

DOCUMENT DE TRAVAIL

DT/2022-03

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Denialism, Politics and the Covid-19 pandemic in Brazil: an empirical analysis on observational data

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Abstract

Brazil is among the countries most affected by Covid-19 in terms of number of confirmed cases and deaths. This happens in a national context marked by a denialist positioning of the federal government in combating the pandemic. This study examines, along with other socioeconomic, health and demographic factors, how the political orientation of municipalities is related to the Covid-19 mortality rate. Using several sources of municipal data, a negative binomial model is applied, contemplating the two waves of the pandemic. Subsequently, two other econometric models were estimated in order to analyse two different transmission channels through which political factors impact on the Covid-19 mortality rate: one associated with non-pharmacological measures to combat Covid-19 (the mobility of people) and another associated with pharmacological measures (the vaccination). Among the factors analysed, the most striking result concerns the '*Bolsonaro effect*': the estimations show that mortality rates are higher in the municipalities where the president had the most expressive vote in the 2018 elections. This relationship persists over time in the most recent period. The results regarding population mobility confirm that this is one of the main transmission mechanisms of Covid-19 fatalities. Indeed, the Bolsonaro' score in the 2018 election is also shown to be significantly and positively correlated with the population mobility in particular when the pandemic reached its most critical levels. Finally, the denialist position at the top of the Federal Government does not seem to compromise the complete vaccination rate of the population beyond the first months after the beginning of the campaign. This result suggests to some extent the increasing awareness of the president's supporters of the risks involved and the effectiveness of vaccines against Covid-19. But above all, it reflects apparently the success of the National Immunization Program in Brazil, based on a long tradition, recognized at the international level.

Keywords: Brazil; Bolsonaro effect; Covid-19; Social distancing; Political Factors; Mobility; Mortality; Public Policies; Socioeconomic Inequalities; Vaccination.

JEL Classification: I14, I18, I38, O17, P16, O54

Résumé

Le Brésil est un des pays les plus touchés par la Covid-19 que ce soit en termes de cas et de décès. Cette hécatombe s'est déroulée dans un contexte où le gouvernement fédéral a adopté une attitude négationiste dans la lutte contre la pandémie. Cet article se propose de voir dans quelle mesure l'orientation politique au niveau des municipalités joue sur la mortalité due à la Covid-19, à côté d'autres facteurs socioéconomiques, démographiques et de santé. Un premier modèle économétrique couvrant l'ensemble des deux vagues (2020-2021), elles-mêmes décomposées en sous-périodes, et mobilisant de nombreuses sources de données, est estimé. Dans un second temps, deux autres modèles visent à explorer deux principaux canaux de transmission (pharmaceutique et non pharmaceutique) à travers lesquels les facteurs politiques sont susceptibles d'avoir joué sur la mortalité : la distanciation sociale et la vaccination. Le principal résultat est la mise en évidence d'un '*effet Bolsonaro*' : les estimations montrent que la mortalité croît avec les scores du président aux élections de 2018, toutes choses égales d'ailleurs. Cette relation est robuste et persiste tout au long de la pandémie, L'*effet Bolsonaro*' est également à l'œuvre sur la mobilité au quotidien. Plus les municipalités sont favorables au président et moins la population a limité ses déplacements. Le non-respect du confinement prôné par le président est un candidat privilégié pour expliquer la hausse de la mortalité. En revanche, nous n'identifions pas d'*effet Bolsonaro*' sur la vaccination au-delà des quelques mois ayant suivi le début de la campagne. Ce résultat peut s'expliquer par la prise de conscience des partisans du président des risques encourus et de l'efficacité des vaccins contre la Covid-19. Mais il semble surtout témoigner de la longue tradition du Brésil dans ce domaine, reconnue à l'échelle internationale, et de la marque du succès du Programme national de vaccination.

Mots-clés: Brésil; Covid-19 ; Distanciation sociale ; Effet Bolsonaro ; Facteurs politiques ; Inégalités socioéconomiques ; Mobilité ; Mortalité ; Politiques publiques ; Vaccination.

1. INTRODUCTION

The Covid-19 pandemic arrived in Brazil shortly after Carnival 2020. After the notification of a first case in São Paulo on February 25th, the pandemic spread rapidly across capital cities. Measures to prevent the spread of the virus were adopted from mid-March. But the number of cases exceeds the first thousand on the last day of the month.

Although there are still many unknown aspects of the disease, its characteristics have made it clear that in addition to health and demographic determinants (such as comorbidities, age, hospital network, among others), socioeconomic characteristics also contributed to the incidence of the Covid-19 and the occurrence of deaths (Razafindrakoto et al, 2021). Factors associated with colour/race, housing and working conditions appear in several studies as determinants. In several countries, non-whites were more affected by Covid-19 - in Brazil, Indians, browns and blacks were more affected than whites. Working conditions - especially informality - may favour the incidence of the disease due to the need to work face-to-face and to use precarious means of transport. Housing conditions may facilitate contagion and make it difficult to apply containment measures and distance between family members. The level of education is also related to incidence, which can be explained by the level of information people have about the disease, but also by the possibility of teleworking.

In addition to these considerations, there is a growing perception that political factors may have an impact on countries' performance in managing the pandemic. In fact, studies on this subject, applied mainly to the United States and Brazil, associate population's behaviour regarding the pandemic to the governments' discourse and action. These factors have influence on the perception of risk by people, and then impact on the degree of compliance with the pandemic mitigation measures. Previous studies have already shown that political leaders' actions and discourses may influence support for public policies as well as individuals behaviour in representative democracies (Ajzenman et al., 2020). In the case of health policies in particular, Greer et al. (2021) state that the few existing works before the outbreak of Covid-19 linked certain political regimes with long-term health indicators such as infant mortality. In the USA, where the outbreak of the pandemic occurred at a time of strong political polarization, several studies analysed the relationship between the political profile of counties and the attitude of their respective population towards the pandemic. Barrios and Hochberg (2020) show that interest in the pandemic and compliance with mobility restrictions are lower in *counties* where Trump won in the 2016 presidential election. They draw attention to the fact that for the same message, the interpretation can vary according to the source of the information and/or the political affiliation of the people giving the information. For the USA, several other studies confirm the difference in behaviour and risk perception according to ideological or partisan orientation.¹

Brazil, similarly to the USA, was hit by the pandemic in a context of political polarization, having at the head of the federal government a president with a denialist posture,² characterized by the rejection of scientific evidence, by questioning the efficacy of lockdown measures in fighting the pandemic. President Bolsonaro's first response was to downplay the seriousness of the virus, referring to the disease as 'little flu' and discouraging social distancing and other measures adopted by subnational (states and municipalities) governments (Razafindrakoto and Roubaud, 2021). His

¹ See, for example, Allcott et al (2021), and Kushner Gadarian, Goodman and Pepinsky (2020).

² Fonseca, Natrass and Bastos (2021) undertake a systematic analysis of the president's discourse throughout the pandemic in order to study his denialist posture.

argument was that the economic consequences would be worse than the health effects. The Brazilian federal government's actions in combating the pandemic were marked by the absence of coherent policies and coordination between the various governmental entities. On the one hand, this resulted in delays and disorganisation in the implementation of measures. On the other hand, the population became confused: some people no longer understood or questioned the measures adopted by the municipalities or the states. When analysing Bolsonaro's 'negationist' posture, Fonseca et al. (2021) point out that subnational governments ended up taking the lead in fighting the pandemic crisis, not without facing the president's resistance to their actions and initiatives. Nonetheless, the president's denialism spread to other levels of government, in general, in states where governors are politically aligned with the president (Touchton et al., 2021). As we will see below, the central government's denialist stance seems, however, to have had less effect on Brazilians' decision to vaccinate, which may be related to the success of the National Immunization Program (NIP) or to different attitudes of voters who seek vaccination even to maintain the "freedom to come and go" so vaunted by the president's supporters.

Various academic papers in political sciences and public health point out Bolsonaro responsibility in the catastrophic management of the pandemic. Lasco (2020), comparing Bolsonaro, Duteurtre and Trump responses to the outbreak of the pandemic, forged the concept of "medical populism", characterized by the following features: simplification of the pandemic by downplaying its impacts or touting easy solutions or treatments, spectacularization of the responses to crisis, forging divisions between the 'people' and dangerous 'others', and making medical knowledge claims to support the above. Ortega and Orsini (2020) argue that the lack of public health governance can best be described as governance without (central) government based on 'strategic ignorance'. The role of social media, misinformation and fake news is also key on this topic (Biancovilli, Macszin and Jurberg, 2021; Calvo and Ventura, 2021; Gramacho et al., 2022; for or more general discussion at the global level: De Angelis et al., 2021).

One of the pioneer works to analyse the influence of the President's behaviour on the evolution of the pandemic in Brazil was Argentieri Mariani et al. (2020). The authors perform an econometric analysis of the Covid-19 contamination rate in municipalities where Bolsonaro won more than 50% of the total votes in the first round of the 2018 election, comparing their situation before and after the demonstrations of 15 March 2020.³ The authors show that the municipalities where the demonstrations occurred recorded more hospitalizations and deaths than the others. The authors believe that this effect is due both to people crowding into the demonstrations and to more "lax" attitudes towards social distancing according to the rhetoric and position of the president.

Ajzenman et al. (2020) assess also to what extent the president's rhetoric, at the beginning of the pandemic in 2020, impacted social distancing (measured by a mobility indicator calculated from daily mobile phone information). The results show that in pro-Bolsonaro municipalities (identified by 2018 election results), people's mobility consistently increases in the week following the president's actions and speeches to minimise the impacts of the pandemic and discourage compliance with social distancing. This effect is stronger in municipalities with a significant local media

³ Pro-government demonstrations were held in 250 of the 1,050 municipalities that recorded at least one case of Covid-19 before April 15, 2020.

presence, a large number of Twitter accounts and a high proportion of evangelicals (a significant base of Bolsonaro's support).

Rache et al. (2021) rely on a descriptive analysis to put forward a positive correlation between voting for Bolsonaro and Covid-19 deaths during the first quarter of 2021. Xavier et al (2022) find a positive relationship between political orientation - alignment with the president's position - and Covid-19 mortality, from municipal data, controlling for inequality, relationship between regions and quality of health services.

Razafindrakoto et al. (2021) analyses a wide range of determinants of the incidence and number of deaths of Covid-19, including the '*Bolsonaro effect*', i.e., the political orientation, measured by the result of the first round of the 2018 presidential election. The study adopts an approach by municipalities, considering the multiple determinants of the disease (health, demographic and socioeconomic), with a more rigorous treatment of the political factor, because the estimation of its effect occurs controlling the influence of other factors. In line with the national and international literature on the influence of the political aspect in the evolution of the pandemic, the '*Bolsonaro effect*' was one of the factors that proved to be more robust in explaining the pandemic.

This article is an extension of the work presented above and sheds additional light on the political factors' influence on the pandemic incidence in Brazil. It covers one and a half year of Covid-19, allowing us to assess the extent to which explanatory factors have changed or not between May 2020 and October 2021. The analysis confirms that the political factor maintained its explanatory importance in the different phases of the pandemic. More specifically, the '*Bolsonaro effect*' resists time and interaction with the other factors.

This study aims also at investigating the effectiveness of public policies and the mechanisms through which political factors ultimately affect Covid-19 mortality rates. The main mitigation measures adopted in the country, until the start of vaccination in 2021, were non-pharmacological (mask use and social distancing, given that testing and other measures were almost non-existent). Therefore, the analysis of people's mobility and its determinants can be interpreted as an indirect measure of the effectiveness of the public policies adopted. Then, with the arrival of vaccines (pharmacological means to combat the pandemic), we analyse the determinants of the vaccination rate by municipality for more recent periods (from February to October 2021).

The next section sets the context in Brazil: the evolution of the pandemic and the main measures adopted. The third section presents the methodology and the database used in the estimations. Section 4 discusses the results and the last section concludes with some final considerations.

2. THE BRAZILIAN CONTEXT

2.1 Covid-19 incidence, mobility and vaccination

Brazil is among the countries with the highest numbers of Covid-19 deaths, whether in absolute terms or relative to its population. In absolute terms, only the US recorded (until October 2021) a higher cumulative number of confirmed cases than Brazil (Table 1). Regarding the Covid-19 mortality rate, Brazil ranks eighth, behind Peru and six Eastern European countries. In terms of

confirmed cases, underreporting⁴ - partly associated with low population testing - largely explains the low incidence rate in some countries like in India in particular.

The evolution of the pandemic showed a first acute phase in the first semester of 2020, which lasted for several months, followed by a deceleration between August and October (Figure 1). The differentiated profile between the two curves is, in part, influenced by the underreporting that occurs especially for the number of confirmed cases due to the extremely low volume of testing in the country.

Table 1. International comparison of Covid-19 case, death, testing and vaccine statistics

	Confirmed cases	Infection rate (per million inhab.)	Deaths	Mortality rate (per million inhab.)	Tests (in thousand)	Test rate (per million inhab.)	Vaccination complete (in 1,000)	Vaccination complete Rate (% of population)	Population (in thousand)
World	247 164 753	31 386	5 001 217	635	n.a.	n.a.	3 049 146	38,7	7 874 966
USA	46 007 342	138 195	747 189	2 244	628 319	1 887 325	191 679	57,6	332 915
Brazil	21 810 855	101 923	607 824	2 840	n.d.	n.d.	116 118	54,3	213 993
Índia	34 285 814	24 606	458 437	329	608 320	437	329 089	23,6	1 393 409
Mexico	3 807 211	29 227	288 365	2 214	10 895	83 637	60 566	46,5	130 262
Russia	8 377 984	57 418	234 194	1 605	n.d.	n.d.	47 602	32,6	145 912
Peru	2 201 796	66 002	200 246	6 003	5 934	177 884	15 694	47,0	33 359
Indonesia	4 244 358	15 358	143 405	519	31 236	113 026	73 699	26,7	276 362
United Kingdom	9 100 442	133 424	141 055	2 068	301 911	4 426 382	45 712	67,0	68 207
Italy	4 771 965	79 049	132 100	2 188	104 252	1 726 956	43 110	71,4	60 367
Colombia	5 002 387	97 577	127 281	2 483	26 752	521 834	21 399	41,7	51 266

Source: Our World in Data (<https://ourworldindata.org/>), extracted in 01/12/2021.

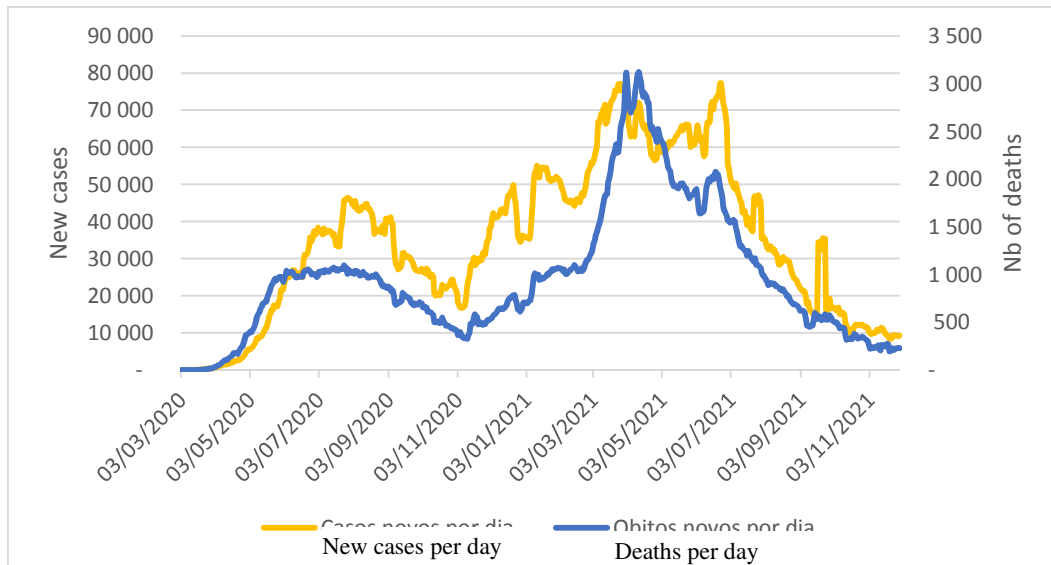
Notes: The table show the countries with the ten highest numbers of deaths. Figures are cumulative numbers until 31/10/2021.

In fact, the Brazilian ‘first wave’ took a little longer to accelerate, but it had a longer duration and the number of confirmed cases and deaths never fell significantly. In the last months of 2020, the number of cases and deaths rose again, but the acceleration regarding the so-called second wave occurred from February, with a peak of infections and deaths in March and April 2021. The reached levels in terms of daily new cases and deaths were much higher in the ‘second wave’ compared to the ‘first wave’.⁵

⁴ See Hallal et al. (2020). Under-reporting affects also death count, but in a much lesser extent. Brazil official data are considered of relatively good quality. Modelling excess mortality for 2020 ad 2021, Wang et al. (2022) estimates the under-reporting at 28%, one of the lowest rate in the world. Brazil still remains among the most affected country in the world (5th rank). The last estimates provided by the WHO (2022) confirm this diagnosis. For the same period, the underreporting is even lower (with 9.2%; Excess mortality vs Official data) and the correlation coefficient is 0.93.

⁵ The number of daily deaths at the peak of the second wave was 150% higher than the corresponding figures in the previous peak (4,148 deaths on 04/08/2021 compared to 1,595 deaths on 07/29/2020). These absolute figures must be interpreted with caution since fluctuations may result from time lags in recording. However, globally the diagnostic hold when we consider moving averages (see Figure 1).

Figure 1. Newly confirmed cases and daily deaths from Covid-19 in Brazil

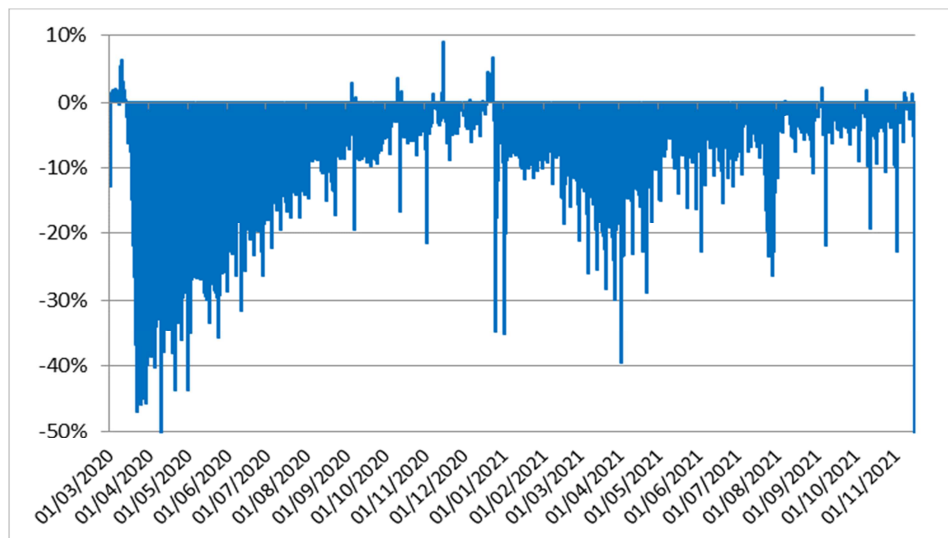


Source: Ministry of Health, Fiocruz. Authors' elaboration.

Note: Data considered are 7-day moving average of each variable.

Figure 2 reveals a sharp and massive drop in mobility in Brazil in March and April 2020. Then, a gradual resumption of movements can be observed until reaching in August levels close to those of February (pre-pandemic month). During the acceleration phase of the second wave, with the implementation of social distancing measures by States and Municipalities plus the effect of the reduction of economic activities, mobility decreased again.

Figure 2. Mobility of people (deviation compared to February 2020).



Note: Percentage difference of average mobility per municipality compared to February/2020.

Source: Facebook. Authors' elaboration.

The smaller drop in mobility in the second wave reflects the difficulty (observed also in most Western countries) to impose restrictions similar to those adopted in the first months of the pandemic. But it can be explained also by problems of coordination among different levels of government and conflicts with the Federal Government. In addition, there was delay in adopting measures to mitigate the economic impacts of Covid-19 on workers and businesses.

2.2 Public policy to confront the pandemic

The main specificity of Brazil, regarding the management of the pandemic, has been President Bolsonaro's attitude and speeches aimed at minimizing it, even denying its existence. This (anti) health policy by default has used the full panoply of imaginable methods and rhetoric: denial, conspiracy, contestation of scientific results, fake news, etc.⁶ The President has consistently denied the seriousness of the pandemic and the effectiveness of the measures, whether pharmaceutical or non-pharmaceutical, when the vaccines were developed. Table 2 shows some illustrative examples of Bolsonaro denialist declarations over the period.

Table 2. Declarations by President Bolsonaro on denial of the pandemic

	Death, confirmed cases	Date
On the pandemic and the virus	"Depois da facada, não vai ser uma gripezinha que vai me derrubar, não ";	03/2020
	"Pelo meu histórico de atleta, caso fosse contaminado pelo vírus, não precisaria me preocupar, nada sentiria ou seria acometido, quando muito, de uma gripezinha ou resfriadinho, como bem disse aquele conhecido médico, daquela conhecida televisão."	
	"está superdimensionado o poder destruidor desse vírus"	03/2020
	"Muito do que tem ali é muito mais fantasia, a questão do coronavírus, que não é isso tudo que a grande mídia propaga"	
	"Muitos pegarão isso independente dos cuidados que tomem , mas não podemos entrar numa neurose, como se fosse o fim do mundo"	04/2020
	"E daí? Lamento. Quer que eu faça o quê? Eu sou Messias, mas não faço milagre"	11/2020
	"E agora tem essa <i>conversinha de segunda onda</i> "	12/2020
	"Tudo agora é pandemia. Tem que acabar com esse negócio. Lamento os mortos, todos nós vamos morrer um dia. Não adianta fugir disso, fugir da realidade, tem que deixar de ser um país de maricas."	03/2021
	"Nós temos que enfrentar os nossos problemas, chega de frescura e de mimimi. Vão ficar chorando até quando? Temos de enfrentar os problemas » ; "parece que só se morre de Covid" no Brasil.	
	"Eu tive a melhor vacina: o vírus..." Sem efeito colateral"...	12/2021

Source: Various media. Authors' compilation.

The responsibility of policy measures to fight the pandemic in Brazil lies with different spheres of government - municipal, state and federal. An effective action would require a convergence of the visions of these three governmental bodies and, evidently, a coordination of the actions undertaken to ensure complementarity and coherence.

However, the measures of social distancing were not only adopted in an uncoordinated way without the support of the federal government, but they were also the target of attacks and criticism by the president (Table 3). He even challenged them in court or encouraged events and demonstrations against them.⁷ The actions of the two sub-national governments were often conflicting: in March

⁶ See the report "Boletim nº10, Direitos na Pandemia" established by Cepedisa (Centro de Estudos e Pesquisas de Direito Sanitário - USP) in partnership with Conectas Direitos Humanos, January 2021.

⁷ Ajzenman et al. (2020), cited in the introduction, analyse the effects on the pandemic of early demonstrations of support for the president.

2020, all states closed their schools and at least part of non-essential businesses, but the reopening of the economy took place according to local plans (at the municipality level) with different measures and timelines.⁸ The performance of local plans and the success of non-pharmacological interventions were further undermined by the absence of an adequate testing and screening policy (Benitez et al., 2020; Moraes, Silva and Toscano, 2020).

On the part of the Ministry of Health, the non-pharmacological measures were treated differently according to the ministers who occupied the portfolio - 4 different ministers were in charge of the Ministry of Health during the studied period. While the first health minister to face the pandemic (Luiz Mandetta) tried to articulate the actions of different government bodies (hospitalization, distancing, personal protective equipment, etc.), the minister who was in charge of the portfolio for the longest time (Colonel Pazuello) did not encourage non-pharmacological measures, such as distancing and use of masks. On the contrary - and in consonance with the speech of the President of the Republic - he did not invest in awareness campaigns and stimulated the use of medicines and treatments whose efficacy is contested by scientists.

Table 3. Declarations by the President Bolsonaro on non pharmaceutical measures

	Non pharmaceutical measures: Lockdown, social distancing, masks	
Social distancing	"Muitos pegarão isso independente dos cuidados que tomem" ;	
Masks wearing	"A vida continua, não tem que ter histeria. Não é porque tem uma aglomeração de pessoas aqui e acolá esporadicamente [que] tem que ser atacado exatamente isso" <i>eficácia quase nenhuma</i>	03/2020
Lockdown	"Vocês não pararam durante a pandemia. Vocês não entraram na conversinha mole de 'fica em casa'. Isso é para os fracos."	10/2020
Masks wearing	"Sabia que o tio estava na praia nadando de máscara? Mergulhei de máscara também, para não pegar Covid nos peixinhos"	12/2020
Masks wearing	"Começam a aparecer os efeitos colaterais das máscaras"	02/2021
Lockdown	"Tem uns idiotas aí, o 'fique em casa'. Tem alguns idiotas que até hoje ficam em casa"	
Lockdown	"Eu tenho o poder de, numa canetada, fazer um lockdown no Brasil todo, mas isso não será feito."	04/2021

Source: Various media; Authors' compilation.

In terms of vaccines, the government's actions reproduced the problems faced on other fronts in the fight against Covid-19. They were characterized by negative campaigns, lack of coordination and lack of transparency and lack of willingness to rely on science (Table 4).⁹ The vaccines procurement

⁸ Moraes, Silva and Toscano (2020) discuss the wide diversity of these plans in terms of format, technical criteria and transparency, as well as the number of municipalities that adhere to the state plan.

⁹ Given the posture of the Federal Government and the suspected flaws in the handling of the Covid-19 pandemic, a parliamentary committee of investigation (CPI) was established in April 2021 in order to investigate the federal government responsibility on the spread of the pandemic in the country and, in particular, the worsening of the health crisis in Amazonas." . In October 2021, the CPI delivered its report. Bolsonaro was "*proven to be primarily responsible for the mistakes made by the federal government during the Covid-19 pandemic*" (Senado Federal, 2021). He was found guilty of nine charges, among which crime of prevarication, charlatanism, and above all crime against humanity. Paradoxically, his popularity was not significantly affected by this judgment.

was late and insufficient. Besides, it has involved controversies and disputes with governors and mayors of various regions. According to some epidemiologists, this is one of the explanatory factors of the occurrence of the second wave. But, despite the late start and repeated problems with vaccine supply (as attested by the low vaccination rate in October 2021; Table 1), the vaccination rate has increased relatively rapidly in Brazil. This is due to the prior existence of a comprehensive primary healthcare system (SUS) and a well-established immunisation programme (Bernardeau-Serra et al., 2021). Indeed, the National Immunization Program (NIP), created in 1973, is noted as one of the most successful immunization programs in the world, with remarkable vaccination capacity in terms of geographical coverage and agility, having already proven capable of curbing other epidemics (Fonseca et al., 2021).

Table 4. Declarations by President Bolsonaro on pharmaceutical measures

	Pharmaceutical measures: vaccination, other medications	
Chloroquine	"Toma quem quiser, quem não quiser, não toma. Quem é de direita toma cloroquina. Quem é de esquerda toma Tubalina."	05/2020
Purchase of vaccine by the Ministry of Health	:" Mande cancelar, o presidente sou eu, não abro mão da minha autoridade "	10/2020
Vaccination	Morte, invalidez, anomalia. Esta é a vacina que o Doria queria obrigar todos os paulistanos a tomá-la"	11/2020
Vaccination	"O presidente disse que a vacina jamais poderia ser obrigatória. Mais uma que Jair Bolsonaro ganha. "	12/2020
Vaccination	" Se tomar e virar um jacaré é problema seu. Se virar um super-homem, se nascer barba em mulher ou homem falar fino, ela [Pfizer] não tem nada com isso"	01/2021
Vaccination	"Isso é um abuso o que está acontecendo. Uma forma de blindar a Covid é a vitamina D. Então, você pega sol"	03/2021
	"Não há nada comprovado cientificamente sobre essa vacina aí"	04/2021
Chloroquine	« canalha é aquele que é contra o tratamento precoce e não apresenta alternativa. Esse é um canalha »	05/2021
Chloroquine	"Tem idiota que a gente vê nas mídias sociais, na imprensa, né?... Vai comprar vacina. Só se for na casa da sua mãe."	10/2021
Chloroquine	"Fui acometido de Covid. Procurei não me apavorar. Tomei um medicamento que todo mundo sabe qual foi e no outro dia estava bom."	
Vaccination	"Defendi que os médicos brasileiros tivessem autonomia para receitar os remédios, uma decisão que pode ter salvado a vida de muitas pessoas"	01/2022
Vaccination	"vacinados [contra a Covid] estão desenvolvendo a síndrome da imunodeficiência adquirida [Aids]"	
	(Ministério da Saúde) : não há demonstração de efetividade da vacina "em estudos controlados e randomizados" nem de segurança "em estudos experimentais e observacionais adequados"	

Sources: various media; Authors' compilation.

The federal government's actions were based primarily on two sets of emergency economic policy measures to address the negative effects of the pandemic (Silva, 2020): i) fiscal measures to ensure household income, support businesses and provide financial assistance to states and municipalities; and ii) liquidity support and regulatory capital measures to ensure the stability of the financial system and expand the supply of credit.¹⁰ Regarding measures to mitigate income loss (notably the

¹⁰ For this point, see Martins et al. (2020).

Emergency Aid and the Emergency Benefit for Preservation of Employment and Income), despite initial hesitation to adopt them in the two "waves"¹¹ and the concern with the fiscal issue, the actions of the federal government were effective, having contributed to minimize, at least temporarily, the impacts of the pandemic on the population and on the economy.

The Emergency Aid (*Auxílio Emergencial*, AE) was the main income guarantee mechanism for workers, targeting informal workers in vulnerable situation.¹² The value in the first 3 months corresponded to about 60% of the minimum wage, a value that was halved in the last 4 months of 2020. The initial value resulted from a strong campaign by civil society and intense pressure from Congress, forcing the federal government to introduce an emergency basic income with a value equivalent to the triple initially proposed by the government. In 2021, the renewal of the programme by the federal government faced strong resistance within the government itself. It ended up being relaunched with a lower amount and directed only to the 2020 beneficiaries, without including people who started to meet the criteria after mid-2020.

For formal workers, the Brazilian government launched an income guarantee programme in the form of an Emergency Benefit for the Preservation of Employment and Income (BEM). Within this programme, the federal government supplemented workers' wages proportionally to the reduction in working hours they had to face. This benefit was extended until December 2020 and relaunched again in April 2021, at the time of the second wave of the pandemic.

These two measures to guarantee income for workers were even more relevant given the situation in the labour market, which has already suffered from the low dynamism in 2019. In the first months of the pandemic, unemployment rate has not increased much, but an important share of workers exit from the labour force, mainly from the informal sector, due to the restrictions of circulation in the streets. The relaxation of social distancing measures brought, from mid-2020 onwards, a slight economic recovery and the return of part of the workforce. However, perhaps the most notable labour market figure in the first six months of the pandemic was the loss of 12 million jobs, reducing the number of employed people from 94 to 82 million (Razafindrakoto and Roubaud, 2021).

In terms of income, the two aid programmes (AE and BEM) were successful in protecting the income of low-income workers, despite programme design and implementation problems.¹³ On the one hand, AE contributed to a significant reduction in poverty and inequality for a few months in 2020 (Neri, 2020). On the other, however, income inequality increased, since most of the jobs destroyed were among those with lower pay - informal or not (Carvalho, 2020; Pero, Carusi and Fontes, 2020).

¹¹ The federal government has playdowned at different times the numbers of cases and the pandemic consequences, and ultimately delayed or restricted the application of support measures. See, for example, <https://www1.folha.uol.com.br/mercado/2020/11/chance-de-nova-onda-de-covid-e-baixissima-diz-secretario-de-guedes.shtml>.

¹² This aid is basically aimed at informal workers in vulnerable situation and is also accompanied by the extension of the Bolsa Família Programme to another 1.2 million families. The target population is people aged 18 or over who meet the following criteria : with total monthly per capita family income less than half minimum wage or total family income less than 3 minimum wages; who did not receive any other social benefit (except Bolsa Família); with no formal employment contract and taxable income which do not exceed R\$28.560 in 2018.

¹³ By way of illustration, as of August 31, 2020, 67.2 million people benefited from the AE. Regarding the BEM, on July 31, 2020, 12.4 million work contracts had been signed within the program.

The central government also introduced a Financial Assistance for States, Municipalities and the Federal District, as subnational governments were hit hard by the combination of sharp falls in revenue collection and increases in spending on hospitals and social security (Silva, 2020).

Despite the coverage of the SUS and its resilience in the face of low investments in recent years,¹⁴ the conditions for coping with the pandemic differed widely among the regions. Given the lack of centralized coordination of actions and distribution of resources, the pandemic have spread in a differentiated manner across regions. Spatial disparities in income and resources between the various Brazilian regions, as well as between the countryside and the city, is well known and is also reflected in the unequal supply of medical resources across the national territory (Hallal et al., 2020; Rocha et al., 2021). In fact, given the differences in income of individuals, housing and working conditions, hospital resources and even productive structure, it should not be expected that regions would be affected in the same way by Covid-19.

3. DATA AND EMPIRICAL STRATEGY

The empirical analysis is based, first, on estimates of the relationship between political and socioeconomic factors and the Covid-19 mortality rate. Second, we estimate also the relationship between these factors and two possible transmission channels: the degree of confinement and the vaccination rate of the population. The objective is to find out if the political factor is related to the degree of mobility/movement of people on the streets and to the vaccination rate, thus influencing the mortality rate. These estimates will be made for the period May 2020 to October 2021,¹⁵ capturing the two waves of the epidemic in Brazil.

The unit of analysis is the municipality. Information was collected and structured from various sources for the 5,570 municipalities in Brazil. It is the smallest administrative entity for which Covid-19 data are available for the whole country. Moreover, it allows capturing effects of collective (or neighbourhood behaviour) and individual behaviour. Indeed, the estimated models consider a broad spectrum of explanatory factors, aiming to be as exhaustive as possible about the types of potential variables that can have a direct or indirect effect on the mortality rate. Finally, due to the lack of coordination at the central level on Covid-19 policies, responsibilities for pharmacological and non-pharmacological measures fell more heavily on states and municipalities, generating different policy responses, with varying consequences on the death rate. For these three reasons, the municipal approach is suitable and presents advantages.

However, this type of approach has its limitations and the results should be interpreted with due caution. First, the analysis by municipalities cannot be interpreted in terms of individual risks. But at least we know that a significant effect at the municipal level tends to be significant in terms of individual probabilities. We can assume, then, that the individual and municipal approaches generally converge in terms of signs. Second, the econometric models tested here can be used to estimate the relationships between the mortality rate and different factors, corrected for structural effects. However, as in most analyses of observational data, we identify correlations that do not necessarily point to causality. For example, it is quite plausible that restriction measures were applied more strictly in municipalities where mortality rates were already higher. It is therefore difficult to

¹⁴ For more details on the national coverage and configuration of the SUS, see Paim et. al. (2011) and Benitz et al. (2020).

¹⁵ The first three months (February-April 2020) were excluded of the analysis because the number of observations was too low.

disentangle the actual impact of the restriction measures. Finally, the main problem may result from potentially omitted variables, such as data on comorbidities, scope of non-pharmaceutical measures (mask use, social distancing measures, etc.), among others. These different variables may be correlated with other characteristics of the municipality (geographical location, income level, health infrastructure, etc.) and, therefore, the correlation we observed in our model may be influenced by these omitted variables.

But, although we do not identify actual causal relationships, the multiple regression framework we adopted, considering information on all Brazilian municipalities, can help policymakers better understand whether or not there is a conditional correlation of political and socioeconomic factors with the Covid-19 mortality rate. This helps, at least, to rule out certain hypotheses about potential causal mechanisms.

The mortality rate is modelled to identify the characteristics of municipalities affected by the pandemic and the changes in patterns between May 2020 and October 2021.¹⁶ Considering the non-normality of the data on number of deaths and the overdispersion of count data, the parameters are estimated by a negative binomial (NB) model¹⁷ using the maximum likelihood method.

The model is applied in 6 quarters, characterised by different phases of the pandemic: the first wave running from May to October 2020 and the second wave from November 2020 to October 2021.

- Q1 (May to July 2020): first wave - growth phase;
- Q2 (August to October 2020): first wave - deceleration phase;
- Q3 (November 2020 to January 2021): second wave (stability and beginning of a growth phase at the end);
- Q4 (February to April 2021): second wave - growth phase
- Q5 (May to July 2021): second wave - start of deceleration and vaccination
- Q6 (August to October 2021): second wave - deceleration phase and increased vaccination coverage with the 2nd dose.

The specification of the Covid-19 mortality rate models are as follows:

$$Y_i = \exp(a_0 + \gamma P_i + \alpha X_i + \beta M_i + u_i) \quad (1)$$

Where:

Y_i represents the dependent variable - mortality rate (per 100,000 inhabitants in municipality i).

P_i is the vector of variables of interest related to policy measures or political factors.

X_i is the vector of socio-economic and health characteristics.

M_i is the vector of direct transmission factors at the municipal level, arising from characteristics and place of residence.

u_i is the error term.

To analyse the results, we considered three groups of explanatory variables. The first group P_i includes the variables of interest, referring to political factors and implemented policies: i) the percentage of votes for President Bolsonaro in the 1st round of the 2018 elections per municipality

¹⁶ It is worth mentioning that in the present paper the mortality rate was privileged in relation to the incidence rate (number of confirmed cases) due to possible problems resulting from low testing and underreporting of cases. Hallal et al. (2020) estimate that the underreporting of Covid-19 cases reached 70% in the first semester of 2020.

¹⁷ This model was also estimated in OLS specification, obtaining similar results and with the same order of magnitude.

and ii) the vaccination rate (applied for the estimations in recent periods). The percentage of voters intends to capture what we call the '*Bolsonaro effect*', which reflects the portion of the population that is aligned with the president's negationist stance. This population ends up adopting postures with deleterious collective health effects, by not wearing masks or not respecting the confinement measures, and also inhibits or disrupts the adoption of more restrictive measures by local governments, which, as explained before, became the main responsible for the implementation of policies to combat the pandemic. We also consider as a policy measure the municipal differences in vaccination rates in the fight against Covid-19, both in the application of the 1st dose and the full vaccination with the 2nd dose. It should be noted here that the introduction of the vaccination rate may entails a reverse causality problem in model 1. Vaccination started in municipalities with higher mortality rates, as was the case of Manaus. However, when we consider the 2nd dose of the vaccine, controlling for the 1st dose is a way to purge the effect of one direction of the causality: from mortality rate to the number of vaccines.

We could have considered also the mobility/confinement variable in the model specification. However, we did not take it into account for two reasons. Firstly, this variable would have absorbed at least part of the effect of the demographic characteristics or political factors we are trying to measure. Indeed, as already stressed, mobility is potentially a channel or intermediate variable through which the effect of the primary variables passes. And contrarily to the vaccination which appears only in the three last quarters (variables effects without vaccination can then be captured before), confinement have an influence since the beginning. Second, we face a reverse causality issue. Mortality rate also influences the decision to stay at home, but in this case, there is no way to control for it.

The second group X_i is composed of control variables referring to the demographic and health characteristics of individuals (gender, age, race, education and health status represented by life expectancy and number of doctors per 100,000 inhabitants), socioeconomic (poverty rate measured by the number of Emergency Aid (EA) beneficiaries in relation to the population, GDP per capita and labour informality).

The third group M_i comprises the factors related to the characteristics of the household dwelling and location that may accelerate or reduce the transmission of the disease in the municipality: territorial (population density, urban/rural location, living in slums and number of residents per room). In addition to these classic variables, we also included an indicator of commuting and migration, potential factors of virus dissemination.

We then devised an empirical strategy to relate these socio-political factors to two key transmission mechanisms: (i) the degree of population confinement, which reflect of the adoption of and respect for non-pharmacological measures, and (ii) the vaccination rate, a pharmacological measure to control the disease. Our objective is to check if the effects observed for Covid-19 mortality rates in the previous estimations are observed also for these two variables. It would indicate - at least for a part of them - that non respect for social isolation measures and/or differences in vaccination rates per municipality would be at the origin of deaths.

Considering people's commuting/mobility, the parameters were estimated from the ordinary least squares (OLS) method for the equation specified below.

$$D_i = a_0 + \alpha X_i + \beta M_i + \gamma P_i + u_i \quad (2)$$

D_i represents the average number of displacements per month relative to February 2020 (before the pandemic) per municipality. The independent variables are defined similarly to specification (1) and estimates were made for the same analysis periods.

Finally, we analysed the vaccination rate, as a way to measure the relationship between socio-political factors and vaccination. To this end, we estimated a negative binomial model for the socioeconomic determinants of the vaccination rate (percentage of vaccinated people in relation to the population of the municipality). Model 3 regresses the vaccination rate of the 1st and 2nd dose by municipality (V_i) with the same explanatory variables as in the previous models:

$$V_i = \exp(a_0 + \alpha X_i + \beta M_i + \gamma P_i + u_i) \quad (3)$$

As the start of vaccination occurred in January 2021 with very few cases, we ran model 3 from May to October 2021. To better understand the behaviour over the period, estimates were made for the quarters from February 2021 for first dose (Q4, Q5 and Q6) and from May for second dose of the vaccine (Q5 and Q6).¹⁸

The data used come from various sources: demographic census, survey data, administrative records and *big data*. Data on Covid-19 deaths and vaccination come from the multi-institutional programme of the Ministry of Health. Organising and concatenating the independent variables involved processing tens of millions of observations. We also used a dataset on non-pharmaceutical interventions in Brazilian municipalities with *Facebook Movement Range Maps* to calculate the indicator of confinement at the municipal level.¹⁹

4. RESULTS AND DISCUSSION

4.1. Mortality

Table 2 presents the estimated coefficient of model (1) for Covid-19 mortality rate in each quarter in the period from May 2020 to October 2021, seeking to identify the main explanatory factors and temporal patterns of the pandemic, allowing analysis of changes in the patterns of Covid-19 mortality rates over time.

We first analyse the coefficients of voting for Bolsonaro and then examine the other independent factors, with emphasis on the significant ones. As highlighted in bold in Table 2 we focus on three main variables, which results are more robust.

Voting for Bolsonaro. A noteworthy finding is that municipalities with a higher proportion of Bolsonaro voters maintain a higher probability of higher Covid-19 mortality rates throughout the period. The '*Bolsonaro effect*' persists over time with positive and significant coefficients. As previously commented, the affinity of the voters with the discourse of the president can influence the infection rate in several ways. The little adherence of his voters to the distancing measures (investigated below) has individual and collective effects on the mortality rate. Besides, it has dissuasive effects on the local governors who are in charge of the implementation of the social distancing measures.²⁰ Our results converge and extend those found in other studies based on quasi-

¹⁸ It is worth saying that the number of observations in the first period considered for vaccination analysis is very small.

¹⁹ The definition of the variables of analysis and the data sources can be seen in Appendix Table A.1.

²⁰ Touchton et al (2021) shows, in a survey of the implementation of non-pharmacological measures in the 27 states, that governors' performance differed in terms of speed of response and restriction of measures depending on their political alignment with the president.

experimental approaches (Argentieri Mariani et al., 2020; Ajzenman et al., 2020) conducted in the early stages of the pandemic. Moreover, they point to the fact that this effect remains despite observed changes in other determinants of Covid-19 mortality over time, in line with the analyses undertaken by Rache et al (2021) and Xavier et al. (2022).

Table 2. Evolution of factors associated with the Covid-19 mortality rate

	<i>Cumulative data Fev20- Oct2021</i>	Q1 Mai-July 2020	Q2 Aug-Oct 2020	Q3 Nov-Jan 2021	Q4 Fev-Apr 2021	Q5 May-Jul 2021	Q6 Aug-Oct 2021
Vote for Bolsonaro	0.836****	1.370****	1.242****	1.108****	0.615****	0.436****	1.302****
Poverty (AE)	2.123****	2.287****	2.957****	2.142****	1.640****	2.169****	1.993***
Age (log)	2.013****	1.585***	2.329****	0.978**	1.980****	2.524****	1.595***
Race (White)	0.0855	-0.762****	-0.530***	0.454***	0.535****	0.152	-0.521***
Sex (Male)	-1.918***	-0.245	-0.446	-7.682****	-2.806**	-2.171*	8.549****
Higher education	1.251**	1 570	1 368	1 882	1 458	1 493	2 489
GDP/cap (log)	0.156****	0.307****	0.106**	-0.0419	0.201****	0.200****	-0.0238
Life Expectancy (log)	1.266****	-4.335****	0.0851	1 473	0.394	1.597***	8.562****
Nb. Doctors(/100k h)	-0.00001	-0.00118	0.149	0.109	0.158	-0.217	-0.114
Density (log)	-0.0228****	0.154****	0.0313	-0.152****	-0.0647****	-0.0166	-0.0346
Area (Rural)	-0.545****	-0.581****	-0.699****	-0.171	-0.353****	-0.664****	-0.703****
Migration	0.411****	0.151	0.175	0.494**	0.880****	0.353****	-0.142
Commuting	0.162**	0.735**	0.384	0.0939	0.165	0.128	0.375
Overcrowding	0.624****	2.520****	0.512**	-0.128	0.746****	0.178	-0.743***
Favela	0.507***	2.056****	-0.0868	1.861****	0.998***	-0.995****	-1.441***
Informal worker	-0.0162	0.967**	0.170	-0.245	0.0275	-0.367	-0.191
Vaccin. rate 1 st dose					0.00392	0.00177	0.00907***
Vaccin. rate 2 nd dose						-0.00901***	-0.00695**
Constante	-8.165****	12.58**	-6 922	-3 096	-5.712*	-12.70****	-44.44****
Lalpha	-1.614****	0.968****	0.610****	0.528****	-0.150****	-0.349****	0.835****
N	5269	5269	5269	5269	5269	5228	5228
pseudo R ²	0.040	0.014	0.007	0.010	0.018	0.021	0.020
AIC	62116.5	38519.0	42345.7	43445.2	53948.2	52849.3	38719.6

Sources: Ministry of Health, IBGE, TSE; authors' calculations.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Note: Negative Binomial (NB) model.

Analysing the vaccination rate, we found a positive and significant coefficient for the first dose, indicating that municipalities with higher rates of vaccination are those with higher mortality rates. This reflects the fact that more persons are vaccinated where it is most needed. As regards the 2nd dose of vaccination, the coefficient is negative and significant. Therefore, municipalities with a higher percentage of the population with the 2nd dose are those with a lower Covid-19 mortality rate. The complete vaccination scheme is negatively correlated with the mortality rate, suggesting its already proven efficiency in combating the disease.

Poverty. The higher the municipality's poverty rate, the more it is affected in terms of Covid-19 mortality. This effect is positive and significant for all the quarters analysed, but decreases over time. This result is consistent with a growing number of studies in other countries (Brandily et al., 2021). It is worth noting that the measure used for poverty consists of the percentage of the municipality's population that was deemed eligible for Emergency Relief in 2020. So this variable is an updated indicator of structural poverty which captures pre-Covid-19 social conditions.

GDP per capita variable has positive coefficients in the four periods where they are significant. Richer municipalities were more affected by Covid-19 in terms of mortality rate. In fact, the epidemic started in big cities (with the first cases registered in São Paulo) and spread faster in these cities due to the intensity of social interactions (exchanges, population movements, diversity of economic and social activities). Thus, as the poverty effect holds when controlling for GDP per capita, our results suggest that the greater the inequalities in municipalities, the higher the mortality rates.

Age. As expected, the variable age appears as a prominent explanatory factor for the Covid-19 mortality. Municipalities where the age profile of the population is older are, on average, more affected in terms of Covid-19 deaths. Another variable with an expected result is **Rural Area**, for which the coefficients always had the same negative sign and were significant in five periods. This result indicates that municipalities with a higher proportion of residents in rural areas were less affected.

Four variables deserve attention for presenting changes of sign or significance between the two waves: Race, Life expectancy, density and favela population.

Race presents significant and negative coefficients in the first wave, indicating that municipalities with a higher percentage of blacks have higher Covid-19 mortality rates. The coefficients became positive in the following quarters, indicating that if at the beginning municipalities with a higher percentage of whites had a lower probability of Covid-19 mortality, at the end of the period the probability of death is greater for municipalities with a greater share of whites. This is a relevant result because much of the existing work - especially those referring to 2020 and the first waves in different countries - point to a significant race difference, with non-white populations being more affected by the disease. The fact that the second wave was more intense in the Southern region, where a large portion of the population is white, may explain to some extent this reversal over time. It is worth noting that in the last period, with vaccination underway, the sign becomes negative and significant again.

Life expectancy. At the beginning of the pandemic, municipalities with lower life expectancy are more affected by Covid-19 mortality. It turns non-significant in the following quarters, and significant and positive again at the end of the period. This may indicate that at the beginning, the pandemic reached more the more fragile municipalities (in terms of health conditions) before affecting mainly the less fragile in the second wave.

The municipalities with high **population density** were also more affected by Covid-19 during the first wave. Then we observe a reversal of sign at the beginning of the second wave with a coefficient which is no more significant afterwards. The evolution of this variable may reflect the evolution of the pandemic. First, it has affected more strongly urban municipalities and cities with higher population density before spreading throughout Brazil.

A higher proportion of people living in slums (*favelas*) in the municipality leads to more fatalities, in line with the fact that it is more difficult to control the disease in these communities. However, the

sign of the coefficient turns negative and significant in the last two quarters. It raises the hypothesis that collective immunization campaigns in slums may have had greater effectiveness in combating Covid-19,²¹ as well as the greater organization and mobilization of solidarity campaigns.

4.2. Mobility

Since the incidence and, consequently, the Covid-19 mortality rate, are related to the implementation and the compliance with the rules of confinement, we present the results of the estimation of model (2) in order to examine if socioeconomic factors are associated with mobility behaviours. It is a way to assess to what extent the impact of social distancing measures can explain the evolution of the pandemic. The clarification of this transmission mechanism contributes to a better understanding of the patterns found for the Covid-19 mortality rate.

The dependent variable here consists of the difference in mobility relative to the pre-pandemic period. Therefore, the higher the indicator, the greater the relative mobility changes and the weaker the average confinement of people in each municipality. Table 3 presents the results of model (2).

Voting for Bolsonaro. Our main variable of interest, identifying the '*Bolsonaro Effect*', appears as significant and positive for almost all periods, indicating that mobility was relatively higher in municipalities with more Bolsonaro voters. This result reinforces the previous results regarding mortality. It confirms that mobility is one of the transmission channels through which political factors have an impact on Covid-19 infection and mortality.

Socio-demographic indicators. In this block, significant coefficients are observed in almost all periods for race, sex, higher education, GDP per capita, poverty and age. The results indicate that during the pandemic the reduction in mobility was higher in municipalities with a higher percentage of whites, older people, women, more educated, with higher average income (except in the last quarter), and lower percentage of poverty. These characteristics correspond to those of groups more able to work at home or do not work. In the case of women, they are induced to stay at home, among other things, because of the sexual division of labour (care activities).

Location/housing indicators. Municipalities with lower population density are relatively more mobile. This may be due to the greater need for displacement. Besides, the incentive is lower to change behaviour given the lower prevalence of the pandemic in these areas. More interestingly, the presence of slums (*favelas*) and the concentration in dwellings (number of people per room) increase the level of compliance to confinement measures. Maybe the population living in *favelas* is less able to move in a crisis situation, even taking into account the organizational strategies within the communities themselves. This lower mobility, however, does not prevent this population from being more affected by Covid-19, given the precariousness of their housing conditions. The results of the various variables point, however, in the same direction: municipalities where the population is more dispersed are those that present greater relative mobility.

The policy measure related to the vaccination rate has a negative and significant coefficient for the 1st dose, revealing that in municipalities with higher relative mobility, the vaccination rate was lower. However, for the 2nd dose the coefficient is positive, indicating that people move relatively more in municipalities with higher rates of complete vaccination.

²¹ As seen below, vaccination in the slums was strongest in the initial quarters of the immunisation process (Q4 and Q5).

Table 3. Evolution of factors associated with mobility

	<i>Cumulated Fev2020- Oct2021</i>	Q1 May-Jul-2020	Q2 Aug-Oct-2020	Q3 Nov-Jan-2021	Q4 Fev-Apr-2021	Q5 May-Jul-2021	Q6 Aug-Oct-2021
Vote for Bolsonaro	0.0646****	0.094****	0.058****	0.010	0.093****	0.108****	0.036**
Poverty (AE)	0.126***	0.108***	0.292****	0.293****	0.152****	0.125***	0.177****
Age (log)	-0.144****	-0.164****	-0.055	-0.072**	-0.158****	-0.068*	-0.169****
Race (White)	-0.0556****	-0.062****	-0.080****	-0.060****	-0.010	-0.069****	-0.0427****
Sex (Male)	0.869****	1.255****	1.348****	0.801****	0.350****	1.050****	0.886****
Higher education	-0.516****	-0.407****	-0.273***	-0.349****	-0.517****	-0.465****	-0.555****
GDP/cap (log)	0.001	-0.010****	-0.007**	-0.006*	0.006**	-0.001	0.009**
Life Expectancy (log)	-0.0039	0.0340	-0.111*	-0.0876	-0.0745	0.128*	0.0253
Nb. Doctors(/100K h)	0.00001	-0.000	-0.000	-0.000	0.008	0.046**	0.021
Density (log)	-0.009****	-0.0195****	-0.005****	-0.0004	-0.010****	-0.009****	-0.006****
Area (Rural)	-0.0146	-0.049****	-0.006	0.010	-0.003	0.008	-0.005
Migration	-0.0127	0.005	-0.003	0.007	0.001	-0.023*	-0.036***
Commuting	-0.0278**	-0.014	-0.042***	-0.064****	-0.013	0.008	-0.012
Overcrowding	-0.0807****	-0.131****	-0.014	-0.045****	-0.0941****	-0.039**	-0.073****
Favela	-0.114****	-0.153****	-0.113****	-0.104****	-0.0906****	-0.068***	-0.097****
Informal worker	-0.0222	-0.044*	-0.082***	-0.100****	-0.051**	-0.019	-0.014
Death rate	0.00001	-0.0003****	-0.0002****	-0.0002****	-0.0002****	-0.0001	0.0002***
Vaccin rate 2nd dose	0.000163					-0.0012***	0.0008****
Vaccin rate 1 dose	-0.00037***				-0.0008**	-0.0001	-0.0010****
_Constante	0.0443	-0.205	0.0793	0.286	0.531**	-0.823**	-0.00821
N	2037	3075	2970	2876	2586	2316	2035
R2	0.380	0.376	0.333	0.300	0.250	0.277	0.233
adj. R2	0.374	0.373	0.329	0.296	0.244	0.271	0.226
AIC	-6674.2	-8410.0	-7517.3	-7622.4	-7875.7	-6237.9	-5629.8

Sources: Ministry of Health, IBGE, TSE, Facebook Movement Range; authors' calculations.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Note: OLS model.

4.3. Vaccination

Finally, Table 4 presents the coefficients for model (3), which investigates another transmission channel between political (and other factors) and the disease, namely vaccination.

Voting for Bolsonaro. Analysing the results for cumulative data on vaccination until October 2021, the estimation show a positive and significant coefficient for the first dose. Thus, municipalities with a higher percentage of Bolsonaro voters had a higher vaccination rate. The coefficient becomes non-significant for 2nd dose, indicating that the political factor loses effect when considering the complete vaccination scheme. These results are at odds with our intuitive expectations.

The evolution by quarter of the '*Bolsonaro effect*' on vaccination rate is interesting to discuss. In the first quarter, for the 1st and 2nd dose, the relationship is negative and significant, which means lower vaccination rate in municipalities with higher Bolsonaro vote. This result is supported by the survey conducted in October 2020 which shows that Bolsonaro supporters are less likely to vaccinate than those who do not support him (Gramacho and Turgeon, 2021). However, in the following quarters,

this relationship is reversed, being positive and significant, suggesting that the initial resistance to vaccination of Bolsonaro supporters does not hold over time. This reversal may be explained by a greater pragmatism of Bolsonaro supporters in the face of strong evidence of the vaccination efficiency in the world and in the country. Again the results are supported by the evolution over time of intention to get vaccinated, as measured by poll surveys (Poder360, various issues). On the one hand, intention has steadily increased, from 75% in January 2021, at the beginning of the vaccination campaign, to 89% in August. On the other hand, the negative initial gap between Bolsonaro supporters and his opponents (65% vs 85%) gradually narrowed until it was completely closed in August 2021 (90% for both).²²

Table 4: Evolution of factors associated with vaccination rate

	Vaccination rate – First Dose				Vaccination rate – Second Dose		
	TOTAL 1st dose (cumulative data at the end of oct. 2021)	Q4 <i>1st dose Fev-Apr 2021</i>	Q5 <i>1st dose May-Jul 2021</i>	Q6 <i>1st dose Aug-Oct 2021</i>	TOTAL 2nd dose (cumulative data at the end of oct. 2021)	Q5 <i>2nd dose May-Jul 2021</i>	Q6 <i>2nd dose Aug-Oct 2021</i>
Vote for Bolsonaro	0.163****	-0.149****	0.244****	0.269****	0.0365	-0.0920**	0.0995**
Poverty ((AE))	1.578****	0.711****	0.994****	3.184****	1.312****	0.565****	1.868****
Age (log)	0.501****	2.842****	0.792****	-1.660****	1.337****	2.397****	0.702****
Race (White)	0.157****	0.0785**	0.232****	0.103**	0.382****	0.266****	0.471****
Sex (Male)	0.758****	-3.042****	0.927****	3.435****	1.069****	-2.218****	3.148****
Higher education	0.830****	1.064****	1.509****	-0.314	2.451****	2.060****	2.686****
GDP/cap (log)	0.0787****	0.0204*	0.0651****	0.134****	0.0862****	0.0407****	0.115****
Life Expectancy (log)	0.554****	0.651****	0.655****	0.421*	0.366**	0.603****	0.166
Nb. Doctors(/100 h)	0.0660*	0.190****	-0.0501	0.126*	-0.0111	0.136**	-0.112*
Density (log)	-0.0114****	-0.0504****	-0.0197****	0.0280****	-0.0262****	-0.0603****	-0.00680
Area (Rural)	0.103****	0.232****	0.0227	0.101**	0.103****	0.198****	0.0392
Migration	-0.0775****	-0.0968**	0.0114	-0.177****	-0.0422	-0.0202	-0.0303
Commuting	0.311****	0.0389	0.359****	0.413****	0.481****	0.211****	0.650****
Overcrowding	-0.332****	0.273****	-0.0991**	-1.150****	-0.119**	0.257****	-0.378****
Favela	0.00695	0.198**	0.157*	-0.362**	-0.120	0.0462	-0.208*
Informal worker	-0.164**	-0.00644	-0.304****	-0.127	-0.366****	-0.129**	-0.511****
<i>Constante</i>	-1.587**	-8.455****	-3.590****	2.656**	-4.110****	-7.209****	-3.180**
Lalpha	-3.843****	-17.55	-3.557****	-2.715****	-3.347****	-4.800****	-2.621****
N	5228	5268	5228	5228	5228	5269	5228
pseudo R ²	0.055	0.127	0.062	0.029	0.082	0.115	0.057
AIC	42996.8	28752.5	37722.7	36852.4	41689.0	31665.5	40278.7

Sources: Ministry of Health, IBGE, TSE; authors' calculations.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Note: Negative Binomial (NB) model.

In Brazil, the political factor appears, with respect to vaccination in model (3), with inverse sign than expected from the results of models (1) and (2). This result contrasts with the studies done for the US.²³ The higher rate of vaccination (first dose) in the pro-Bolsonaro municipalities may stem from

²² As anecdotal evidence, although Bolsonaro declared he will not get vaccinated, his family did.

²³ In the US, several papers show a positive relationship between political orientation (Republican) and low vaccination rate. The study by Albrecht (2022), for example, shows that voting for Trump is strongly and inversely related to the

the fact that they were more affected by the pandemic. The population, in this case, would have adhered more strongly to vaccination, as a way to protect themselves, in a context of low compliance with non-pharmacological measures (distancing or use of masks, etc.). In any case, what is clear from this result - and is reinforced by the non-significance of the political factor regarding complete vaccination - is that the National Immunization Program (NIP) has been successful: high level of support, regardless of individuals' political orientations and despite the federal government's lack of commitment to promote vaccination. Bernardeau et al. (2021) also note the strong adherence of the Brazilian population to immunization campaigns compared to other countries. In a paper on vaccine confidence in 67 countries, Larson et al. (2016) confirms that the share of the population considering vaccine is important, safe and effective is negligible, putting Brazil at the top positions in the world. Even more importantly, as evangelists are one of the main groups supporting Bolsonaro, Brazil has one of the lowest levels of reported incompatibility with religious beliefs (3.2%).

Focusing the analysis on the cumulative figures (Table 4), in relation to demographic indicators, we see that municipalities with higher percentages of men,²⁴ of whites, of elderly, and of people with high level of schooling show higher vaccination rates, both for the first dose and the second dose. Similarly, the richest municipalities (in terms of GDP) have higher rates of vaccination in all periods. But, municipalities with more numerous poor people have also higher rates of vaccination, which highlights the universal nature of vaccination and the NIP, with a focus on vulnerable populations. Considering the health variables, life expectancy has a positive relationship and the number of doctors per inhabitant was not significant.

Finally, when the labour-related variables are analysed, municipalities with a higher proportion of workers who commute to work in other municipalities tend to have higher rates of vaccination. On the other hand, informality seems to play a negative role since municipalities with a higher proportion of informal workers have lower rates of vaccination.

4.4. Robustness checks and extensions

In order to consolidate our results and to take our study further, we conducted a set of robustness checks and tested additional hypotheses. First, we estimate our models using over-mortality instead of the official data on Covid-19 fatalities. Two indicators of non-violent over-mortality are computed: one compared to 2019 and the other to the average of the three previous years (2017-2019), in order to smooth the mortality rates. One should remember that in the case of Brazil, it is not clear that over-mortality is a better indicator of real Covid-19 mortality rate. On the one hand, as stressed above, a specific care has been taken to register Covid-19 fatalities (see note 1). On the other hand, our indicator of over-mortality first depends on the reference period chosen, and second include all non-violent deaths, whatever their causes. Our estimations confirm the '*Bolsonaro effect*' is robust to all specifications (Table A2). The coefficients of controls are also robust.

Second, we test the impact of our variable of interest, by using the second round of the 2018 presidential elections. The '*Bolsonaro effect*' is still significant in the cumulative model as for each period (Table A3). However, the coefficients are smaller, suggesting that mortality is more induced by Bolsonaro true supporters. Gramacho et al. (2021) show that supporters of President Bolsonaro

vaccination rate. As the author concludes, "*not only were political views strongly related to vaccination rates, but also had important implications for Covid-19 cases and deaths*" (p. 9).

²⁴ Men usually use to have riskier behaviour, as suggested by several papers, and therefore may prefer to avoid the vaccine. This mechanism would be similar to the one observed for supporters of the president and would be an additional indicator of the population's trust in the NIP.

know significantly less about the coronavirus and its illness. Thus they should be more prone to adopt risky behaviour, as shown by their lower adherence to social distancing. To investigate further this point, we computed a proxy of the voters who rallied Bolsonaro only for the second round, as the difference in Bolsonaro's voters between the second and the first round. The estimation of mortality rate (model 1) leads to negative and significant coefficients for this variable (except for the two last quarters when the virus spread decelerates and the vaccination coverage increases). Therefore, if we put aside this last more specific period, the results provide suggestive evidence that those who joined Bolsonaro in the second round, are reluctant to Bolsonaro's rhetoric against vaccination, much in line with their socio-political profile (centrists and right wing oriented; the so called 'terceira via' - Third way -, between the left and the extreme right). This hypothesis is confirmed by our vaccination and mobility equations. The municipalities where Bolsonaro got more additional voters, the more vaccination is spread. To push our analysis further, we estimate the influence of Haddad's vote on mortality, mobility and vaccination. Haddad was the representative of the worker party (PT), ex-President Lula's party, and the main opponent to Bolsonaro in the 2018 election, who got qualified for the second round. Again, the more the municipalities voted in favour of Haddad (first round), the more they get vaccinated and stayed at home, and the less the registered fatalities due to Covid-19. This result is consistent with Calvo and Ventura (2021) who found, in an experimental design, that at the beginning of the pandemic, Bolsonaro voters were more optimistic about the health risks and job insecurity associated with the Covid-19 when compared to those who voted for Haddad in the second round of the 2018 election. To sum up, the negative impact of Bolsonaro's negationism on mortality and mobility, while the two other political forces (center and right on the one hand and left on the other) played a countervailing role is confirmed, including on vaccination for the left.

Third, we estimate our vaccination model on other types of vaccine than Covid-19 ones for different periods. As a placebo test, we find that there is no '*Bolsonaro effect*' on vaccination rate in 2017-2018 (Table A4), when the President was not in power. In 2019, during the first year of his mandate, but previous to the pandemic, there still is no '*Bolsonaro effect*'. However in 2020 and 2021 the '*Bolsonaro effect*' appears at significant levels. Thus not only the aggregate non Covid-19 vaccination rate dropped during the Covid-19, but the decrease is higher in bolsonarist municipalities. Then anti-vaccine rhetoric focused at Covid-19 denialism seems to be effective on traditional vaccination campaigns, but not on Covid-19 vaccination. One plausible interpretation of this apparent paradox is that while bolsonarist supporters, facing a major health risk in the midst of the pandemic were sensitive to the protection offered by Covid-19 vaccines, the bolsonarist propaganda against vaccination in general had a negative impact on diseases where the immediate risk of dying was considered less acute. Globally, the socioeconomic gradients are much less significant, and the goodness of fit of the models lower for other vaccines than for Covid-19 vaccination, showing that in 'normal time', the vaccination process is more under control and better distributed among social groups.

5. CONCLUSIONS

Brazil stood out in several ways during the pandemic. The high mortality rate and incidence of Covid-19 in the country has drawn attention. Regarding the means to fight the pandemic, on the one hand, the existence of a health system capable to face the health emergency is noticeable. On the other hand, the contradictory and incoherent signals issued by the country's leaders - particularly by the President - regarding measures to combat the pandemic constituted a significant phenomenon.

President Bolsonaro, following the example of former President Trump, since the beginning of the pandemic minimised the effects of the Covid-19. He vehemently and insistently spoke out against distancing measures, relying on the argument that there was a trade-off between measures to contain the epidemic and economic growth. To these arguments were added the valorisation of medical

treatments of unproven efficacy, the deliberate delay in acquiring vaccines and the systematic devaluation of scientific opinions. In this context, governors and mayors were in charge of most of the actions to combat the pandemic. But their actions were not coordinated and they often had to face the opposition and confusion sown by the president of the republic.

Given this denialist stance of the president and the political polarization that has characterized the Brazilian political scene since the election of President Bolsonaro, one can ask whether, and to what extent, his actions have influenced the evolution of the pandemic. His attitude, beyond decisions directly related to the economy, can discourage compliance with measures to prevent and combat Covid-19.

Given this framework, the present paper analysed, along with other socioeconomic, health and demographic factors, how the political orientation of the municipalities - informed by the vote for Bolsonaro in the first round of the 2018 presidential election - is related to the Covid-19 mortality. The joint analysis of the factors allows a better assessment of the effect of the political element since the different phenomena that interact in determining the number of deaths and infections were controlled.

The analysis is based on the estimation, through a negative binomial model using municipal data, of the different determinants of Covid-19 mortality over two waves of the pandemic. One key factor was the adhesion of the population to policy measures which were challenged by the president. Therefore we proceeded to the estimation of a second set of models focused on the two main transmission channels of the disease: both non-pharmacological (social distancing) and pharmacological (vaccination) measures adopted in the country.

The results regarding what we call the '*Bolsonaro effect*' confirm the hypothesis that the political orientation of the electorate is related to the Covid-19 mortality rate. In the municipalities where the president had more votes in 2018, mortality tends to be higher. Moreover, this relationship persisted over time, being observed for both the first and second waves of the pandemic.

Besides, the results concerning the mobility estimation suggest that political orientation tend to influence compliance with confinement measures, which in turn affected the Covid-19 spread. Voting for Bolsonaro is shown to be significantly and positively correlated with less respect for social distancing, particularly at times when the pandemic reached the most critical levels in Brazil.

In the case of vaccination, the results are differentiated according to the quarter considered. The '*Bolsonaro effect*', observed for mortality and mobility, appeared at the beginning of the vaccination process, but reversed afterwards. So, the president's voters were proportionally less vaccinated in the first quarter, but seem to have changed their mind as of the second quarter. The positive effect of vaccination in reducing mortality may have induced them to get vaccinated after the initial months.

Finally, when assessing the '*Bolsonaro effect*' on cumulative vaccination until October 2021, we found that municipalities with a higher percentage of pro-Bolsonaro had higher vaccination rate for the 1st dose. However, the coefficient becomes non-significant for the 2nd dose, indicating that the political factor loses effect on the complete vaccination rate in the population. Thus, unlike countries like the US, political positioning does not seem to significantly affect the vaccination rate, revealing, to some extent, the success of the National Immunization Programme in Brazil.

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Appendix

Table A.1. Description of variables used and data sources

Variables	Description	Sources
Race (White)	% of whites in the <i>municipios</i> [0,1]	Censo 2010
Sex (Male)	% of males in the <i>municipios</i> [0,1]	Censo 2010
Higher education	% of persons with higher education in the <i>municipios</i> [0,1]	Censo 2010
GDP/cap	Gross Domestic Product per capita (log)	IBGE, 2018
Poverty (AE)	% of beneficiaries of the <i>Auxilio Emergencial</i> [0,1]	Caixa, 2020
Age (log)	Age on average (log)	Censo 2010
Life Expectancy (log)	Life expectancy (log)	FIRJAN, 2018
Nb. Doctors (/100,000 h)	Rate: Number of doctors per 100,000 inhabitants	IBGE, Health2019
Density (log)	Population size/area size (log)	IBGE, 2019
Area (Rural)	% of residences in rural areas [0,1]	Censo 2010
Migration	% of migrants (born in another <i>municipios</i>) [0,1]	Censo 2010
Commuting	% of persons who work outside the <i>municipios</i> [0,1]	Censo 2010
Overcrowding	Number of persons per room	Censo 2010
Favela	% of residences in <i>aglomerados subnormais (favela)</i> [0,1]	IBGE, 2019
Vote for Bolsonaro	% vote for Bolsonaro (1st round) 2018 presidential election [0,1]	TSF 2018
Informal worker	% informal workers (Censo2010 adjusted by PNADC_2019) [0,1]	Censo 2010*
Vaccination rate	% persons vaccinated ((relative to the population of the municip	Min. Saude/Fiocruz
Mobility	Difference % average mobility per municipio / fev.2020	Facebook

Note: All variables are considered at the municipal level.

* adjusted (updated partially) at the state level considering PNAD-C 2019

Table A2. Factors associated with overmortality in 2020

	<i>Covid Mortality (Min. Health)</i>	(1) Overmortality Natural death/ mean 2017-19	(2) Overmortality Natural death/ Year 2019	(3) Overmortality Total death/ mean 2017-19	(4) Overmortality Total death/ 2019
Vote for Bolsonaro	1.146****	0.770***	0.765***	0.670***	0.644**
Poverty (AE)	2.372****	3.532****	2.731****	3.522****	2.938****
Age (log)	1.682****	2.497****	2.941****	2.498****	2.797****
Race (White)	-0.185**	-0.443**	-0.441**	-0.394**	-0.387*
Sex (Male)	-1.949	1.674	1.841	1.904	1.943
Higher education	0.837	-0.323	-1.528	-0.937	-2.075
GDP/cap (log)	0.109****	0.121**	0.147**	0.104*	0.136**
Life Expectancy (log)	-0.863	-1.213	-2.167*	-1.711	-2.392*
Nb. Doctors(/100k h)	-0.0001	-0.0005	-0.0005	-0.0005	-0.0006
Density (log)	-0.0106	0.00204	-0.00647	-0.000930	-0.00675
Area (Rural)	-0.405****	-0.0914	-0.0169	-0.0833	-0.0568
Migration	0.304***	0.339*	0.373	0.445**	0.460*
Commuting	0.292**	0.460*	0.524	0.290	0.445
Overcrowding	0.785****	0.495*	0.578*	0.351	0.396
Favela	1.215****	0.502	0.775	0.777	0.968
Informal worker	0.222	-0.327	-0.173	-0.528	-0.211
Nb days without measure	0.0033****	0.0006	0.0002	0.0007	0.0004
_constante	1.484	-1.599	0.679	0.632	2.191
/					
Lalpha	-0.464****	0.923****	1.268****	0.951****	1.280****
N	5269	5267	5267	5267	5267
pseudo R ²	0.013	0.002	0.001	0.002	0.001
AIC	54242.4	55591.6	51951.1	55508.0	52266.6

Sources: Ministry of Health, IBGE, TSE; authors' calculations.

p-values in parentheses $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Note: Negative Binomial (NB) model. For the first column, the Covid-19 mortality rate is the official figure (Ministry of Health, cumulative numbers in january 2021)

Table A3. The 'Bolsonaro effect' on the Covid-19 Mortality rate

	<i>Cumulative data at the end of oct. 2021</i>	Q1 May-July 2020	Q2 Aug-Oct 2020	Q3 Nov 2020- Jan 2021	Q4 Fev-Apr 2021	Q5 May-Jul 2021	Q6 Aug-Oct 2021
Vote for Bolsonaro 1 st round	0.836****	1.370****	1.242****	1.108****	0.604****	0.461****	1.415****
+ control variables							
Pseudo R2	0.040	0.014	0.007	0.010	0.018	0.021	0.019
Vote for Bolsonaro 2nd round	0.691****	0.941****	0.893****	0.762****	0.416****	0.511****	1.618****
+ control variables							
Pseudo R2	0.040	0.013	0.007	0.009	0.018	0.021	0.020
Vote for Bolsonaro 1 st round	0.862****	1.579****	1.427****	1.314****	0.716****	0.341**	1.025****
Difference vote for Bolsonaro 2 nd -1 st round	-0.318	-2.928****	-2.327****	-2.601****	-1.347***	1.459****	5.071****
+ control variables							
Pseudo R2	0.040	0.014	0.008	0.010	0.018	0.021	0.020
N	5269	5269	5269	5269	5269	5269	5269

Sources: Ministry of Health, IBGE, TSE; authors' calculations.

p-values in parentheses $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Note: Negative Binomial (NB) model. The control variables are always the same (those considered in table 4) for each one of the three specifications considered here (with only the percentage of vote for Bolsonaro in the first round; with only the percentage of vote for Bolsonaro in the second round; with the percentage of vote for Bolsonaro in the first round and the difference 2nd -1st round)

Table A4. Factors associated to Covid-19 vaccination rate

	(1)	(2)	(3)	(4)	(5)	(6)
	Covid Vaccin rate dose 1 2021	Covid Vaccin rate dose 2 2021	Vaccin rate - All other vaccins 2017-2018	Vaccin rate - All other vaccins 2017-201	Vaccin rate - All other vaccins 2020	Vaccin rate - All other vaccins 2021
Vote for Bolsonaro	0.116****	-0.0204	-0.0133	-0.0429	-0.103**	-0.158****
Poverty (AE)	1.714****	1.476****	0.113	0.156*	0.0256	0.240**
Age (log)	0.529****	1.225****	0.193**	0.0926	0.0504	0.0863
Race (White)	0.207****	0.469****	0.0988****	0.198****	0.222****	0.245****
Sex (Male)	0.807***	1.245***	0.950***	1.060***	2.038****	2.010****
Higher education	0.773****	2.177****	-0.500**	-0.476*	-0.569*	-0.0700
GDP/cap (log)	0.0827****	0.0860****	0.0173**	-0.00998	-0.00732	-0.00205
Life Expectancy (log)	0.624****	0.402**	0.350**	0.0330	0.359*	0.0332
Nb. Doctors(/100k h)	0.0001**	0.00002	-0.0001	0.00004	0.00007	-0.0001
Density (log)	-0.0147****	-0.0309****	-0.00957***	-0.0267****	-0.0261****	-0.0237****
Area (Rural)	0.103****	0.109****	0.0718****	0.0479**	0.0844***	0.00245
Migration	-0.0493**	0.00125	0.0822****	0.138****	0.0913**	0.0653*
Commuting	0.325****	0.489****	-0.0495	0.00394	0.0767	0.140***
Overcrowding	-0.324****	-0.198****	-0.216****	-0.279****	-0.547****	-0.504****
Favela	-0.0160	-0.115	-0.191***	-0.131*	-0.254**	-0.212**
Informal worker	-0.225****	-0.449****	-0.110**	-0.0727	0.0404	-0.00740
_constante	-2.064***	-4.018****	1.465**	3.334****	1.387	2.548***
/						
Lalpha	-3.549****	-2.993****	-3.521****	-3.189****	-2.627****	-2.512****
N	5269	5269	5269	5269	5269	5269
pseudo R ²	0.051	0.073	0.019	0.017	0.023	0.017
AIC	44061.5	43128.3	44552.6	45857.4	47538.7	47181.3

Sources: Ministry of Health, IBGE, TSE; authors' calculations.

p-values in parentheses $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$

Note: Negative Binomial (NB) model. For the first column,