state that in the past seven days they have experienced at least one Covid-19 symptom that is not linked to a pre-existing condition are then asked when their symptom(s) began, and what the result was if they were tested. To date, studies show that the infectious period tends to begin two-three days before symptoms. People with the virus are considered most infectious the day before symptoms appear, and their viral load remains high during the first week of symptoms. Thereafter, infectiousness declines. There is variation across individuals for all of these periods, however, and occasionally people have been found to have significant viral loads for up to 25 days after the onset of symptoms[32].

Testing

We estimate different versions of the model predicting whether a respondent has received a coronavirus test. In the first, (Model 7a), we observe that, in the first round, individuals in the income bracket of 10 or more minimum wages were 4.7% more likely to get tested than those who received up–to–one minimum wage. However, being probably contagious and having had at least one symptom of Covid-19 did not significantly predict whether people had received a test. In the second round, individuals in the highest income bracket were 12% more likely to get tested than those who

[32] As per our first OxCGRT working paper about Brazil, taking this evidence together, we include in the category '(probably) contagious with symptoms' responses from people who stated that their symptoms began between 10 and 20 days before the interview. Those for whom symptoms started 10 days prior to interview are likely to have already been infectious at least during days 2-11 of the prior 14 days, and from day 11 onwards their viral load would have been decreasing. To include only individuals whose symptoms started on or very close to this day would have meant a very small sample for comparison with the rest, so we extended the relevant days of symptom onset. Those for whom symptoms began 20 days ago would have been most infectious in the first day or two of the fortnight prior to interview if patterns for median viral loads among all infected people are to apply to them. However, because we only probe the date of symptom onset among respondents who have (still) been experiencing symptoms during the week before their interview, it is likely that these individuals are struggling more than most to shake off the virus, and may, therefore, have more steady declines in viral load than the median. While it is certainly true that these people may no longer have been infectious for the full two weeks prior to the survey, this concern should be considered alongside the fact that infected people whose symptoms started less than 10 days before their interview are likely to have been infectious for some of the previous two weeks. This latter group is not included in the category '(probably) contagious with symptoms'. We exclude from the '(probably) contagious with symptoms' group anyone who was tested and received a negative result.

received up–to–one minimum wage. However, being probably contagious and having had at least one symptom of Covid-19 significantly predicted whether people had received a test. Model 7a for the second round also shows that individuals between 40 and 60 years of age were 5.5% more likely to get tested than those between 18 and 24.

In Model 7b, we substitute being probably contagious and having had at least one symptom of Covid-19 for ever having had symptoms during the outbreak (regardless of when the symptoms occurred). Across rounds, the effect of income remains unchanged in this model while the symptoms variable is positive and significant, indicating that symptomatic individuals in the first and second round were 7.8% and 20%, respectively, more likely to be tested at all than people who had not had any such symptoms during the outbreak. Note that Model 7a indicates timely testing, as viral loads need to be carried out within the correct window to diagnose infectiousness, whereas Model 7b indicates testing overall, without indicating whether tests were taken in a timely fashion.

In the second survey round, but not in the first, we asked people whether they took a RT-PCR test or an antibody test. Using the second-round data only, we then estimated the two versions of Model 7 for each type of test, which confirmed our conclusions to date. Model 7c shows that being probably contagious and having had at least one symptom of Covid-19 significantly predicts whether people had received a PCR test, while Model 7d indicates that symptomatic individuals were 17% more likely to be PCR tested than people who had not had any such symptoms during the outbreak. As Models 7e and 7f show, the effects remain largely unchanged when considering antibody testing, the difference being a loss of significance for the coefficient indicating probable contagiousness. This result is expected as, unlike PCR, antibodies tests should be performed sometime after the symptoms have vanished.

Leaving home

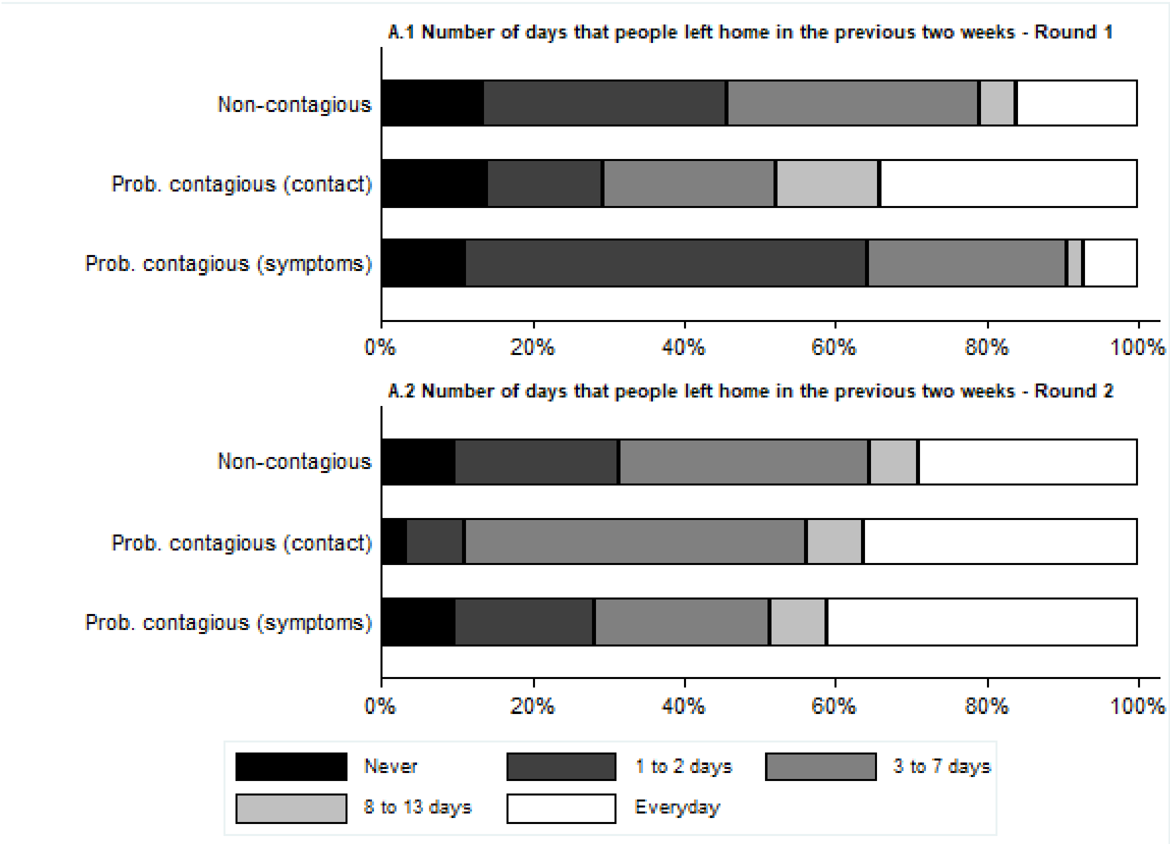
Model 8 shows that staying at home during the prior two weeks was strongly related to age during the two survey rounds, with people aged 60 and above more likely than 18-24-year-olds to have never left the house during the previous fortnight. Women were more likely to have not left home than men (6.6% and 4.6% in the first and second round, respectively). In the first round, informal workers were 4.9% more likely to have stayed at home than formal workers, and MEIs were 8.8% more likely than formal workers. Those who lacked paid employment in February were the most likely to have stayed at home during the fortnight prior to interview (they were 9.9% more likely than formal workers). These differences across types of work remain unchanged in the second round, although informal workers were 5.6% more likely to have stayed at home than formal workers, and those who lacked paid employment in February were 5.7% more likely to have stayed at home than formal workers. In this round, MEIs were the most likely to have stayed at home during the fortnight prior to interview (specifically, 6% more likely than formal workers).

Men also tended to leave the house more often than women. Model 9 reports that this was on 2.6 days more, on average, during the previous two weeks for both survey rounds. Over the same period, people with higher education left the house on fewer days than those with primary education (1.1 days fewer, on average) in the first round, while this difference is not significant in the second round. Furthermore, people with middle education left the house on more days of the prior fortnight than those with primary education (0.6 days more, on average) in the second round.

As would expected from the fact that some are essential workers, in the first round, formal workers left the house on more days (on 1.2 more, on average, over two weeks) than informal workers, on more days (1.3 more, on average) than MEIs, and on 1.9 more days, on average, than those without a remunerated activity in February. Indeed, 42% of formal workers are essential works, compared to 30% of informal workers. However, the difference in leaving home is likely also a results of job losses—formal workers were less likely than others to have lost their jobs, as indicated by total income loss. In the second round, these differences remained, although they decrease in magnitude. Formal workers left the house on more days in the prior fortnight (0.6 more, on average) than informal workers, on more days (1.3 more, on average) than those without a remunerated activity in February and did not differ significantly in the frequency of leaving home compared to MEIs.

Crucially for concerns around disease spread, results from our first-round survey showed that individuals who were probably contagious for having at least one Covid-19 symptom left home on significantly fewer days (0.9 days fewer over two weeks) than those unlikely to be contagious. However, those who were probably contagious for contact left the house on 2.1 more days, on average, than people who are unlikely to be contagious. Note that this finding is based on a small number of people's behaviour. In the second round, these differences dissipated. Individuals who were probably contagious for having at least one Covid-19 symptom did not differ significantly from those unlikely to be contagious in the number of days that they left the house. The same is true for those who were probably contagious for contact. This change is concerning. The raw descriptive results are shown in the below figure.

Figure 14. Relative frequencies of people leaving home, by contagiousness category



Source: OxCGRT

Model 10 further characterises the frequency with which different groups of people are leaving the house over the fortnight prior to interview. It assesses how likely different groups of people were to go out on just one or two days during the previous two weeks, which may indicate leaving home for essentials only. Our interpretation here, given the confusion around appropriate self-isolation behaviours, is that people may have reduced how often they left home to a minimum number of days to accommodate basic needs, instead of remaining in their residence throughout the fortnight and asking others to deliver food and other necessary items.

In the first round, compared to Model 9, some differences are seen across education levels. Whereas informal workers left home on fewer days during the fortnight than formal workers did (Model 9), these individuals were more likely than formal workers to go out on one or two days over the two weeks (Model 10). Whereas the unemployed went out on fewer days than formal workers, they were more likely to have also gone out on one or two days in the period than formal workers. Similar differences were observed in the second survey round. Analogous patterns are evident when the results for different education levels are compared across the two models in the first round (with highly educated people going out on more days, and less likely to leave on one or two days).

Unlike the first round, individuals with middle education in the second survey period reported going out on more days and were less likely to leave on one or two days. Women went out on fewer days and were more likely to go out on one or two days on both survey periods.

Differences in the results of Models 9 and 10 are also evident for people who may be contagious. Those in the category ‘probably contagious with symptoms’ left home on fewer days than probably non-contagious individuals, and were more likely to leave on only one or two days in the fortnight during the first round period. This tentatively suggests that contagious individuals were making an effort to stay home, but still went out for essentials. In the second survey period, we do not observe the same pattern. Those in the category ‘probably contagious with symptoms’ did not differ significantly from those unlikely to be contagious in the number of days that they left the house and the likelihood of leaving the house on only one or two days in the fortnight.

Table 6. Regression results of models with testing and leaving home frequencies as dependent variables

	Round 1	Round 2	Round 1	Round 2	Round 2	Round 2	Round 2	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
	Model 7a	**Model 7a**	**Model 7b**	**Model 7b**	**Model 7c**	**Model 7d**	**Model 7e**	**Model 7f**	**Model 8**	**Model 8**	**Model 9**	**Model 9**	**Model 10**	**Model 10**
	Tested for coronavirus	Tested for coronavirus	Tested for coronavirus	Tested for coronavirus	Tested for coronavirus (PCR test)	Tested for coronavirus (PCR test)	Tested for coronavirus (Antibody test)	Tested for coronavirus (Antibody test)	Never left the house in two weeks	Never left the house in two weeks	Number of days left the house in two weeks	Number of days left the house in two weeks	Left the house once or twice in two weeks	Left the house once or twice in two weeks
Age (reference 18 to 24)														
24 to 40	-0.0235	0.0478	-0.0236	0.0415	0.0255	0.0211	0.0169	0.0141	-0.0785***	-0.0229	0.571*	1.242***	-0.0119	0.0164
	(0.0167)	(0.0292)	(0.0166)	(0.0286)	(0.0235)	(0.0231)	(0.0218)	(0.0217)	(0.0245)	(0.0231)	(0.326)	(0.390)	(0.0340)	(0.0307)
40 to 60	-0.0216	0.0555*	-0.0233	0.0501*	0.0263	0.0217	0.0292	0.0275	-0.0480*	-0.000905	0.610*	1.287***	-0.0473	0.0135
	(0.0173)	(0.0290)	(0.0172)	(0.0284)	(0.0234)	(0.0230)	(0.0218)	(0.0216)	(0.0254)	(0.0230)	(0.339)	(0.388)	(0.0353)	(0.0306)
60 or more	-0.0316	0.0356	-0.0264	0.0428	0.00588	0.0142	0.0271	0.0302	0.0682**	0.0468*	-0.393	-0.382	-0.00769	0.118***
	(0.0202)	(0.0332)	(0.0201)	(0.0325)	(0.0268)	(0.0263)	(0.0249)	(0.0247)	(0.0297)	(0.0263)	(0.396)	(0.444)	(0.0412)	(0.0350)
Education (ref. primary education)														
Middle education	0.00864	0.0251	0.00873	0.0196	0.0181	0.0164	0.0155	0.0147	-0.00478	-0.0455**	0.320	0.608*	0.00471	-0.0571**
	(0.0135)	(0.0235)	(0.0134)	(0.0230)	(0.0190)	(0.0187)	(0.0177)	(0.0175)	(0.0199)	(0.0186)	(0.265)	(0.315)	(0.0276)	(0.0248)
Higher education	0.00218	0.130***	0.00414	0.123***	0.0772***	0.0757***	0.0813***	0.0798***	0.0241	-0.0464*	-1.096***	0.206	0.0961***	-0.0246
	(0.0157)	(0.0305)	(0.0156)	(0.0299)	(0.0250)	(0.0245)	(0.0232)	(0.0230)	(0.0230)	(0.0241)	(0.307)	(0.408)	(0.0319)	(0.0321)
Gender (reference female)	-0.00375	-0.0202	-0.00259	-0.0204	-0.0130	-0.0153	-0.00257	-0.00273	-0.0659***	-0.0462***	2.613***	2.621***	-0.144***	-0.109***
	(0.0113)	(0.0182)	(0.0112)	(0.0178)	(0.0149)	(0.0146)	(0.0139)	(0.0137)	(0.0166)	(0.0144)	(0.222)	(0.243)	(0.0231)	(0.0192)
Income (reference up to 1 MW)														
1 to 2 MW	-0.0117	0.0242	-0.0135	0.0377	0.0151	0.0259	0.0199	0.0292	0.0363	-0.116***	-0.164	0.793*	0.0285	0.0604*
	(0.0189)	(0.0315)	(0.0188)	(0.0309)	(0.0260)	(0.0255)	(0.0239)	(0.0237)	(0.0278)	(0.0249)	(0.371)	(0.422)	(0.0386)	(0.0332)
from 2 to 5 MW	-0.00987	-0.0115	-0.00730	0.00667	0.0159	0.0338	-0.0118	-0.00253	-0.0102	-0.0826***	0.338	0.478	0.0324	0.0494
	(0.0172)	(0.0287)	(0.0171)	(0.0282)	(0.0235)	(0.0231)	(0.0216)	(0.0215)	(0.0253)	(0.0227)	(0.337)	(0.384)	(0.0351)	(0.0302)
from 5 to 10 MW	0.0172	-0.0632*	0.0224	-0.0427	-0.0539*	-0.0312	-0.0240	-0.0148	0.105***	-0.0968***	-0.339	0.296	-0.0240	0.0570
	(0.0234)	(0.0372)	(0.0233)	(0.0365)	(0.0306)	(0.0301)	(0.0280)	(0.0279)	(0.0343)	(0.0294)	(0.458)	(0.497)	(0.0477)	(0.0391)
more than 10 MW	0.0467*	0.123***	0.0499*	0.142***	0.119***	0.136***	0.0611*	0.0750**	-0.00898	-0.0982***	0.255	1.207**	-0.0136	-0.0127
	(0.0259)	(0.0430)	(0.0257)	(0.0421)	(0.0359)	(0.0353)	(0.0338)	(0.0336)	(0.0380)	(0.0340)	(0.506)	(0.574)	(0.0527)	(0.0452)
Type of work (ref. formal worker)														
Informal worker	-0.00202	-0.0316	-0.00295	-0.0151	-0.0137	0.00210	-0.0158	-0.0119	0.0490**	0.0556***	-1.246***	-0.619*	0.0698**	0.00107
	(0.0149)	(0.0243)	(0.0148)	(0.0238)	(0.0201)	(0.0198)	(0.0187)	(0.0185)	(0.0218)	(0.0192)	(0.291)	(0.325)	(0.0303)	(0.0256)
Formal entrepreneur	0.00670	-0.0185	0.00714	-0.0120	-0.00344	0.00394	0.00404	0.00350	0.0876***	0.0599**	-1.342***	0.478	0.0444	-0.0201
	(0.0190)	(0.0327)	(0.0188)	(0.0319)	(0.0271)	(0.0266)	(0.0252)	(0.0249)	(0.0279)	(0.0258)	(0.372)	(0.437)	(0.0387)	(0.0344)
No paied work	-0.0235	-0.0993***	-0.0265	-0.0876***	-0.0425*	-0.0319	-0.0510**	-0.0482**	0.0997***	0.0568**	-1.942***	-1.287***	0.0872***	0.0606**
	(0.0163)	(0.0280)	(0.0161)	(0.0273)	(0.0228)	(0.0224)	(0.0212)	(0.0210)	(0.0239)	(0.0221)	(0.318)	(0.374)	(0.0331)	(0.0295)
Contagious (contact w. susp.)	0.00457	0.0396			-0.0609		0.0715*		-0.0177	-0.0265	2.101***	0.136	-0.118	-0.0446
	(0.0406)	(0.0564)			(0.0493)		(0.0429)		(0.0595)	(0.0446)	(0.793)	(0.754)	(0.0826)	(0.0594)
Contagious (with symptoms)	-0.00367	0.358***			0.355***		0.0929		-0.0262	0.0326	-0.952*	-0.166	0.128**	-0.0303
	(0.0260)	(0.0676)			(0.0574)		(0.0644)		(0.0382)	(0.0534)	(0.509)	(0.904)	(0.0530)	(0.0712)
Did not reg. leave house (Feb.)	0.000746	0.00289	0.00257	0.0209	-0.0187	-0.00391	0.0191	0.0236	0.127***	0.0501**	-1.465***	-1.282***	-0.0275	0.0522*
	(0.0184)	(0.0278)	(0.0183)	(0.0272)	(0.0226)	(0.0222)	(0.0208)	(0.0206)	(0.0270)	(0.0220)	(0.360)	(0.372)	(0.0375)	(0.0293)
N. of people in household	-0.00398	-0.00432	-0.00431	-0.00960*	-0.00259	-0.00764	-0.00370	-0.00591	0.00247	-0.0185***	0.0804	0.0708	-0.00530	0.00573
	(0.00364)	(0.00594)	(0.00361)	(0.00583)	(0.00491)	(0.00483)	(0.00452)	(0.00450)	(0.00534)	(0.00470)	(0.0711)	(0.0795)	(0.00741)	(0.00626)
Ever had Covid symptoms			0.0783***	0.204***		0.170***		0.0856***						
			(0.0167)	(0.0198)		(0.0166)		(0.0161)						
Respondent participated in the first round	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes
City-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cal.-fortnight fixed effects	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes
Observations	1,654	1,860	1,654	1,860	1,684	1,684	1,650	1,650	1,654	1,860	1,654	1,860	1,654	1,860
R-squared	0.019	0.084	0.032	0.121	0.075	0.109	0.060	0.074	0.107	0.126	0.191	0.160	0.057	0.064

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Conclusion

Taken together, the results presented in this paper indicate the substantial ongoing risk from Covid-19 faced by states and cities across Brazil. It is also clear that closure and containment policies influence how much citizens in general are staying at home, how often they venture out to make non-essential trips, and how far they travel—even if these policies are associated with fatigue effects.

In addition to recognising the ongoing risk, our key recommendations for policymakers are that they should brainstorm ways to improve testing access for the poor, seek to assist public schools and their teachers in providing learning materials bespoke to their students, and should enrich public health campaigns with specific information about the appropriate behaviours for self-isolating individuals. As previously noted, the fact that three-quarters of respondents in our second-round survey considered behaving as normal but wearing a mask to be appropriate for someone who is self-isolating is worrying, especially as we find that the risk of openness is still high. Our surveys point to TV as the most appropriate vehicle to address this misunderstanding.

There is also good news reported in this paper. By 6 to 27 May, when the first-round survey interviews were conducted, many people had seen their incomes fall dramatically relative to February. For those whose incomes had fallen, and who were receiving income support, this support was generally making an important difference—however, those people were in the minority. By 27 July to 2 October, when the second-round interviews took place, we observe a reduction in the proportion people who experienced an encouraging decrease in their household income since February. A substantial share of the population is struggling to overcome financial problems associated with Covid-19, but the extension of income support has assisted many people to regain, in part, their losses.

Over time, we hope that our publicly available, real-time dataset will assist policymakers and researchers across Brazil as they seek to further understand how to improve policy responses to Covid-19.

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Please note that additional web archived links are referred to in the footnotes.

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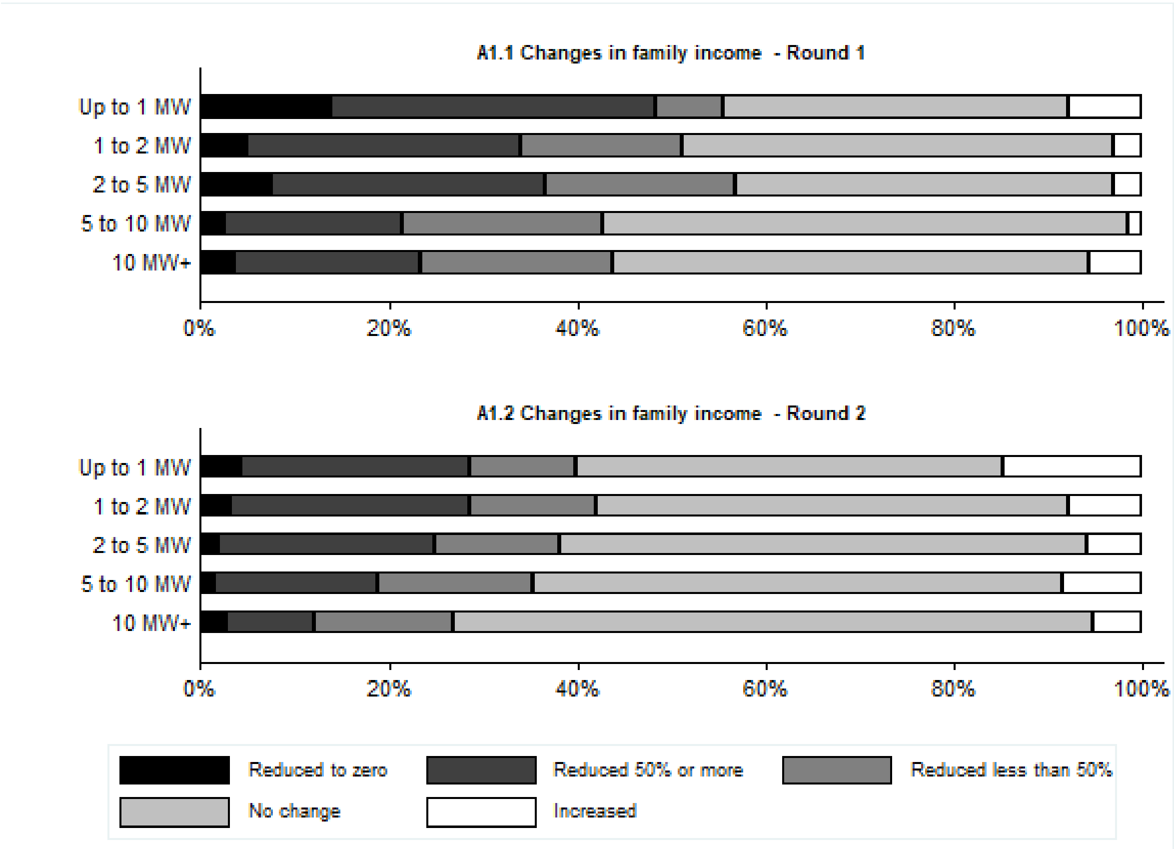
Appendix

Figure A1. Changes in household income by income bracket



Source: OxCGRT

Calculation of the indices

Each index is composed of a series of individual policy response indicators. For each indicator, we create a score by taking the ordinal value and adding an extra half-point if the policy is general rather than targeted, if applicable. We then rescale each of these by their maximum value to create a score between 0 and 100, with a missing value contributing 0. These scores are then averaged to get the composite indices. This calculation is described in equation 1 below where *k* is the number of component indicators in an index and I_j is the sub-index score for an individual indicator.

$$(1) \qquad index = \frac{1}{k}\sum_{j=1}^{k} I_j$$

Table A2. Demographic characteristics of the samples by city

Quotas	São Paulo		Rio de Janeiro		Porto Alegre		Goiânia		Fortaleza		Salvador		Manaus		Recife		Belém
	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 2
Sex																	
F	53.0	60.0	54.5	61.2	55.0	55.2	53.0	47.0	54.2	54.0	55.2	53.7	51.8	54.7	55.5	58.5	57.0
M	47.0	40.0	45.5	38.8	45.0	44.8	47.0	53.0	45.8	46.0	44.8	46.3	48.2	45.3	44.5	41.5	43.0
Age																	
18 to 24	15.9	12.4	15.5	11.9	14.5	9.5	18.8	13.9	20.4	17.0	18.9	10.8	22.1	18.4	18.0	13.0	21.3
25 to 40	35.5	29.9	31.5	27.4	33.0	29.8	37.1	34.2	35.3	36.0	37.8	33.5	40.7	29.9	33.5	38.0	40.1
40 to 60	32.7	38.6	35.0	34.8	34.0	39.8	31.2	37.6	31.3	33.0	31.8	41.9	28.1	40.8	32.5	32.5	30.2
60 +	15.9	19.1	18.0	25.9	18.5	20.9	12.9	14.3	12.9	14.0	11.4	13.8	9.1	10.9	16.0	16.5	8.4
Education																	
Primary education	35.1	30.7	31.0	24.4	32.5	26.4	38.6	20.8	39.8	37.5	32.8	26.6	38.7	21.9	39.5	35.0	34.2
Middle education	30.3	33.1	36.5	38.3	30.5	33.3	35.2	50.5	37.3	38.0	39.3	45.3	39.2	55.2	34.5	36.5	40.6
Higher education	34.7	36.3	32.5	37.3	37.0	40.3	26.2	28.7	22.9	24.5	27.9	28.1	22.1	22.9	26.0	28.5	25.2
Income																	
Up to 2 MW	19.2	29.1	33.0	25.4	24.0	19.9	41.6	32.2	45.3	38.5	36.3	36.5	50.3	47.7	41.5	35.0	36.6
from 2 to 5 MW	51.8	49.8	40.5	48.3	54.0	51.8	38.6	44.6	43.8	46.5	46.3	43.8	33.2	35.8	44.0	47.0	45.5
from 5 to 10 MW	17.5	15.9	15.5	16.9	14.0	15.4	10.4	15.8	8.0	8.5	11.0	13.8	9.6	9.0	5.5	8.5	6.5
10 MW +	11.6	5.2	11.0	9.4	8.0	12.9	9.4	7.4	3.0	6.5	6.5	5.9	7.0	7.5	9.0	9.5	11.4

Table A3. Regression models for mobility with binary policy variables (0=below 50, 1=50 or higher)

	Home perman.	Change in non-essential trips	Change in distance	Home perman.	Change in non-essential trips	Change in distance
School closing (binary)	0.684***	0.211	5.419*	9.687***	-37.85***	-22.12***
	(0.235)	(1.960)	(2.648)	(2.351)	(7.569)	(4.100)
Workplace closing (binary)	0.856*	-8.983***	-5.997**	2.346***	-11.04***	-9.037***
	(0.447)	(3.186)	(2.528)	(0.632)	(3.541)	(2.586)
Cancel public events (binary)	-0.487	-1.310	0.914	1.696	-14.95*	0.788
	(0.287)	(2.027)	(1.789)	(1.922)	(7.884)	(4.029)
Restr. on gatherings (binary)	-0.0848	-3.064**	-0.607	1.419	-5.957**	-4.172
	(0.276)	(1.294)	(1.095)	(0.888)	(2.806)	(2.797)
Stay at home requirem. (binary)	2.577***	-7.337***	-4.733*	1.992***	-6.357***	-3.728
	(0.675)	(2.187)	(2.321)	(0.698)	(2.063)	(2.597)
Restr. on int. movement (binary)	0.00974	-1.599	-1.607	0.836*	-3.415	-4.304**
	(0.335)	(1.865)	(1.673)	(0.468)	(2.016)	(1.846)
Public info. Campaigns (binary)	0.882**	4.063**	-1.470	1.572***	0.603	-1.156
	(0.333)	(1.741)	(1.492)	(0.448)	(1.591)	(1.484)
Linear trend (continuous)	No	No	No	-1.515***	5.401***	5.541***
				(0.103)	(0.459)	(0.368)
Linear trend (categorical; in days after first policy)	Yes	Yes	Yes	No	No	No
Week-day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6372	5697	5697	6372	5697	5697
States	27	27	27	27	27	27
R-squared	0.890	0.852	0.793	0.764	0.791	0.665

Clustered standard errors in parentheses

* p<.10 ** p<.05 *** p<.01

Table A4. Regression models for mobility with month fixed-effects

	Home perman.	Change in non-essential trips	Change in distance	Home perman.	Change in non-essential trips	Change in distance
Stringency Index	0.265***	-1.124***	-0.556***			
	(0.00777)	(0.0309)	(0.0183)			
School closing				0.0573***	-0.183***	-0.137***
				(0.0106)	(0.0409)	(0.0397)
Workplace closing				0.0538***	-0.227***	-0.225***
				(0.00832)	(0.0488)	(0.0415)
Cancel public events				0.0126	-0.213***	0.0719*
				(0.0125)	(0.0541)	(0.0404)
Restr. on gatherings				0.0235	-0.0954*	0.00476
				(0.0149)	(0.0480)	(0.0472)
Stay at home requirem.				0.0728***	-0.199***	-0.140***
				(0.0130)	(0.0436)	(0.0440)
Restr. on int. movement				0.0240***	-0.0663**	-0.0791***
				(0.00574)	(0.0275)	(0.0231)
Public info. Campaigns				-0.00395	-0.0175	0.0186
				(0.00717)	(0.0293)	(0.0265)
Calendar-month fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Week-day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6372	5697	5697	6372	5697	5697
States	27	27	27	27	27	27
R-squared	0.803	0.809	0.675	0.806	0.814	0.705

Clustered standard errors in parentheses

* p<.10 ** p<.05 *** p<.01

Table A5. Regression models for mobility with month fixed-effects

	Home perman.	Change in non-essential trips	Change in distance	Home perman.	Change in non-essential trips	Change in distance
Stringency Index	0.265***	-1.124***	-0.556***			
	(0.00777)	(0.0309)	(0.0183)			
School closing				0.0573***	-0.183***	-0.137***
				(0.0106)	(0.0409)	(0.0397)
Workplace closing				0.0538***	-0.227***	-0.225***
				(0.00832)	(0.0488)	(0.0415)
Cancel public events				0.0126	-0.213***	0.0719*
				(0.0125)	(0.0541)	(0.0404)
Restr. on gatherings				0.0235	-0.0954*	0.00476
				(0.0149)	(0.0480)	(0.0472)
Stay at home requirem.				0.0728***	-0.199***	-0.140***
				(0.0130)	(0.0436)	(0.0440)
Restr. on int. movement				0.0240***	-0.0663**	-0.0791***
				(0.00574)	(0.0275)	(0.0231)
Public info. Campaigns				-0.00395	-0.0175	0.0186
				(0.00717)	(0.0293)	(0.0265)
Calendar-month fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Week-day fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6372	5697	5697	6372	5697	5697
States	27	27	27	27	27	27
R-squared	0.803	0.809	0.675	0.806	0.814	0.705

Clustered standard errors in parentheses

* p<.10 ** p<.05 *** p<.01

Table A6. Regression models results (with alternative measure of exposure to Covid-19)

	Round 1	Round 2	Round 2	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
	Tested for coronavirus	Tested for coronavirus	Tested for coronavirus (PCR test)	Tested for coronavirus (Antibody test)	Never left the house in two weeks	Never left the house in two weeks	Number of days left the house in two weeks	Number of days left the house in two weeks	Left the house once or twice in two weeks	Left the house once or twice in two weeks
Age (reference 18 to 24)										
24 to 40	-0.0232	0.0509*	0.0282	0.0175	-0.0782***	-0.0225	0.555*	1.235***	-0.0113	0.0169
	(0.0167)	(0.0292)	(0.0235)	(0.0219)	(0.0245)	(0.0231)	(0.327)	(0.390)	(0.0341)	(0.0307)
40 to 60	-0.0209	0.0590**	0.0287	0.0301	-0.0483*	-0.000715	0.575*	1.278***	-0.0444	0.0143
	(0.0173)	(0.0291)	(0.0235)	(0.0218)	(0.0254)	(0.0230)	(0.339)	(0.389)	(0.0353)	(0.0306)
60 or more	-0.0316	0.0395	0.00870	0.0279	0.0673**	0.0472*	-0.375	-0.390	-0.00821	0.118***
	(0.0202)	(0.0333)	(0.0268)	(0.0249)	(0.0297)	(0.0263)	(0.396)	(0.444)	(0.0413)	(0.0350)
Education (ref. primary education)										
Middle education	0.00856	0.0280	0.0220	0.0159	-0.00451	-0.0451**	0.321	0.601*	0.00446	-0.0567**
	(0.0135)	(0.0236)	(0.0190)	(0.0177)	(0.0199)	(0.0186)	(0.265)	(0.315)	(0.0276)	(0.0248)
Higher education	0.00201	0.133***	0.0814***	0.0819***	0.0240	-0.0460*	-1.100***	0.196	0.0965***	-0.0241
	(0.0157)	(0.0305)	(0.0251)	(0.0232)	(0.0230)	(0.0241)	(0.307)	(0.408)	(0.0320)	(0.0321)
Gender (reference female)	-0.00397	-0.0193	-0.0125	-0.00251	-0.0661***	-0.0461***	2.610***	2.618***	-0.144***	-0.109***
	(0.0113)	(0.0182)	(0.0149)	(0.0139)	(0.0166)	(0.0144)	(0.222)	(0.243)	(0.0231)	(0.0192)
Income (reference up to 1 MW)										
1 to 2 MW	-0.0116	0.0220	0.0136	0.0197	0.0356	-0.116***	-0.156	0.790*	0.0292	0.0608*
	(0.0189)	(0.0315)	(0.0260)	(0.0239)	(0.0278)	(0.0249)	(0.371)	(0.421)	(0.0386)	(0.0332)
from 2 to 5 MW	-0.00997	-0.0121	0.0148	-0.0118	-0.0108	-0.0828***	0.347	0.470	0.0326	0.0499*
	(0.0172)	(0.0287)	(0.0235)	(0.0217)	(0.0253)	(0.0227)	(0.338)	(0.384)	(0.0352)	(0.0302)
from 5 to 10 MW	0.0168	-0.0647*	-0.0552*	-0.0251	0.104***	-0.0968***	-0.295	0.295	-0.0256	0.0570
	(0.0234)	(0.0372)	(0.0306)	(0.0281)	(0.0343)	(0.0294)	(0.458)	(0.497)	(0.0478)	(0.0391)
more than 10 MW	0.0468*	0.122***	0.117***	0.0604*	-0.00996	-0.0982***	0.235	1.202**	-0.0112	-0.0125
	(0.0259)	(0.0430)	(0.0359)	(0.0338)	(0.0380)	(0.0340)	(0.507)	(0.574)	(0.0528)	(0.0453)
Type of work (ref. formal worker)										
Informal worker	-0.00265	-0.0316	-0.0110	-0.0169	0.0492**	0.0561***	-1.235***	-0.617*	0.0701**	0.000834
	(0.0149)	(0.0243)	(0.0201)	(0.0187)	(0.0218)	(0.0192)	(0.291)	(0.324)	(0.0304)	(0.0255)
Formal entrepreneur	0.00789	-0.0200	-0.00408	0.00328	0.0879***	0.0601**	-1.344***	0.486	0.0421	-0.0212
	(0.0190)	(0.0327)	(0.0271)	(0.0252)	(0.0279)	(0.0258)	(0.372)	(0.437)	(0.0388)	(0.0344)
No paied work	-0.0239	-0.0989***	-0.0399*	-0.0526**	0.0994***	0.0574***	-1.958***	-1.296***	0.0899***	0.0610**
	(0.0162)	(0.0280)	(0.0229)	(0.0212)	(0.0238)	(0.0221)	(0.318)	(0.374)	(0.0332)	(0.0294)
Contagious for contact with suspect (alternative def.)	-0.0363	0.0125	-0.0608	0.0322	-0.0350	-0.0141	1.946***	0.225	-0.0263	-0.0569
	(0.0363)	(0.0528)	(0.0454)	(0.0402)	(0.0533)	(0.0417)	(0.712)	(0.705)	(0.0742)	(0.0556)
Contagious with symptoms (alternative def.)	-0.00421	0.273***	0.269***	0.0476	-0.0413	0.0258	-0.210	-0.551	0.0563	0.0139
	(0.0235)	(0.0541)	(0.0454)	(0.0488)	(0.0345)	(0.0427)	(0.460)	(0.723)	(0.0480)	(0.0569)
Did not reg. leave house (Feb.)	0.000435	0.00282	-0.0191	0.0190	0.127***	0.0504**	-1.464***	-1.274***	-0.0272	0.0515*
	(0.0184)	(0.0278)	(0.0226)	(0.0208)	(0.0270)	(0.0220)	(0.361)	(0.372)	(0.0376)	(0.0293)
N. of people in household	-0.00405	-0.00459	-0.00270	-0.00375	0.00252	-0.0185***	0.0764	0.0689	-0.00478	0.00603
	(0.00363)	(0.00595)	(0.00492)	(0.00453)	(0.00534)	(0.00470)	(0.0712)	(0.0795)	(0.00742)	(0.00626)
Respondent participated in the first round	No	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes
City-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cal.-fortnight fixed effects	No	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes
Observations	1,654	1,860	1,684	1,650	1,654	1,860	1,654	1,860	1,654	1,860
R-squared	0.019	0.082	0.073	0.058	0.107	0.125	0.189	0.125	0.053	0.064

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10