COVID-19 outbreak in Brazil: Adherence to national preventive measures and impact on people's lives

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Abstract

Background: The first case of COVID-19 infection was diagnosed in Brazil 26th February 2020. By March 16th, physical distancing and confinement measures were implemented by the Brazilian government. Little is known about how these measures were followed up by the Brazilian people and their impact on daily routine.

Methods: In early April 2020, using an online platform, we organized an online survey among adults living in Brazil about their COVID-19 preventive behavior.

Results: Data from 23.896 respondents were analyzed (mean age: 47.4 years). Due to COVID-19 restrictions, half (51.1%) of the professionals reported working from home. Regular handwashing was practiced by 98.7% of participants; 92.6% reported adhering to the 1.5-2m physical distancing rule, but only 45.5% wore a face mask when going outside. While 29.3% of respondents found it relatively easy to stay at home, indoor confinement was extremely difficult for 7.9% of participants. Moreover, 11% of participants were extremely worried about their health during the COVID-19 epidemic.Younger people, male, persons living in a rural area/village or popular neighbourhoods, students and workers reported less preventive behaviour.

Conclusion: Restrictive measures markedly affected the daily and professional routines of Brazilians. Participants showed a satisfactory level of adherence to national COVID-19 prevention guidelines. Qualitative and follow-up studies are needed to monitor the impact of COVID-19 in the Brazilian society.

Background

On December 31st 2019, the World Health Organization (WHO) received a notification of an unknown viral pneumonia outbreak in the Hubei Province of China. This outbreak was later found to be caused by the Severe Acute Respiratory Syndrome Coronavirus 2 [1,2]. The disease, now called Coronavirus Disease 2019 (COVID–19), has quickly spread to most countries of the world, affecting almost 5 million individuals and causing more than 320,000 deaths. Until May 22, 492,124 cases were registered in the South America, with 55,3% being in Brazil [3].

COVID–19 is primarily transmitted by respiratory droplets with a similar incubation time and development time as the previously known Severe Acute Respiratory Syndrome Coronavirus (SARSCoV) [1,4]. The rapid international spread of COVID–19 pressured the WHO to declare the COVID–19 epidemic as a public health emergency of international importance in late January 2020. Such a decision is taken when an event with major public health implications crosses the borders of the country initially affected, demanding immediate international action [5]. Although vaccines and antivirals are not yet available, various public health strategies to contain the infection have been implemented around the world. These strategies commonly consist of enforced or semi-enforced “lockdowns” and closure of national and/or intra-national borders, as well as promotion of respiratory hygiene (masking, coughing/sneezing etiquette) and hand hygiene. The package of containment measures for COVID–19 around the world

probably represents the largest global public health intervention in human history, though the societal and individual impact of these measures is not yet well-understood.

The population-level adherence to such measures may determine to a considerable extent the national magnitude and duration of the COVID–19 pandemic [6,7]. However, little is known on population-level adherence to the various containment measures implemented worldwide, with most studies focusing on adherence to hygiene measures among healthcare workers [8,9,10]. In-depth documentation of adherence to containment measures is nonetheless essential, on the one hand to feed into initiatives attempting to model outbreaks [6,11], and on the other hand to adapt and target health promotion messages to sub-populations that may be struggling to adhere to specific measures [12], such as specific age groups.

In Brazil, the first case of COVID–19, reported by the Ministry of Health (MOH) on February 26th, was a 61-year-old man who had traveled to Italy between February 9 and 21 of 2020. Two tests were positive for COVID–19 infection. Since then, the number of infected persons in Brazil has increased dramatically [13]. Physical distancing and confinement measures were implemented by the Brazilian government after COVID–19 was declared a pandemic on March 16th [5]. Events expected to attract large numbers of people were cancelled, universities and schools were closed, and only services considered essential to the population remained functional, such as markets, pharmacies and bakeries. However, traveling between Brazilian states remained possible. To document how the containment measures affected the lives of the Brazilian people, and to understand which containment measures were best adhered to by which strata of the population, we conducted an online survey on the adherence of the Brazilian people to individual public health measures and impact of the COVID–19 outbreak on people's lives. A particular emphasis was placed on age as a stratifying factor, considering the clear association of COVID–19 severity with age, and the general need for adapting health messaging to specific age groups.

Methods

Study design

An online questionnaire survey was organized in Brazil between April 3 to April 9. At the time of the survey Brazil counted 9,056 confirmed COVID–19 cases, 1769 hospitalizations and 359 deaths. People were invited via social media to anonymously respond to a secure web-based online questionnaire (*www.icpcovid.com)* and to disseminate the survey link further in their network.

The questionnaire consisted of 60 questions about individual preventive measures and daily living practices (Additional file 1). We used Likert scores for questions concerning health risk perception and the level of difficulty to observe the confinement instructions.

Data analysis

Statistical analysis was performed using IBM SPSS version 25 for Windows. Containment measures were grouped into three main categories: hand hygiene, respiratory hygiene, and physical distancing/isolation. A composite adherence score was generated for each of these categories using specific questions from the survey, with empirical weights (Table 1). Subsequently an overall adherence score was generated by combining the sub- scores in a 1:1:1 ratio.

Table 1. Composite adherence score to COVID-19 preventive measures

Preventive measures	Composite adherence score
Hand hygiene	
Wash hands regularly with water and soap OR with alcohol gel	1
Avoid touching face	0.5
Disinfect cell phone	0.5
	Divide total score by 2
Respiratory hygiene	
Wear a face mask when leaving home	1
Cover mouth/nose when leaving home	1
Wash hands after coughing/sneezing	1
	Divide total score by 3
Physical distancing/isolation	
Follow rule of staying 1.5-2m from other people	1
Measure temperature twice a week	0.5
Stay home when experiencing flu-like symptoms (among people who had flu-like symptom days)	1
	Divide total score by 2.5
Overall composite score across all measures (1:1:1 ratio of specific score	

Descriptive statistics were presented using means with standard deviation (SD) for continuous outcomes, and percentages (%) for categorical variables. We used Pearson's chi-square test to investigate associations between two categorical variables. The Wilcoxon test was used to compare the number of days of work per week before and after the epidemic.

We used a linear regression model to analyze factors associated with adherence to national prevention restrictive measures. Variables with $p<0.10$ in bivariate analysis were included in the adjusted model with a backward stepwise process. The dependent variable was the overall composite score across all adherence measures described in Table 1. Covariates included: age, gender, state and area of residence, education, marital status, living alone, profession, working in the health sector and comorbidities. The significance level adopted was 5% for all hypothesis tests.

Results

Characteristics of respondents

A total of 25,266 persons participated in the survey. After excluding respondents younger than 18 years (n = 163) and people with inconsistent responses (1,207), 23,896 respondents (94.6%) were included for analysis. Participants were from all parts of the country. The median age of participants was 48.0 years (IQR 37.0–58.0 years); 71.8% were women (Table 2). 7020 (29.4%) reported a chronic underlying disease such as diabetes, cancer, HIV infection or tuberculosis and 2177 were smokers of cigarettes.

Table 2. Characteristics of study participants in an online survey on COVID-19, Brazil, April 2020

Characteristics	N = 23896		
Continuous variables			
Age in years	Mean (SD)	47.4 (13.8)	
	Median (Q1-Q3)	48 (37-58)	
	Range	18-89	
Categorical variables		N	%
Age group	*18-25 years*	1652	6.9
	26-65 years	20109	84.2
	>65 years	2135	8.9
Gender	Male	6741	28.2
	Female	17155	71.8
Brazilian region of residence	North	299	1.4
	Northeast	2315	10.5
	Central-West	2489	11.3
	Southeast	13447	61.2
	South	3428	15.6
Nationality	Brazilian	23746	99.4
	Foreign	150	0.6
Highest educational level	I didn't complete elementary school	1	0.0
	Primary School	99	0.4
	Secondary School	2437	10.2
	University Undergraduate degree holder	7604	31.8
	University Postgraduate degree holder	13755	57.6
Marital status	Single	5876	24.6
	Legally married	12167	50.9
	Cohabitation	2556	10.7
	Divorced	2713	11.4
	Widow/widower	584	2.4
Residential setting	Downtown area	13046	54.6
	Suburb area	4531	19.0
	Rural area/village	631	2.6
	Popular neighborhoods	5688	23.8

Professional impact of COVID–19 restrictive measures

At the time of the survey, 44.6% of professionals were working from home. For those who were not working from home, 66.1% were not able to do so because of the type of job, 9.1% were not allowed by their employer, 5% had to leave the house to make money to support the family, and 1.3% left the home because they considered this to be without a risk (Table 3). Due to COVID–19 restrictions, participants reported going to work less often (mean number of days of work per week: 0.8) compared to the period before the epidemic (mean number of days of work per week: 3.2; p-value<0.001; Wilcoxon test).

Table 3. Professional impact of COVID-19 restrictions reported among participants of an online survey on COVID-19, Brazil, April 2020

Characteristics	Description	n	%
Profession	Unemployed	938	3.9
	Student	1551	6.5
	Self-employed	5235	21.9
	Work for the government (federal, state, municipal)	7028	29.4
	Work for a person, institution or company	5200	21.8
	Other	3944	16.5
Healthcare worker	Yes	7293	30.5
Current working conditions (n=21407 workers)	Work from home	9544	44.6
	Work in an open space (market, shop, roadside, etc)	1452	6.8
	Work in a closed indoor space with several people (office, etc.)	5614	26.2
	Work in a closed indoor space alone (office, etc.)	1833	8.6
	Not informed	2964	13.8
Reasons not to work from home (n=5931 workers)	It is not possible with my job	3918	66.1
	It is possible, but is not allowed by my employer	540	9.1
	I don’t think there is any risk to go out	76	1.3
	I have to leave the house to make money to support my family	298	5.0
	Other	1099	18.5

Impact on personal life

While 29.3% of respondents found it relatively easy to stay at home, indoor confinement was extremely difficult for 7.9% of participants. When queried on their concerns about COVID–19 consequences, respondents were more concerned about the health of their loved ones (29.9% very concerned and 22.2% concerned) than their own health (11.0% very concerned and 13.9% concerned) (Figure 1).

Adherence to the national COVID–19 restrictions

Regression analysis was carried out to identify factors associated with higher overall adherence. Older age, being female, living alone, being self-employed, living in the Northeast region, having at least an undergraduate degree, being a health care worker, and having comorbidities were all independently associated with a higher overall score (Table 4).

Table 4. Factors associated with adherence to national prevention restrictive measures among participants of an online survey on COVID-19, Brazil, April 2020

Variable	Categories	p-value	B	Standard Error	CI 95%
	Intercept	<0,0001	4,242	0,1452	3,957-4,526
Age	18-25				
	26-65	<0,001	0,389	0,0413	0,308-0,47
	>65	<0,001	0,533	0,0504	0,434-0,631
Gender	Male				
	Female	<0,001	0,281	0,0172	0,247-0,315
State of	North				
residence					
	Northeast	0,045	0,137	0,0685	0,003-0,272
	Midwest	0,144	-0,100	0,0683	-0,234-0,034
	Southeast	0,608	-0,033	0,0654	-0,162-0,095
	South	0,443	-0,052	0,0674	-0,184-0,08
Education	Primary School or less				
	Secondary School	0,178	0,164	0,1220	-0,075-0,404
	Undergraduate	0,066	0,222	0,1206	-0,014-0,458
	Postgraduate	0,009	0,317	0,1206	0,081-0,554
Marital Status	Single				
	Legally married	<0,001	0,092	0,0221	0,049-0,136
	Cohabitation	0,825	0,007	0,0295	-0,051-0,064
	Divorced	<0,001	0,138	0,0285	0,082-0,194
	Widow/widower	<0,001	0,231	0,0520	0,129-0,333
Living alone	No				
	Yes	0,009	0,073	0,0282	0,018-0,129
Area of residence	Downtown area				
	Suburban area	0,246	-0,024	0,0203	-0,063-0,016
	Rural area/village	<0,001	-0,220	0,0469	-0,312--0,128
	Popular	0,019	-0,044	0,0189	-0,081--0,007
	neighborhoods				
Profession	Unemployed				
	Student	0,049	-0,107	0,0543	-0,213-0
	Self-employed	0,018	0,099	0,0416	0,017-0,18
	Work for the	0,790	-0,011	0,0412	-0,092-0,07
	government (federal,				
	state, municipal)				
	Work for a person,	0,035	-0,087	0,0414	-0,168--0,006
	institution or				
	company				
	None of the previous	<0,001	0,192	0,0433	0,108-0,277
Health care	No				
worker					
	Yes	<0,001	0,124	0,0175	0,09-0,158
Comorbidities	Not that I know				
	Yes	<0,001	0,165	0,0169	0,132-0,198

Adherence scores for the specific measures were all significantly lower in the younger age group (18–25 years). Respiratory hygiene and physical distancing adherence scores

Discussion

Our study shows that, during the survey period, Brazilians were following the COVID–19 preventive measures relatively well. Hand hygiene measures were adhered to most, followed by physical distancing and respiratory hygiene. In all categories of measures, a clear age effect was observed, with younger individuals (18–25 years old) scoring lowest and people >65 years old showing the highest preventive adherence score. This effect was most pronounced for respiratory hygiene.

Overall, only 45.5% reported wearing a face mask when going out. This is much lower than in Asian countries, where most people wear face masks once the COVID–19 epidemic was introduced in their country [14,15,16]. This is however higher than in several European countries where initially wearing facemasks was initially advised, following WHO recommendations, only to be used in health care settings [17,18,19]. Checking one's temperature for the early detection of a COVID–19 infection at least twice a week was only practiced by 10.8% of the respondents. This may be a point of concern, as WHO reported that temperature screening was able to detect the majority of exported cases during the COVID–19´s expansion [20].

When assessing the profile of individuals with poor general adherence, men were less adherent compared to women, which mirrors findings from a Knowledge, Attitudes, and Practices study conducted in China (16). People living in rural areas and poor neighborhoods were also less adherent: in rural areas people may not perceive themselves at high risk of COVID–19, and therefore may not respect the national restriction measures and not practice individual hygiene measures [21]. Therefore, extra communication and health education may be needed to change the risk perception in rural areas and popular neighborhoods [22]. Brazilian students reported difficulties to stay home, which may be related to a need to travel to their original homes in periods when schools and universities were closed [23] or could be related to differing social habits among this population. Encouragingly, respondents with underlying diseases followed the preventive measures well, which is important considering their higher risk for more severe disease.

Taken together, these observations suggest that tailoring of the public health messages may be indicated. A reinforcement of specific messages, such as mask use and temperature taking, may be beneficial, and using delivery methods tailored to the specific age groups could allow higher uptake. Especially communication methods to the younger age group could benefit from such tailoring, and possibly approaches relying on social media and including influencers to spread public health messages could be considered [24]. Of note, the observation that most respondents' concern was higher for their loved ones than for themselves could be incorporated in such health messages; possibly by emphasizing how adhering to measures protects one's close environment.

In general, our results indicate that following an intensive COVID–19 prevention campaign [25] the Brazilians gradually became aware of the importance of adopting simple methods to prevent COVID–19 transmission. For only 7.9%, of the interviewees, the incorporation of "new habits" was extremely difficult. Initially the MOH of Brazil expected a peak of COVID–19 infections during the second half of April. However, it did not happen. According to a new estimate from the MOH, the peak is now expected by the

end of May [26]. The satisfactory adherence to the preventive measures may have delayed the peak of the epidemic.

COVID–19 associated mortality is highest Brazil, in the North region (Amazonas, 178) and in two states in the Northeast (Ceará and Pernambuco) [27]. Our study showed that the Northeast region had less difficulty to adhere the restrictive measures. This difference between regions may have been influenced by the adoption of restrictive measures to varying degrees by the governors of the Brazilian states. Indeed, 11 states have decreed lockdown for at least one municipality in their state. Only the state of Amapá decreed a lockdown for all your municipalities.

Currently there is a lot of confusion about how to deal with the COVID–19 epidemic in Brazil. The president has minimized the actions of the MOH, downplaying the importance of quarantine, and is defending vertical isolation to avoid financial collapse. Vertical isolation or shielding means, most people return back to normal life and people with underlying diseases, older adults and pregnant women continue to respect physical distance and reduce their social activities. Regarding this vulnerable group, 29.4% stated to have underlying diseases in our survey. This is a concern, as older age and the presence of (an) underlying health condition(s) are associated with increased COVID–19 related mortality [28,29] On the other hand, Brazilian respondents with underlying diseases adhered better to the containment measures.

The lack of unified actions against COVID–19, by the federal government, led to the resignation of the health minister on April 16 [30,31]. From that moment on, there was a relaxation of quarantine measures, opening of part of the trade, and consequently less physical distancing. This increased the number of COVID–19 cases and associated deaths [28,31]. At the end of April, the COVID–19 death toll in Brazil had already exceeded that of China [3] (more than 5,000 deaths) and this scenario is getting worse, not reaching the flattening of the curve and overloading the Brazilian health system [32]. As of May 22th 2020, 291,579 cases had been confirmed in the country, causing 18,859 deaths [2,5]. Currently South America is the new epicenter of the pandemic and Brazil is the country most affected [3]. Our findings suggest a considerable initial willingness of the Brazilian people to follow the quarantine and other containment measures, and it remains to be investigated whether this willingness has been irrevocably subverted through the political stance against the public health measures, or whether it can still be harnessed to achieve better control of the national situation.

Our study had several limitations. The number of respondents was relatively small compared to the entire Brazilian population, and respondents were unevenly spread over the national territory. Indeed, only 2,6% of the participants reported residing in rural areas. In addition, 71,8% of the respondents were female, similar to other studies on COVID–19-related practices (16). Participants were more likely to be higher educated individuals living in cities and in the Southeast region. The latter may be explained by the fact that since the beginning of the pandemic, this region recorded the largest number of COVID–19 infections. Moreover, broadband internet quality is best in the Southeast region [33]. Our survey was also not able to reach vulnerable populations, such as the homeless, prisoners, older adults, migrants and

people with mobility problems. Such populations may be at increased risk for COVID–19 infection and should be considered as priority key groups in the prevention and control of Covid–19 [23,34].

Conclusion

In conclusion, most participants in this survey correctly followed the COVID–19 prevention guidelines, although staying at home was difficult for specific groups, and younger age groups tended to adhere less to containment measures. Larger follow up surveys and in-depth qualitative studies about the preventive behavior of different groups in the Brazilian society are needed. The adherence to the COVID–19 preventive measures will need to be monitored closely as restrictive measures are being relaxed.

List Of Abbreviations

Coronavirus Disease 2019: COVID-19 Ministry of Health: MOH

Standard deviation: SD

World Health Organization: WHO

Declarations

Ethical Approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and the protocol was approved by the National Research Ethics Commission, Brazil (Protocol number: 30343820.9.0000.0008, dated April 01, 2020). The need for consent was waived by the National Research Ethics Commission, according to national regulations (Resolution Number 466, December 12, 2012).

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare no conflict of interest.

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Not applicable.

Author contributions

EFMV and RC conceived the study, coordinated the analysis and wrote the first draft of the manuscript. RVML and APSS conducted the statistical analysis and contributed to the interpretation of data. FMO and EAW provided important contributions to the design of the work and revised it substantively. RVdB and JNSF provided analysis, editorial support and revised it. All authors critically reviewed and approved the submitted version (and any substantially modified version that involves the author's contribution to the study); All authors have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Figures

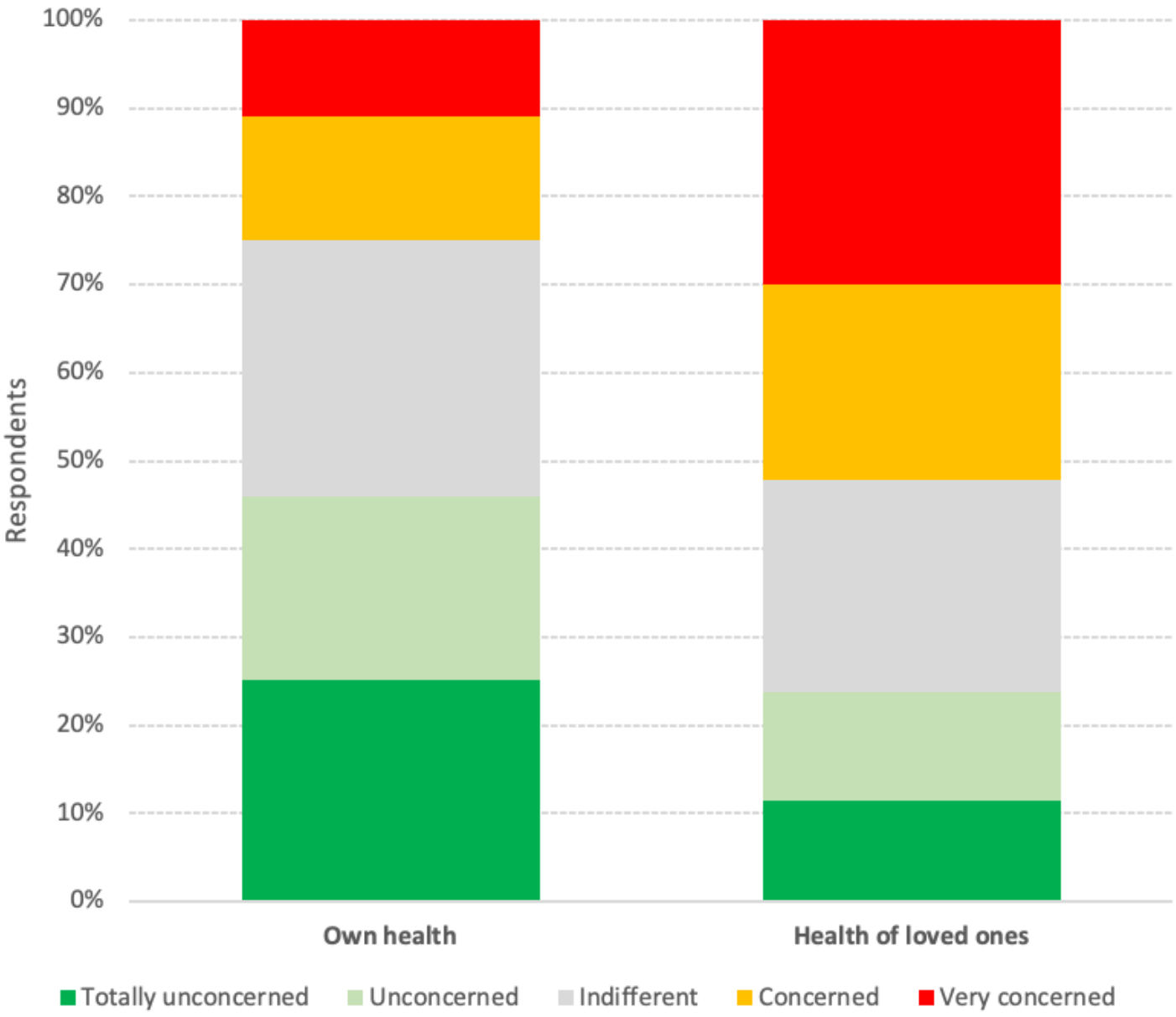

Figure 1

Level of concern about COVID-19 consequences among participants of an online survey on COVID-19, Brazil, April 2020 (bivariate: self-versus loved ones)

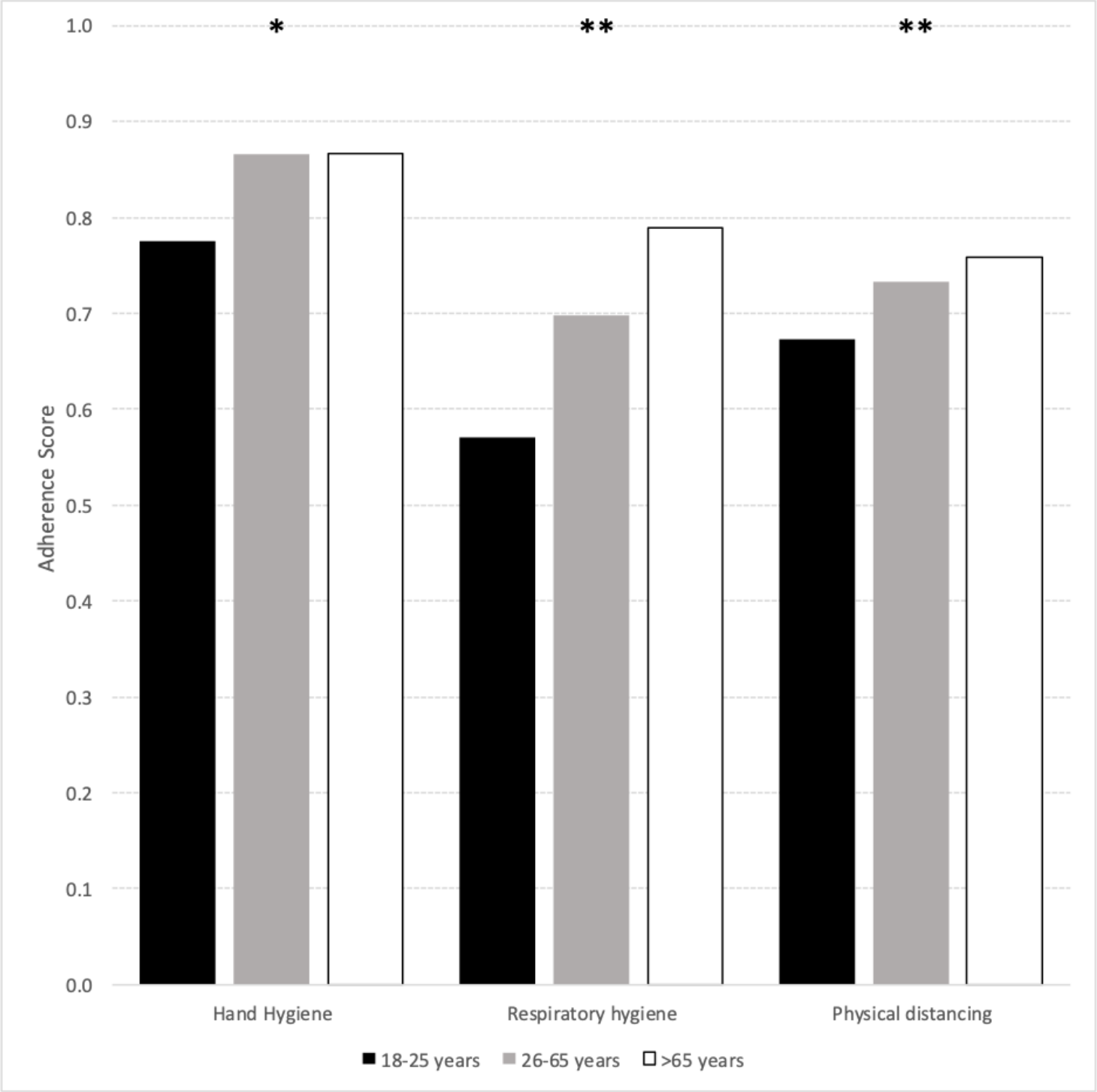

Figure 2

Scores for adherence to COVID-19 containment measures, among respondents of an online survey on COVID-19, per age group, Brazil, April 2020. * p<0.001 for 18-25 years vs 26-65 years and >65 years ** p<0.001 for 18-25 years vs 26-65 years and >65 years; 26-65 years vs >65 years

Supplementary Files

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- Additionalfile1.pdf