

## Social distancing measures to control the COVID-19 pandemic: potential impacts and challenges in Brazil

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**Abstract** *The COVID-19 pandemic has challenged researchers and policy makers to identify public safety measures for preventing the collapse of healthcare systems and reducing deaths. This narrative review summarizes the available evidence on the impact of social distancing measures on the epidemic and discusses the implementation of these measures in Brazil. Articles on the effect of social distancing on COVID-19 were selected from the PubMed, medRxiv and bioRxiv databases. Federal and state legislation was analyzed to summarize the strategies implemented in Brazil. Social distancing measures adopted by the population appear effective, particularly when implemented in conjunction with the isolation of cases and quarantining of contacts. Therefore, social distancing measures, and social protection policies to guarantee the sustainability of these measures, should be implemented. To control COVID-19 in Brazil, it is also crucial that epidemiological monitoring is strengthened at all three levels of the Brazilian National Health System (SUS). This includes evaluating and using supplementary indicators to monitor the progression of the pandemic and the effect of the control measures, increasing testing capacity, and making disaggregated notifications and testing results transparent and broadly available.*

**Key words** COVID-19, Pandemics, Social distancing, Epidemiological surveillance

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## Introduction

Ever since the emergence in China in December 2019 of the new coronavirus, SARS-CoV-2, the virus responsible for the COVID-19 pandemic, humanity has been facing a severe global health crisis. Numerous new cases quickly appeared in Asian countries such as Thailand, Japan, South Korea and Singapore, followed by nations in Europe and in the other continents, leading the World Health Organization (WHO) to declare a public health emergency of international concern on January 30, 2020<sup>1</sup> and a pandemic on March 11, 2020<sup>2</sup>. By April 16 of this same year, 210 countries and territories worldwide had reported a total of 2.1 million confirmed cases of COVID-19, with a death toll exceeding 144,000<sup>3</sup>.

Although the lethality of the disease caused by SARS-CoV-2 is lower than that found with other coronaviruses, its high transmissibility has led to more deaths in terms of absolute numbers than the combination of the SARS-CoV and MERS-CoV epidemics<sup>4</sup>. SARS-CoV-2 transmission occurs predominantly through the spread of contaminated droplets of oropharyngeal secretions from an infected individual to a disease-free person. However, the role of airborne transmission and transmission via contact with contaminated surfaces and objects, where the virus could remain active for up to 72 hours, is still unknown<sup>5</sup>, and the role of fecal-oral transmission remains under debate<sup>6,7</sup>. SARS-CoV-2 transmission is aggravated by its protracted mean incubation period of approximately 5-6 days (min-max: 0-24 days)<sup>8-10</sup>, and by the fact that individuals who are asymptomatic, pre-symptomatic or with only mild symptoms are able to transmit the disease<sup>11-13</sup>. Although 80% of cases present as milder respiratory infections and pneumonias, the severe forms of the disease tend to affect the elderly and those with underlying chronic diseases<sup>14</sup>, requiring hospitalization, intensive care and mechanical ventilation.

The still sparse information on the modes of transmission and the role of asymptomatic carriers in spreading SARS-CoV-2, together with the inexistence of vaccines and specific treatment options, represents a challenge to researchers, healthcare managers and governments. Non-pharmaceutical public health interventions aimed at reducing the spread of the virus and avoiding the collapse of healthcare systems, have been used to allow timely treatment of severe complications and avoid deaths.

Several countries have implemented a series of interventions to reduce transmission of the

virus and decelerate progression of the pandemic<sup>15</sup>. These include isolation of cases, encouraging hand hygiene, respiratory etiquette and the use of homemade facemasks, and implementing social distancing measures such as closing schools and universities, banning large events and mass gatherings, restricting travel and public transportation, making the public aware of the need to stay at home, and even implementing total lockdown in which individuals are only allowed out to buy food or medicines or to seek healthcare. These measures have been introduced gradually and in differing ways, to a greater or lesser extent, in the different countries, and their results probably depend on socioeconomic and cultural aspects, on the characteristics of their political and health-care systems, and on the operational procedures used in their implementation.

The sustainability and effectiveness of these measures depend on establishing social protection and support policies for vulnerable populations, guaranteeing the survival of individuals and their families while restrictions to economic activities remain in effect. In Brazil, there are vast social and regional inequalities, with 66 million individuals living in poverty or extreme poverty and only 40% of the population in formal employment<sup>16</sup>. Such conditions require urgent economic measures to be implemented to guarantee a minimum income for the most vulnerable segment of the population and employment protection for salaried workers so as to ensure that a relevant proportion of the population will comply with social distancing measures.

The present study aimed to analyze the impact of social distancing policies on the COVID-19 pandemic and the challenges to implementing these policies in Brazil with a view to increasing understanding in the population and to provide a basis capable of supporting managers in their decision-making.

## Methods

A total of 2,771 articles on COVID-19, published up to April 6, 2020 and listed in the PubMed databases, were screened for inclusion in this narrative review. In addition, manuscripts in the pre-publication phase and available in the medRxiv and bioRxiv databases or in the grey literature were also reviewed. Due to the speed of publication at the present time, articles published after the cut-off date but of the utmost relevance for Brazil were included in this review *a posteriori*.

Twenty-one original or review articles focusing on control strategies and measures, particularly those on social distancing measures in different countries, were selected for inclusion. In addition to the scientific papers, federal and state legislation implemented throughout the country, specifically decrees and judicial decisions regarding social distancing, were analyzed up to the cut-off date of April 16, 2020 to summarize social distancing strategies in Brazil.

Since a great number of new papers are being produced every day, the recommendations presented here are subject to change as new evidence emerges.

### **What are social distancing measures and what is known regarding their effect on the progression of the epidemic?**

The recent discovery of SARS-CoV-2 has resulted in a colossal effort by doctors, epidemiologists and other healthcare professionals to classify individuals with symptoms such as fever, cough, breathing difficulties and loss of smell and taste as being suspected of having the disease or not. Defining a case is relevant in monitoring the progression of an epidemic and studying the effect of disease control strategies in the population. In view of the high transmissibility of individuals infected by SARS-CoV-2 (symptomatic, pre-symptomatic and asymptomatic individuals), ideally, health surveillance authorities should adopt the definition most capable of detecting the universe of cases within a population. Since this is a new disease, the definitions need to be reviewed as more detailed information on the cases investigated comes to light<sup>17</sup>. In Brazil, a large proportion of symptomatic SARS-CoV-2 infections fail to be diagnosed in a timely fashion; therefore, to monitor the progression of the epidemic it has been suggested that broader definitions of cases should be included in the figures, also taking into consideration additional admissions to hospital and excess deaths due to acute respiratory diseases.

Some terms have been used to refer to the control actions used in the COVID-19 epidemic. These terms are not new and refer to the non-pharmaceutical public health interventions historically adopted for the control of epidemics, particularly in the absence of vaccines and antivirals. These include, principally, isolation, quarantining, social distancing and community containment strategies<sup>18</sup>.

*Isolation* consists of separating people who are ill from uninfected individuals to reduce the risk

of transmission of the disease. To be effective, the isolation of sick individuals requires cases to be detected at an early stage and viral transmissibility of asymptomatic carriers to be very low. In the case of COVID-19, in which the incubation period is longer than that of other viruses, the high transmissibility of the disease by asymptomatic carriers limits effectiveness whenever case isolation constitutes the single or main measure<sup>18</sup>. In fact, there is evidence that in asymptomatic SARS-CoV-2 carriers the viral load is similar to that of symptomatic patients<sup>19</sup>, a finding that is corroborated by reports of disease transmission involving both asymptomatic carriers and individuals with only mild symptoms<sup>20</sup>. Therefore, the mass use of diagnostic tests, allowing infected individuals to be identified, as adopted in Germany and South Korea, is essential for isolation to be effective.

*Quarantining* consists of restricting the movement of individuals who are presumed to have been exposed to a contagious disease but who are not ill, either because they were not infected or because they are still in the incubation period of the disease or even because in the case of COVID-19 they will remain asymptomatic and will fail to be identified. This can be applied at individual or group level, ensuring that exposed individuals remain in their own homes, in institutions or in other specifically designated places. Quarantine can be voluntary or obligatory. During quarantine, all individuals must be monitored for the occurrence of symptoms. If symptoms develop, the individuals must be immediately isolated and treated. Quarantining is more successful in situations in which cases are detected rapidly and their contacts can be identified and screened within a short space of time<sup>18</sup>.

*Social distancing* refers to measures aimed at reducing interactions within a community, which can include infected individuals as yet unidentified, hence not in isolation. Since diseases transmitted through respiratory droplets require a certain physical proximity for contagion to occur, social distancing allows transmission to be reduced. Examples of social distancing measures that have been adopted include: the closure of schools and workplaces, closure of certain businesses, and cancellation of events to avoid mass gatherings. Social distancing is particularly useful in settings where there is community transmission of the virus, where the restriction measures imposed exclusively on known cases or on the most vulnerable segments of the population are considered insufficient to prevent new transmissions. The most extreme case of social

distancing is total lockdown in which a rigorous intervention is applied to an entire community, city or region by forbidding people to leave their homes except to purchase basic supplies or to access emergency services. Lockdown enables social contact to be drastically reduced<sup>18</sup>.

### **What measures have been adopted in different countries and under what circumstances?**

The first cases of this new disease began to appear in December 2019 in the Chinese city of Wuhan. There was one common source of exposure, a seafood market that also sold live animals<sup>21</sup>. The health surveillance authorities were alerted and several measures began to be taken to identify the causative agent of the disease. On December 31 of that same year, China notified the WHO of the outbreak and on the following day the market where the cases had originated was closed<sup>22</sup>. From then onwards, an exponential increase occurred in the number of cases and community transmission was confirmed. Within a short period of time, measures were implemented to restrict travel and the circulation of people, including screening travellers for symptoms, until on January 23, 2020 total lockdown was declared in Wuhan, with no one being allowed to enter or leave the region<sup>23</sup>.

These localized measures were followed by the implementation of similar actions in other Chinese provinces affected by the virus, in several other Asian countries, and in other countries around the world. The initial measures focused to a major extent on controlling travel at a time when the majority of cases were imported; however, the measures were progressively ramped up as community transmission was confirmed.

The first three cases of COVID-19 in Europe were recorded in France on January 24, 2020 and the first death in that continent was reported in that same country on February 15<sup>24</sup>. A week later, cases were registered in another eight countries. The epidemic expanded dramatically in Italy, Spain and France, where it rapidly developed into a severe health crisis with many critical cases and deaths, consequently overwhelming healthcare system resources. This accelerated the adoption of control measures, which did not occur simultaneously and varied greatly between countries and between different regions of the same country. However, over time these measures had to be ramped up and strengthened in all countries as the health crisis deteriorated.

Chart 1 summarizes the main interventions adopted by selected European countries based on a study by Imperial College London. Despite some similarities, implementation of the different measures varied, even in relation to the time period between the first initiative and the announcement of total lockdown.

In some countries, the first initiative was to ban mass gatherings of more than 1,000 people; however, this number was subsequently reduced to 500 and then to 50. In other countries, cinemas, restaurants, gyms and places of worship were closed. Germany determined the closure of most non-essential shops and extended the opening times of supermarkets to reduce the number of customers in the stores at the same time. In some countries, stores reserved the first hours of trading for elderly clients at a high risk of severe disease<sup>25</sup>.

The closure of schools, a measure adopted in all countries, has been the subject of much debate. Children are rarely affected by COVID-19 and the extent to which they develop asymptomatic infections and transmit the virus is unclear. Although closing schools may have the added benefit of contributing towards ensuring that parents remain at home, this measure may affect the ability of parents, who are health professionals and whose services are of the utmost importance at this time, to work. Furthermore, other negative effects include an increase in the number of children cared for by elderly grandparents, interruption to the supply of free school meals to vulnerable children and, obviously, the fact that children would be denied their right to formal education for months at a time<sup>25</sup>. For these reasons, although schools in Austria, the Netherlands and the United Kingdom were closed, an exception was made for the children of key workers such as health professionals<sup>25,26</sup>. In the United Kingdom, vulnerable children (recipients of social care) were also allowed to attend school. In addition, the government decided that schools could provide meals to children who usually received them free of charge and announced in the media the creation of a national program of food vouchers<sup>26</sup>. In Singapore, although schools remained open, measures were adopted to reduce the size of classes and the number of interclass and interschool activities, while rigorous hygiene measures were implemented and recess and lunch breaks were staggered<sup>25,27</sup>.

Some countries such as the United Kingdom, the Netherlands, Sweden and the United States were initially reluctant to adopt social distancing

**Chart 1.** Measures to contain COVID-19 implemented in a selection of European countries affected by the disease.

Country	Date of the 1st and the 50th confirmed cases	Type of Measurement (date of the start of implementation)					Time between the 50th case and the start of social distancing
		Isolation of suspected/ confirmed cases	Social Distancing				
			Closure of schools and universities	Social distancing encouraged	Mass gatherings banned	Total lockdown decreed	
Germany	1 <sup>st</sup> : One case (local transmission) 27/01/2020  50 <sup>th</sup> : 29/02/2020	Individuals with symptoms should undergo testing and then self-isolate (06/03/2020)	Nationwide (14/03/2020)	The Prime Minister recommended avoiding social interaction whenever possible (12/03/2020)	No gatherings of >1,000 people. Otherwise, regional restrictions (only until lockdown) (08/03/2020)	Meeting of more than 2 people forbidden; 1.5 meters of distance between individuals (22/03/2020)	8 days
Spain	1 <sup>st</sup> : One case (imported) 31/01/2020  50 <sup>th</sup> : 01/03/2020	Self-isolation for 7 days if symptoms of cough or fever are present (17/03/2020)	Nationwide (13/03/2020)	Social distancing and working from home recommended (09/03/2020)	All public events banned (14/03/2020)	Nationwide lockdown (14/03/2020)	8 days
France	1 <sup>st</sup> : Three cases (imported) 24/01/2020  50 <sup>th</sup> : 29/02/2020	Recommended from lockdown (16/03/2020)	Nationwide (14/03/2020)	Recommended from lockdown (16/03/2020)	Events involving more than 100 people banned (13/03/2020)	The population must stay at home. Allowed out for maximum of 1 hour with a self-declaration form (17/03/2020)	13 days
Italy	1 <sup>st</sup> : Two cases (imported) 31/01/2020  50 <sup>th</sup> : 22/02/2020	Recommendation to self-isolate if symptoms are present and to quarantine if test is positive (09/03/2020)	Nationwide (05/03/2020)	People must keep at least one meter from each other and all gatherings are banned (09/03/2020)	Government bans all public events (09/03/2020)	The government closed all public venues. People should stay at home except for essential travel (11/03/2020)	12 days
United Kingdom	1 <sup>st</sup> : Two cases (imported) 31/01/2020  50 <sup>th</sup> : 04/03/2020	Self-isolation for 7 days if symptoms of cough and fever are present (12/03/2020)	Nationwide. Kindergartens and nurseries instructed to follow guidance to close (21/03/2020)	Warnings to avoid pubs, clubs, theaters and other public institutions (16/03/2020)	Implemented with lockdown (24/03/2020)	Meetings of more than 2 people not from the same household banned and police authorized to break them up. (24/03/2020)	12 days

Source: Adapted from Flaxman et al.<sup>37</sup> and WHO Situation Reports<sup>47</sup>.

measures<sup>28,29</sup>, advocating the isolation of confirmed cases and of groups at greater risk. Nevertheless, as the epidemic progressed and the epidemiological indicators worsened, these countries were obliged to review their policies and adopt restrictive measures already implemented in other countries. Within a context of rapid spread of the pandemic, with the number of cases and the number of deaths continuing to increase in many countries, the need for social distancing measures and measures to restrict the circulation of people became obvious, with total lockdown sometimes being necessary<sup>30</sup>. Measures of this nature allow time to be gained in which to organize the healthcare and epidemiological surveillance resources required to control COVID-19. In countries of continental dimensions and very large populations such as India and Brazil, social inequalities are immense and healthcare resources are chronically deficient and unequally distributed. In such countries, the adoption of more rigorous social distancing measures will be a determining factor in minimizing the imminent collapse of healthcare services and avoiding thousands of deaths as a result of lack of care for severe cases of the disease.

#### **What scientific evidence is there on the impact of control measures on the epidemic?**

Due to the speed at which the COVID-19 epidemic emerged, many of the epidemic control interventions were introduced simultaneously, and compliance differed from country to country. Therefore, it is difficult to evaluate the effectiveness of each single intervention alone. In general, the studies available involve mathematical models of disease transmission based on observed data and on the simulation of hypothetical scenarios according to which the interventions adopted would be able to reduce transmission of the virus. Simulation studies evaluate responses associated with different contexts and are useful for directing the allocation of resources and taking decisions to maximize the intervention strategies. Few studies have managed to evaluate the actual effectiveness of some of these measures in the dynamics of SARS-CoV-2 transmission.

In mid-March, investigators from Imperial College London used a mathematical model to simulate the effect of a series of epidemic control measures, implemented individually or together, in the United Kingdom (specifically Great Britain) and in the United States. The effectiveness of any single intervention seemed limited, indi-

cating that multiple interventions must be used in conjunction to make a substantial impact in reducing transmission of the virus<sup>31</sup>. Combining less restrictive control measures (isolation of suspected cases, quarantining of contacts and social distancing for the elderly and those at greater risk of the disease) could reduce the peak of demand on healthcare services by two-thirds, also halving the number of deaths. Nevertheless, with this type of strategy, the COVID-19 epidemic would result in hundreds of thousands of deaths and would overwhelm healthcare services, particularly intensive care units (ICUs). For this reason, drastic measures of social distancing applied to the entire population should be the policy of choice, despite the fact that this option will depend on the feasibility of its implementation and on the social contexts<sup>31</sup>.

China initiated a form of isolation in which all cases were hospitalized, not only those requiring hospital care, while simultaneously implementing social distancing for the entire population, resulting in a reduction in transmission. Several studies have estimated that these interventions reduced the mean rate of transmission of COVID-19, as measured by a decrease in the basic reproduction number ( $R_0$ )<sup>32</sup> to less than 1, i.e. showing that an infected individual can infect on average less than one other person, a situation that is essential if a decrease in the incidence of cases is to be achieved<sup>31</sup>.

A study conducted in Wuhan using COVID-19 data associated with smartphone records concluded that people's mobility was the principal factor in the spread of SARS-CoV-2, both in that city and in other provinces, before implementation of the sanitary cordon<sup>10</sup>. In this respect, restricting the mobility of the population can contribute to delaying the peak of the epidemic, to reducing the number of cases within a city and to avoiding transmission to other locations<sup>10,23,33,34</sup>. Measures involving travel restrictions from Wuhan, the quarantining of household contacts and social distancing were responsible for increasing the doubling time in the number of cases of the disease and for slowing disease spread, as measured by the  $R_0$ , which decreased from 0.98 to 0.91<sup>34</sup>.

Another study that evaluated travel restrictions in Wuhan, using COVID-19 data from within and outside this urban center for the period from December 2019 to February 2020, found a reduction in transmission at the end of January, coinciding with the introduction of travel restrictions<sup>35</sup>. In addition, the closure of the airports in

China, which occurred around two months after the beginning of the epidemic, led to a delay in the occurrence of new cases outside of Wuhan, both in the rest of China and internationally<sup>23</sup>. Nevertheless, it is estimated that reducing the number of flights by up to 90% would only result in a decrease in the number of cases in other countries if early detection, isolation and behavioral changes in the population such as hand hygiene, avoiding mass gatherings, etc., were implemented and encouraged in conjunction<sup>23</sup>.

The reduction in the epidemic in China partially attributed to social distancing triggered the implementation of similar measures in other places. An early study using smartphone tracking data to evaluate the impact of social distancing in Italy reported a reduction of around 40% in travel between regions and a 17% reduction in the rates of social mixing (the number of devices within 50 meters of each other over a 1-hour period) following total lockdown in the country<sup>36</sup>. In the northern provinces, in the regions more affected by the disease, the measures implemented to control spread of the virus achieved a reduction of up to 30% in the rate of social contact<sup>36</sup>.

In an attempt to perform a broader modeling of the course of the epidemic in various countries around the world, data from China and from other high-income countries were used to model the effect of three interventions on COVID-19-related mortality<sup>37</sup>. A comparison was made with data from a setting in which social distancing measures were not implemented but where mass testing for COVID-19 is performed, including the isolation of cases and quarantining of contacts (measures already widely reported to be essential). By protecting the elderly, reducing their social contacts by 60%, and reducing social contacts in the general population by 40%, there would be a huge decrease in the number of infections, admissions to hospital and deaths. A drop of up to 67% was estimated in COVID-19-related deaths (median 49%; range 23-67%), representing 20 million lives saved. Nevertheless, the effect of these strategies on reducing the number of infections in low- and medium-income countries could be less, since the elderly in those countries tend to have greater contact with the younger generations. In general, the authors of that study exert caution when discussing the actual impact of these interventions on the reduction in the number of cases of COVID-19 in these countries. If, on the one hand, the demographic structure is characterized by a greater percentage of younger

people, on the other hand, a large proportion of the population lives in conditions of social vulnerability, in overcrowded environments and homes, and consists of individuals with chronic morbidities. In settings in which the organization and capacity of the healthcare system are precarious, these factors can contribute to increasing mortality.

A study conducted in Brazil using a mathematical model to estimate the effect of social distancing measures in the greater metropolitan region of São Paulo showed that, without the adoption of social distancing measures, the capacity of the ICUs for COVID-19 would be overwhelmed by 130% in the first month and 14-fold in the second month. The model also suggested that the set of social distancing measures implemented (and their continuation up to the present time) could avoid overwhelming the healthcare system, maintaining capacity at a maximum of 76% and avoiding the death of around 90,000 individuals over the course of the epidemic<sup>38</sup>. Furthermore, the study recommended the use of data on admissions to hospital for severe acute respiratory syndromes (SARS) to monitor the effect of social distancing measures<sup>38</sup>. Another study conducted in Brazil also showed that, at the present moment, maintaining and strengthening current social distancing measures, quarantining and isolating cases, is absolutely vital to avoid the collapse of the healthcare systems in the country<sup>39</sup>. Other studies, still at the prepublication stage, describe similar findings, arguing that the more restrictive the measures, the more effective they are in reducing the number of affected individuals and the faster the end of the epidemic will be reached<sup>40,41</sup>.

Finally, a rapid Cochrane review performed to evaluate the effectiveness of quarantine measures in avoiding deaths due to COVID-19 included 22 papers on epidemics such as SARS, MERS and COVID-19 published up to March 12, 2020, ten of which deal with the current epidemic<sup>42</sup>. The synthesis of the studies included, most of which used a mathematical model, indicated that quarantining is an effective measure to reduce the number of cases of COVID-19; however, to achieve effective control of the disease, quarantine must be implemented together with other control measures<sup>42</sup>.

Therefore, there are strong indications that the strategies used to control the spread of the epidemic are effective when the isolation of cases and quarantining of contacts are combined with a set of social distancing measures that encom-

pass the entire population<sup>42</sup>. In general, data on the effectiveness of single measures are sparse<sup>31</sup>; however, it is extremely unlikely that they would be effective, since asymptomatic individuals, including children and adults, contribute to the chain of transmission of the disease. Furthermore, it is of the utmost importance that screening and the isolation of cases and contacts are enhanced in combination with social distancing measures<sup>34</sup>. Chart 2 summarizes the principal measures, and their respective impacts, as evaluated in the studies included in this narrative review.

### What is the current epidemiological situation in Brazil and what constitutes adequate measures to control the epidemic?

The first case of COVID-19 in Latin America was registered in Brazil on February 25, 2020 and consisted of a 61-year old male from São Paulo who had recently returned from a trip to Lombardy in Italy. Following laboratory confirmation of COVID-19, the patient, who had mild symptoms of the disease, was given the standardized care recommended by the epidemiological surveillance authorities and told to self-isolate at home while contacts were investigated among family members, at the hospital where he received care and on the flight back from Italy.

Since then, the epidemic has spread in the country and, on April 16, 2020, there were already 30,718 confirmed cases and 1,926 deaths throughout Brazil, with an incidence of 14.51/100,000 inhabitants<sup>43</sup>. The entire academic community was mobilized nationwide, with the creation of several national networks formed to

combat COVID-19<sup>44</sup>. The large number of samples for laboratory testing that remained untested due to the impossibility of increasing testing capacity points to major underreporting.

Although legislation regarding measures with which to tackle COVID-19 has been in place in the country since February 7, 2020, i.e. before the epidemic was officially recognized in the country, President Jair Bolsonaro has given little importance to it. In fact, he is one of the few world leaders who refuse to recognize the threat constituted by the virus. There are numerous articles in the media repeating his public statements against the measures implemented in the states and municipalities and encouraging his followers on social media sites to disobey the social distancing recommendations. An open political conflict began between the president and the then Minister of Health, Luiz Henrique Mandetta, who defended the measures recommended by the WHO and until recently supported the more rigorous measures implemented locally and regionally to control COVID-19. At the beginning of April, following rumors regarding his imminent removal from office, which indeed occurred on April 16, Mandetta began to recommend “relaxation” of the social distancing measures implemented in the states and municipalities from April 13 onwards.

In this political setting in which a serious political crisis is compounding the health crisis, control measures, including social distancing, have been implemented by the state governors and municipal mayors (and sometimes by the Judiciary), particularly in the states most affected by the epidemic. The administrative autonomy of the states and municipalities in areas such as

**Chart 2.** Principal effects of non-pharmaceutical interventions in the COVID-19 epidemic as analyzed in the scientific literature.

Intervention analyzed	Resulting impact	Referência
Reducing mobility	The peak of the epidemic was delayed; there was a reduction in the number of cases within cities, and in transmission to other locations	10,23,33,34
Travel restrictions, quarantining and distancing	A reduction in R0 and an increase in doubling time	34
Travel restrictions	A reduction in transmission and in the number of cases in the country and abroad	23,35
Social distancing	A reduction in social interaction A reduction in the demand for hospital care and in the number of deaths	36 37 38,39*

\* Brazilian studies. R0: basic reproduction number.



health, education and business, guaranteed in the federal constitution, limits the possibility of direct interference by the federal government in decisions made by local governments. This has been a subject of debate in the Supreme Court and up to the present time recognition of the autonomy of the states and municipalities with respect to the adoption of emergency measures regarding public health has been upheld.

Chart 3 describes the measures adopted in Brazil in some of the states in which the epidemic has been more severe and in Bahia, one of the first states to adopt social distancing measures. The complete Chart is presented as supplementary material (Chart S1). In general, practical measures to restrict circulation and prevent mass gatherings have already been put into practice, to greater and lesser degrees. Nevertheless, the federal government, by minimizing the importance of social distancing and publicly opposing the measures adopted in the states and municipalities, may well undermine the population's willingness to comply with them.

Although no studies have yet been published on the degree to which the Brazilian population is complying with these measures, in a survey conducted by Datafolha 1,511 individuals were interviewed between April 1 and 3, with results showing that 76% were in agreement with maintaining social distancing to control the epidemic despite the economic damage resulting from these measures. Support was highest in the northeast of the country (81%) and lowest in the south (70%) (Figure 1). Nevertheless, a quarter of those interviewed reported that they had to leave their homes to go to work or to perform other activities.

Some indicators supplied by Google, obtained from smartphone records, suggest that there was a reduction of 70% of peoples movements in parks, of 71% in people engaging in commercial and leisure activities and of 64% in people circulating in transport hubs (Figure 2). However, as shown in the Datafolha survey, a significant proportion of the population is unable to stop working or cannot work from home and, in this respect, the reduction in mobility was of 34%.

Despite support by the population for social distancing measures, however insufficient these may be, the Ministry of Health, on April 6 (hence still under the jurisdiction of Mandetta) expressed intention to relax these measures<sup>45</sup>, at a time when the epidemic was still on the increase, not yet having reached its peak, even in São Pau-

lo where the first cases in Brazil were registered. The states were recommended to transition to selective distancing if the number of confirmed cases did not exceed 50% of the capacity of the healthcare facilities already in existence prior to the pandemic. In places where the incidence rate was 50% higher than the national rate, social distancing measures should be maintained until supplies and equipment (hospital beds, personal protective equipment, mechanical ventilators and laboratory testing) and healthcare teams were sufficient available.

The decision to relax social distancing measures and the criteria adopted by the Ministry of Health should be discussed in the light of the information available in the international scientific literature, which, contrary to those proposed for Brazil, has based its decisions on monitoring the speed of transmission of the epidemic and, consequently, as a function of the increase in the number of infected individuals, the number of cases of the disease and the number of deaths.

Relaxing or ending social distancing measures is a delicate issue, since maintaining control of the pandemic until a vaccine is available could require the population's routine activities of daily living to be curtailed for many months, with economic implications and consequent high costs for the lives of the population. On the other hand, the possibility has been suggested of ending the more rigorous social distancing measures, allowing some infections to occur, preferably in low-risk groups such as children or young adults so that a large part of the population gains immunity (the so-called "herd immunity").

The principal limitation in the Ministry of Health's proposed criteria for relaxing the social distancing measures is that these are based solely on the capacity of the healthcare services, as measured by indicators of the offer and structure of the services. Hence, they fail to take into consideration the surveillance and monitoring indicators of the pandemic in each one of the Brazilian municipalities such as, for example, the number of suspected and confirmed cases, the number of admissions to hospital for acute respiratory syndromes, mortality,  $R_0$  and doubling time. Furthermore, the epidemic is at different stages in the different parts of the country. As suggested by the European commission<sup>46</sup>, the criteria for relaxing social distancing measures must include: 1) a significant decrease and stabilization for a sustained period of the number of cases and the number of admissions to hospital due to the disease; 2) sufficient health system capacity, includ-

**Chart 3.** COVID-19 control measures implemented at state and federal level in Brazil, presented for a selection of Brazilian states, together with the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

Location (Notified cases/100,000 inhabitants)	Category of social distancing	Measure (government act)	Effective date
Brazil (14.51)	Social distancing	Remote working for vulnerable civil servants in at-risk groups (Administrative Act19 - Ministry of Economy)	17/03
		Remote working, anticipation of individual and collective statutory leave, compensation of time and anticipation of public holidays (Provisional Act927)	22/03
Amapá (39.69)	Events	Mass gatherings banned (Judicial decision)	29/03
	Education	Closure of all teaching establishments (Decree 1377)	17/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 1377)	17/03
		Mass gatherings banned (Decree 1414)	20/03
		Non-essential businesses and services closed except for deliveries (Decree 1414)	20/03
		All river transport stopped (Decree 1415)	23/03
Amazonas (36.93)	Events	Public gatherings and gatherings in public facilities banned (Decree 42,061)	16/03
		Events involving more than 100 people banned (Decree 42,063)	17/03
	Education	Partial closure of state schools (Decree 42,061)	16/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups and those with mild symptoms (Decree 42,061)	16/03
		All river transport stopped (Decree 42,087)	19/03
		Gyms and similar establishments closed (Decree 42,087)	19/03
		Circulation of all intercity bus services and tourist coaches stopped (Decree 42,098)	20/03
		All establishments involved in serving food directly to customers, as well as the leisure events industry, closed (Decree 42,099)	21/03
		Remote working for all civil servants (Decree 42,101)	23/03
		All non-essential businesses and services closed (Decree 42,101)	23/03
		Circulation of interstate bus services stopped (Decree 42,158)	04/04

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ing the occupation rate for ICUs, the availability of health care workers and medical material; 3) appropriate monitoring capacity, including large-scale testing capacity to quickly detect and isolate infected individuals and quarantine contacts, and, if possible, the application of rapid testing to monitor herd immunity.

In addition, up to the present moment, the Ministry of Health has failed to make clear what has to be taken into consideration when measur-

ing the capacity of healthcare services, although the number of hospital beds, personal protective equipment (PPE), mechanical ventilators and laboratory testing are already covered, apparently indicating that priority is being given to the more specialized services. Given that in Brazil there are marked social and regional inequalities in the distribution of healthcare services and in access to those services, particularly those of greater complexity, we are aware that not everyone who

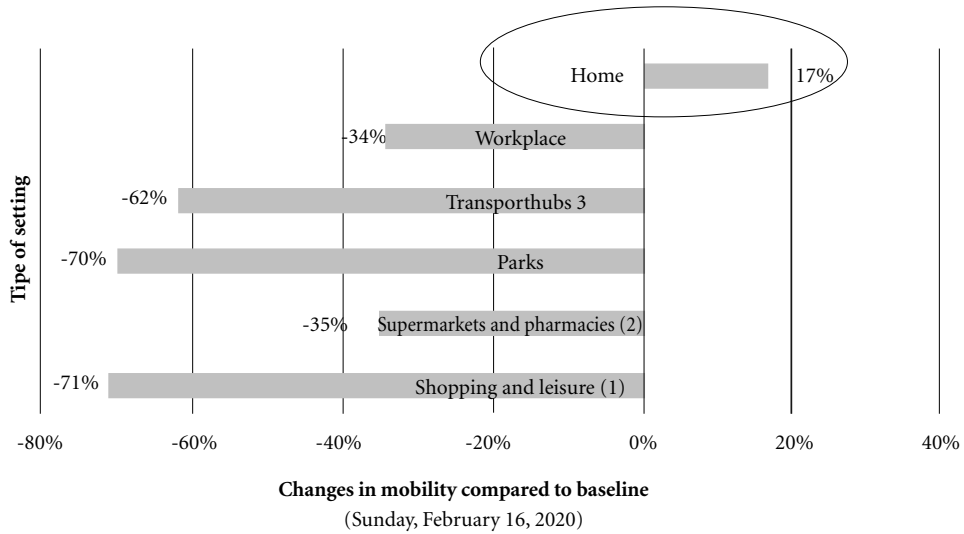
**Chart 3.** COVID-19 control measures implemented at state and federal level in Brazil, presented for a selection of Brazilian states, together with the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

Location (Notified cases/100,000 inhabitants)	Category of social distancing	Measure (government act)	Effective date
Bahia (5.92)	Events	Events involving more than 50 people banned in cities in which there is community transmission (Decree 19,529)	17/03
		Events involving more than 50 people banned in the entire state (Decree 19,586)	28/03
	Education	Partial closure of teaching establishments (Decree 19,529)	17/03
		Complete closure of teaching establishments (Decree 19,586)	28/03
	Circulation of people	Obligatory self-isolation at home for people with symptoms of the disease (Decree 19,529)	17/03
		Docking of large vessels banned (Decree 19,529)	17/03
		Remote working for vulnerable civil servants in at-risk groups (Decree 19,528)	17/03
		Circulation of interstate buses stopped (Decree 19,528)	19/03
		Circulation of intercity transport stopped in locations in which there is community transmission - except for professional activity (Decree 19,549)	19/03
Ceará (24.95)	Events	No licenses granted for events involving more than 100 people (Decree 33,510)	16/03
		Collective activities using public facilities banned (Decree 33,510)	16/03
	Education	Total closure of all teaching establishments (Decree 33,510)	19/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 33,510)	16/03
		Discretionary leave for civil servants (Decree 33,519)	19/03
		Non-essential industrial activities and non-essential on-site activities in the commercial and service sectors closed (Decree 33,519)	19/03
		All beaches, rivers, lakes and swimming pools closed for visitation (Decree 33,519)	19/03
		Circulation of intercity and municipal public road transport, and subways stopped (Decree 33,519)	19/03
		Obligatory self-isolation at home for people with symptoms of the disease (Decree 33,519)	19/03
		Circulation of interstate buses stopped (Decree 33,519)	19/03
Remote working for all civil servants able to work from home (Decree 33,536)		05/04	
Federal District (22.80)	Events	No licenses granted for events involving more than 100 people (Decree 40,509)	11/03
		No licenses issued for any events (Decree 40,538)	19/03
	Education	Complete closure of all teaching establishments (Decree 40,509)	11/03
	Circulation of people	Quarantining of suspected cases and obligatory self-isolation at home for individuals with symptoms of the disease (Decree 40,475)	28/02
		Remote working for civil servants with mild symptoms (Decree 40,526)	17/03
		Non-essential on-site activities in the commercial and services sectors closed (Decree 40,538)	19/03
		Remote working for all civil servants (Decree 40,546)	23/03

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**Chart 3.** COVID-19 control measures implemented at state and federal level in Brazil, presented for a selection of Brazilian states, together with the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

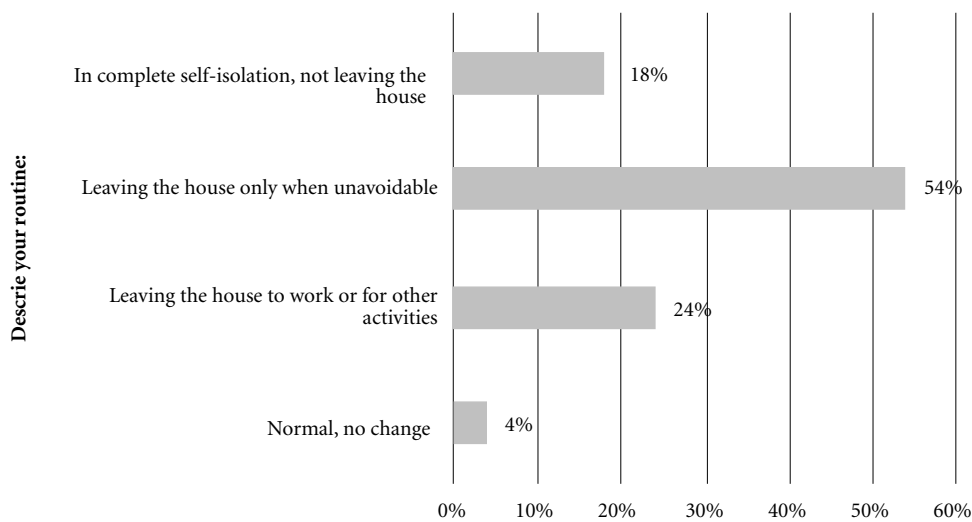
Location (Notified cases/100,000 inhabitants)	Category of social distancing	Measure (government act)	Effective date
Espírito Santo (18.55)	Events	All events banned except for places of worship (Decree 4599-R)	18/03
	Education	All teaching establishments closed (Decree 4597-R)	23/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 4599-R)	18/03
		Self-isolation for civil servants with mild flu-like symptoms (Decree 4599-R)	18/03
		All gyms and shopping malls with on-site activities closed (Decree 4600-R)	19/03
		On-site activities at bank branches stopped (Decree 4604-R)	20/03
		All commercial establishments and restaurants with on-site activities closed (Decree 4605-R)	20/03
Rio de Janeiro (21.55)	Events	Mass gatherings banned (Decree 46,970)	13/03
	Education	All teaching establishments closed (Decree 46,970)	13/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 46,970)	13/03
		Circulation of interstate buses with journeys originating in a state with community transmission banned (Decree 46,973)	17/03
		Free student travel pass cancelled (Decree 46,973)	17/03
		Intercity public road transport between the state capital and other cities banned (Decree 46,980)	19/03
		Air transport and docking of cruise ships coming from areas in which there is community transmission stopped (Decree 46,980)	19/03
		All beaches, rivers, lakes and pools closed for visitation (Decree 46,980)	19/03
Roraima (22.50)	Events	All events banned (Decree 28,587-E)	16/03
	Education	Partial closure of teaching establishments (Decree 28,587-E)	16/03
	Circulation of people	Circulation of intercity transport stopped (Decree 28,635-E)	23/03
		All non-essential business and service activities stopped except for deliveries (Decree 28,635-E)	23/03
		Remote working for all civil servants (Decree 28,635-E)	23/03
São Paulo (23.86)	Events	Events involving more than 500 people banned (Decree 64,862)	14/03
		Mass gatherings banned (Decree 64,864)	17/03
	Education	Partial closure of teaching establishments (Decree 64,862)	14/03
	Circulação de pessoas	Remote working for vulnerable civil servants in at-risk groups (Decree 64,864)	17/03
		Parks closed for visitation (Decree 64,879)	21/03
		All non-essential business and service activities closed except for deliveries (Decree 64,881)	24/03



- 1 Restaurants, cafés, shopping malls, museums, libraries, cinemas;
- 2 supermarkets, grocery stores, farmers markets, specialist food shops, drug stores and pharmacies;
- 3 subway, bus and train stations.

**Figure 1.** Performance of activities of daily living during social distancing in Brazil, April 1-3, 2020 (Source: Datafolha).

Source: COVID-19 Community Mobility Report (google.com/covid19/mobility)



**Figure 2.** Changes in social mobility according to the type of setting in Brazil on March 29, 2020 in relation to February 16, 2020 (Source: COVID-19 Community Mobility Report: google.com/covid19/mobility).

Source: Datafolha (April 1-3, 2020)

**Chart 4.** COVID-19 control measures implemented at state and federal level in Brazil and the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

Area (Notified cases/100,000 inhabitants)	Social distancing category	Measure (Government Act)	Effective date
Brazil (14.51)	Social distancing	Remote working for vulnerable civil servants in at-risk groups (Administrative Act19 - Ministry of Economy)	17/03
		Remote working, anticipation of individual and collective statutory leave, compensation of time and anticipation of public holidays (Provisional Act927)	22/03
Acre (11.29)	Events	Events involving more than 100 people banned (Decree 5,465)	17/03
	Education	Partial closure of teaching establishments (OrdinanceSEE 764)	20/03
	Circulation of people	Non-essential businesses and services closed except for deliveries (Decree 5,496)	20/03
		International and interstate transport stopped (Decree 5,496)	20/03
Alagoas (2.48)	Events	Open-air events involving more than 500 people and indoor events involving more that 100 people banned (Decree 69,501)	16/03
		Activities using public cultural facilities banned (Decree 69,501)	16/03
		Total ban on any events (Decree 69,541)	20/03
	Education	Complete closure of all teaching establishments (Decree 69,501)	23/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 69,502)	16/03
		Non-essential businesses, industries and services closed except for deliveries (Decree 69,502)	20/03
		Intercity road transport and subways stopped (Decree 69,502)	20/03
		All beaches and parks closed for visitation (Decree 69,502)	20/03
		Self-isolation obligatory for individuals with any flu-like symptoms (Decree 69,502)	20/03
		Discretionary leave for civil servants (Decree 69,502)	23/03
Remote working for all civil servants able to work from home (Decree 69,577)		30/03	
Amapá (39.69)	Events	Mass gatherings banned (Judicial decision)	29/03
	Education	Total closure of all teaching establishments (Decree 1,377)	17/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 1,377)	17/03
		Gatherings in public places banned (Decree 1,414)	20/03
		All non-essential businesses and services closed except for deliveries (Decree 1,414)	20/03
		River transport stopped (Decree 1,415)	23/03
Amazonas (36.93)	Events	Public events and those using public facilities banned (Decree 42,061)	16/03
		Events involving more than 100 people banned (Decree 42,063)	17/03
	Education	Partial closure of state teaching establishments (Decree 42,061)	16/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups and for those with mild symptoms (Decree 42,061)	16/03
		River transport stopped (Decree 42,087)	19/03
		Gyms and similar establishments closed (Decree 42,087)	19/03
		Circulation of intercity buses and tourist coaches stopped (Decree 42,098)	20/03
		On-site food sector closed and leisure events banned (Decree 42,099)	21/03
		Remote working for all civil servants (Decree 42,101)	23/03
		All non-essential businesses and services closed (Decree 42,101)	23/03
Circulation of interstate public road transport stopped (Decree 42,158)		04/04	

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**Chart 4.** COVID-19 control measures implemented at state and federal level in Brazil and the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

Area (Notified cases/100,000 inhabitants)	Social distancing category	Measure (Government Act)	Effective date
Bahia (5.92)	Events	Events involving more than 50 people banned in municipalities in which there is community transmission (Decree 19,529)	17/03
		Events involving more than 50 people banned throughout the entire state (Decree 19,586)	28/03
	Education	Partial closure of teaching establishments (Decree 19,529)	17/03
		Total closure of teaching establishments (Decree 19,586)	28/03
	Circulation of people	Obligatory self-isolation at home for people with symptoms of the disease (Decree 19,529)	17/03
		Docking of large vessels banned (Decree 19,529)	17/03
		Remote working for vulnerable civil servants in at-risk groups (Decree 19,528)	17/03
		Circulation of interstate buses stopped (Decree 19,528)	19/03
		Intercity bus transport from cities in which there is community transmission stopped except for professional activity (Decree 19,549)	19/03
Ceará (24.95)	Events	No licenses granted for events involving more than 100 people (Decree 33,510)	16/03
		Gatherings in public spaces banned (Decree 33,510)	16/03
	Education	Complete closure of teaching establishments (Decree 33,510)	19/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 33,510)	16/03
		Discretionary leave for civil servants (Decree 33,519)	19/03
		All non-essential industries and non-essential on-site commercial establishments and services closed (Decree 33,519)	19/03
		All beaches, rivers, lakes and swimming pools closed for visitation (Decree 33,519)	19/03
		Intercity and metropolitan road transport and subways stopped (Decree 33,519)	19/03
		Self-isolation at home obligatory for anyone with symptoms of the disease (Decree 33,519)	19/03
		Circulation of interstate buses stopped (Decree 33,519)	19/03
Remote working for all civil servants able to work from home (Decree 33,536)		05/04	
Federal District (22.80)	Events	No licenses granted for events involving more than 100 people (Decree 40,509)	11/03
		No licenses for events granted (Decree 40,538)	19/03
	Education	Complete closure of all teaching establishments (Decree 40,509)	11/03
	Circulation of people	Quarantining of suspected cases and obligatory self-isolation at home for individuals with symptoms of the disease (Decree 40,475)	28/02
		Remote working for civil servants with mild symptoms (Decree 40,526)	17/03
		All on-site non-essential businesses and services banned (Decree 40,538)	19/03
		Remote working for all civil servants (Decree 40,546)	23/03
Espírito Santo (18.55)	Events	All events banned except for places of worship (Decree 4,599-R)	18/03
	Education	Complete closure of all teaching establishments (Decree 4,597-R)	23/03
	Circulation of people	Remote working for all vulnerable civil servants in at-risk groups (Decree 4,599-R)	18/03
		Self-isolation at home for civil servants with flu-like symptoms (Decree 4,599-R)	18/03
		Gyms and shopping mall with on-site service closed (Decree 4,600-R)	19/03
		On-site service at banks stopped (Decree 4,604-R)	20/03
		Retail businesses and restaurants with on-site service closed (Decree 4,605-R)	20/03

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**Chart 4.** COVID-19 control measures implemented at state and federal level in Brazil and the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

Area (Notified cases/100,000 inhabitants)	Social distancing category	Measure (Government Act)	Effective date	
Goiás (4.27)	Events	All events banned (Decree 9,633)	13/03	
	Education	Complete closure of all teaching establishments (Technical note 1/2020 - SES/GO)	18/03	
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups and alternating schedules for the remainder (Decree 9,634)	17/03	
		Non-essential commercial establishments and services closed except for deliveries (Decree 9,637)	19/03	
		Road and air transport from regions where the virus is in circulation stopped (Decree 9,638)	24/03	
		Non-essential businesses closed (Decree 9,644)	25/03	
Maranhão (9.77)	Events	No licenses granted for events (Decree 35,660)	16/03	
		Activities involving mass gatherings banned (Decree 35,677)	21/03	
	Education	Partial closure of teaching establishments (Decree 35,662)	17/03	
	Circulation of people	Self-isolation at home for civil servants with mild symptoms (Decree 35,660)	16/03	
		Interstate transport stopped (Decree 35,672)	21/03	
		Non-essential commercial establishments and services closed except for deliveries (Decree 35,677)	21/03	
		Docking of large vessels from countries in which the disease is in circulation banned (Decree 35,677)	21/03	
Mato Grosso (4.28)	Events	All events banned except for those guaranteeing at least 1.5 meters between each individual present (Decree 419)	20/03	
		All events banned (Decree 425)	26/03	
	Education	Complete closure of all teaching establishments (Decree 425)	26/03	
		Circulation of people	Remote working and alternating schedules authorized for civil servants (Decree 407)	16/03
			Bars, convenience stores, bakeries and restaurants closed except for deliveries (Decree 421)	23/03
			Intercity road transport stopped (Decree 421)	23/03
			Leisure spaces, places of worship, sports and cultural venues closed for visitation (Decree 425)	26/03
			“Vertical” isolation of infected individuals in cities with community transmission (Decree 432)	02/04
			Restrictions imposed on non-essential activities in cities with community transmission (Decree 432)	02/04
Mato Grosso do Sul (4.31)	Events	No licenses for events granted (Decree 15,396)	20/03	
	Education	Partial closure of teaching establishments (Decree 15,393)	23/03	
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups and who have any symptom (Decree 15,391)	16/03	
		Remote working for all civil servants able to work from home, with alternating schedules being an option (Decree 15,393)	20/03	
		All state-run parks and sports facilities closed (Decree 15,393)	20/03	
		Discretionary leave for civil servants (Decree E 29)	03/04	

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**Chart 4.** COVID-19 control measures implemented at state and federal level in Brazil and the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

Area (Notified cases/100,000 inhabitants)	Social distancing category	Measure (Government Act)	Effective date
Minas Gerais (4.24)	Events	Events involving more than 30 people banned (Decision 17 of the Extraordinary Covid-19 Committee)	22/03
	Education	Partial closure of all teaching establishments (Decision 01)	18/03
		Complete closure of all teaching establishments (Decision 15)	21/03
	Circulation of people	Priority given to remote working for all civil servants and/or measures to reduce the number of employees present (Decision 02)	17/03
		Remote working for all vulnerable civil servants in at-risk groups (Decision 04)	18/03
		All interstate road, river and rail transport stopped (Decision 11)	21/03
		Remote working for all civil servants (Decision 12)	21/03
		All municipalities ordered to close businesses and services (Decision 17)	22/03
Pará (5.60)	Events	No licenses issued for events involving more than 500 people (Decree 607)	16/03
		Events involving more than 10 people banned (Decree 609)	07/04
	Education	Total closure of all state teaching establishments (Decree 607)	16/03
	Circulation of people	Possibility of remote working, particularly for vulnerable civil servants in at-risk groups (Decree 607)	16/03
		All beaches, riversides, bathing resorts, clubs, etc. closed for visitation (Decree 607)	16/03
		Gyms, bars, restaurants, nightclubs and similar types of establishment closed except for deliveries (Decree 607)	16/03
		On-site religious gatherings banned (Decree 607)	16/03
		Interstate road, sea and river transport stopped (Decree 607)	23/03
		Intercity road and sea/river transport stopped during April extended public holidays (Decree 607)	08/04
Paraíba (4.08)	Events	State-run events cancelled (Decree 40,128)	19/03
		Events in cities in which there are cases of the disease banned (Decree 40,173)	04/04
	Education	Partial closure of teaching establishments (Decree 40,128)	19/03
	Circulation of people	Alternating schedules for all civil servants and remote working for all those in at-risk groups (Decree 40,128)	19/03
		All crews from cargo ships banned from disembarking (Decree 40,135)	21/03
		All non-essential businesses and services closed except for deliveries (Decree 40,135)	21/03
		Intercity transport from major cities stopped (Decree 40,135)	21/03
		Remote working for all civil servants able to work from home (Decree 40,136)	21/03
Reduction in service of the main ferry routes (Decree 40,135)	22/03		
Paraná (7.09)	Events	Events involving more than 50 people banned (Decree 4,230)	16/03
	Education	Complete closure of all teaching establishments (Decree 4,230)	20/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups and a reduction in working hours, alternating schedules and remote working for the remainder (Decree 4,230)	16/03
		All state road transport stopped (Decree 4,263)	20/03
		Access of non-residents to an isolated community (Ilha do Mel) banned (Decree 4,230)	21/03

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**Chart 4.** COVID-19 control measures implemented at state and federal level in Brazil and the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

Area (Notified cases/100,000 inhabitants)	Social distancing category	Measure (Government Act)	Effective date
Pernambuco (15.43)	Events	Events involving more than 500 people banned (Decree 48,809)	14/03
		Events involving more than 50 people banned (Decree 48,822)	18/03
		Activities in cultural facilities and gyms banned (Decree 48,822)	18/03
		All events banned (Decree 48,837)	24/03
	Education	Complete closure of all teaching establishments (Decree 48,810)	18/03
	Circulation of people	Docking of large vessels banned (Decree 48,809)	14/03
		Remote working for all vulnerable civil servants in at-risk groups (Decree 48,810)	17/03
		Obligatory self-isolation at home for individuals arriving from countries in which there are cases of the disease (Decree 48,822)	18/03
		All travel to an isolated community (Fernando de Noronha) and tourism there stopped (Decree 48,822)	18/03
		All crews of cargo ships banned from disembarking (Decree 48,830)	19/03
		All non-essential businesses and services closed except for deliveries (Decree 48,833)	21/03
		All access to an isolated community (Fernando de Noronha) stopped except for essential activities (Decree 48,878)	03/04
	All beaches and parks closed for visitation (Decree 48,881)	04/04	
Piauí (2.77)	Events	Open-air events involving more than 100 people and indoor events for more than 50 people banned (Decree 18,884)	16/03
	Education	Partial closure of teaching establishments (Decree 18,884)	16/03
		Complete closure of all teaching establishments (Decree 18,913)	30/03
	Circulation of people	All non-essential businesses and services closed except for deliveries (Decree 18,901)	21/03
		Reduction of 50% in the flow of personnel involved in essential activities (Decree 18,902)	23/03
		Reduction in working hours for the industrial sector (Decree 18,902)	23/03
All intercity road transport stopped (Decree 18,924)	03/04		
Rio de Janeiro (21.55)	Events	Mass gatherings banned (Decree 46,970)	13/03
	Education	Complete closure of all teaching establishments (Decree 46,970)	13/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 46,970)	13/03
		The circulation of all interstate buses coming from states in which there is community transmission of the disease banned (Decree 46,973)	17/03
		Free student travel pass cancelled (Decree 46,973)	17/03
		All intercity road transport between the state capital and other cities cancelled (Decree 46,980)	19/03
		Air transport and docking of cruise ships from areas with community transmission of the virus stopped (Decree 46,980)	19/03
	Beaches, rivers, lakes and swimming pools closed for visitation (Decree 46,980)	19/03	

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**Chart 4.** COVID-19 control measures implemented at state and federal level in Brazil and the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

Area (Notified cases/100,000 inhabitants)	Social distancing category	Measure (Government Act)	Effective date
Rio Grande do Norte (11.29)	Events	Events involving more than 100 people banned (Decree 29,524)	18/03
		Events involving more than 50 people banned (Decree 29,541)	21/03
		Events involving more than 20 people banned (Decree 29,583)	02/04
	Education	Complete closure of all teaching establishments (Decree 29,524)	18/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 29,512)	14/03
		All non-essential businesses and services closed except for deliveries and for open-air shopping malls (Decree 29,541)	21/03
		Any establishment with artificial air circulation system closed (Decree 29,583)	02/04
Rio Grande do Sul (6.67)	Events	All events banned (Decree 55,128)	19/03
	Education	Partial closure of all teaching establishments (Decree 55,118)	17/03
		Complete closure of all teaching establishments (Decree 55,154)	01/04
	Circulation of people	Remote working for all civil servants able to work from home and alternating schedules for the remainder (Decree 55,118)	17/03
		Remote working for all vulnerable civil servants in at-risk groups (Decree 55,118)	17/03
		Interstate transport banned (Decree 55,128)	19/03
		Alternating schedules and remote working for all civil servants (Decree 55,128)	19/03
		All interstate and international road transport stopped (Decree 55,130)	21/03
		Beaches closed for visitation (Decree 55,130)	21/03
All non-essential businesses and services stopped except for deliveries (Decree 55,128)		01/04	
Rondônia (4.06)	Events	All events involving more than 5 people banned (Decree 24,887)	25/03
	Education	Complete closure of all teaching establishments (Decree 24,871)	17/03
	Circulation of people	Remote working for all civil servants able to work from home (Decree 24,871)	17/03
		Circulation of all motorcycle taxis banned (Decree 24,887)	25/03
		All flights from out of state banned (Decree 24,887)	25/03
		All non-essential businesses and services closed except for deliveries (Decree 24,887)	25/03
		The entry of all vehicles from other countries banned (Decree 24,887)	25/03
		The circulation of personnel for essential activities to be obligatorily reduced (Decree 24,887)	25/03
Roraima (22.50)	Events	All events banned (Decree 28,587-E)	16/03
	Education	Partial closure of all teaching establishments (Decree 28,587-E)	16/03
	Circulation of people	All intercity transport stopped (Decree 28,635-E)	23/03
		All non-essential businesses and services closed except for deliveries (Decree 28,635-E)	23/03
		Remote working for all civil servants (Decree 28,635-E)	23/03

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**Chart 4.** COVID-19 control measures implemented at state and federal level in Brazil and the number of notified cases per 100,000 inhabitants, updated on April 16, 2020.

Area (Notified cases/100,000 inhabitants)	Social distancing category	Measure (Government Act)	Effective date
Santa Catarina (12.29)	Events	All events banned (Decree 515)	17/03
	Education	Complete closure of all teaching establishments (Decree 509)	17/03
	Circulation of people	Remote working for all vulnerable civil servants in at-risk groups (Decree 507)	16/03
		Public spaces closed for gatherings and visitation (Decree 521)	19/03
		Municipal, intercity and interstate public road transport stopped (Decree 521)	19/03
		River and sea transport for pedestrians and cyclists stopped (Decree 525)	23/03
		All non-essential businesses and services closed except for deliveries (Decree 525)	23/03
		Reduction of 50% in number of customers for essential activities (Decree 525)	23/03
		Reduction of 50% in the size of the workforce in the industrial sector - prioritizing remote working for personnel in at-risk groups and administrative staff, without affecting salaries. Charter transportation service to run at no more than 50% of capacity (Decree 525)	23/03
São Paulo (23.86)	Events	Events involving more than 500 people banned (Decree 64,862)	14/03
		Mass gatherings banned (Decree 64,864)	17/03
	Education	Partial closure of teaching establishments (Decree 64,862)	14/03
	Circulation of people	Remote working for vulnerable civil servants in at-risk groups (Decree 64,864)	17/03
		Parks closed for visitation (Decree 64,879)	21/03
		All non-essential businesses and services closed except for deliveries (Decree 64,881)	24/03
Sergipe (2.07)	Events	Open-air events involving more than 100 people and indoor events involving more than 50 people banned (Decree 40,560)	17/03
		All events banned (Decree 40,563)	20/03
	Education	Complete closure of all teaching establishments (Decree 40,560)	17/03
	Circulation of people	Cinemas, theaters and similar establishments closed (Decree 40,560)	17/03
		Remote working for all vulnerable civil servants in at-risk groups (Decree 40,560)	17/03
		All non-essential businesses and services closed except for deliveries (Decree 40,563)	20/03
		Docking of ships coming from regions where the virus is in circulation banned (Decree 40,563)	23/03
		Interstate buses from states in which the virus is in circulation stopped (Decree 40,563)	23/03
		Alternating schedules for the workforce in the commercial and industrial sectors (Decree 40,563)	20/03
		Alternating schedules and remote working for all civil servants, as well as a reduction in working hours (Decree 40,563)	20/03
Remote working for all civil servants able to work from home (Decree 40,567)		25/03	
Tocantins (1.82)	Events	All events banned (Decree 6,072)	21/03
	Education	Partial closure of all teaching establishments (Decree 6,065)	18/03
		Total closure of all teaching establishments (Decree 6,071)	19/03
	Circulation of people	Reduction in working hours and alternating schedules for civil servants (Decree 6,066)	16/03
		Nature parks closed for visitation (Decree 6,067)	17/03
		The practice of sports in state-owned venues banned (Decree 6,071)	19/03
		Remote working for vulnerable civil servants in at-risk groups (Decree 6,072)	21/03

needs care will receive it. Therefore, the collapse not only of hospital services but indeed of the entire healthcare network is predictable.

Social distancing measures cannot be implemented without analyzing the progression of the disease, as monitored by health surveillance measures. This is the only possible way of defining the moment at which the interventions can be temporarily relaxed for relatively short windows of time in case it becomes necessary to reintroduce measures if or when the number of cases starts to rise again<sup>31</sup>. The criteria adopted in various countries for relaxing social distancing measures have prioritized monitoring the speed of transmission of the virus and, as a consequence, the number of infected individuals and of existing cases.

Imperial College London proposed the systematic inclusion of data on hospital admissions in surveillance systems on which decisions to activate and deactivate social distancing are based, rather than opting for interventions of fixed duration. Measures can then be adapted for use at regional and state level. Since the pandemic does not occur in a synchronized fashion, local policies can be more effective, reaching levels of suppression comparable with those at national level, even if in effect for a shorter period. Estimates for Great Britain indicate that nationwide social distancing strategies would need to be kept in force for at least two-thirds of the time until a vaccine becomes available<sup>31</sup>.

The experiences in China and South Korea have shown that suppression of the epidemic is possible over the short term; however, it is not known whether this is maintained over the long term and if the social and economic costs of the interventions adopted up to now could be reduced. China, which managed to stop progression of the epidemic with social distancing measures implemented in conjunction with the isolation of cases, started to relax these measures after they had been in force for three months. This relaxing of the measures is accompanied by rigorous monitoring of the epidemiological situation so as to permit rapid reversal should the number of cases start to increase again. This will, without doubt, help direct strategies in other countries<sup>31</sup>.

Major uncertainties still remain regarding the effectiveness of the measures and to what extent the population will spontaneously adopt risk-reduction behavior. Therefore, it is impossible to establish the precise duration of the measures, except that it will probably be several months. Nevertheless, the only certainty at the moment

is that future decisions regarding the moment at which measures can be safely relaxed and for how long will have to be based on continuous and rigorous epidemiological surveillance<sup>31</sup>.

## Final considerations and recommendations

The COVID-19 epidemic is still on the increase in all the Brazilian states and Federal District. The political crisis, aggravated by the change in command at the Ministry of Health, introduces further uncertainties regarding the policies to be adopted by the federal government. The scientific findings presented in this review strongly suggest that, taken in conjunction, isolating cases, quarantining contacts and implementing large-scale social distancing measures, particularly those aimed at reducing social contact by at least 60%, can potentially reduce transmission of the disease. Although there is little in the literature on the subject in the particular setting of Brazil, the prior experience of countries in Asia and Europe suggests that social distancing strategies should be strengthened, should be intersectoral and must be coordinated between different government and regional agencies with the aim of reaching the end of the epidemic as quickly as possible and avoiding second and subsequent waves of the virus.

Implementation in Brazil is undoubtedly an enormous challenge. The marked social inequalities in the country, with a large percentage of the population living in a state of poverty and an increasing number of homeless people, in addition to the large prison population, may facilitate transmission and hamper the adoption of social distancing. In addition, the large proportion of informal workers means that policies of social protection and support for vulnerable segments of the population will have to be instituted to guarantee the sustainability and effectiveness of COVID-19 containment measures. Minimum income guarantees for the entire population, as well as policies that guarantee the jobs of those in the formal job market, are crucial in ensuring the survival of individuals, particularly, but not exclusively, while measures are in place that restrict economic activities.

Finally, it is vital to strengthen the surveillance system at all three levels of the National Health Service. This includes: developing indicators with which to evaluate the progression of the epidemic; systematically disclosing notification data, separated by municipality and sanitary

district; increasing testing capacity to identify asymptomatic, pre-symptomatic and symptomatic infected individuals, hospitalized cases and deaths resulting from COVID-19; precisely defining suspected and confirmed cases based on clinical and laboratory criteria; and continuously

evaluating the implementation, effectiveness and the impact of control strategies. Only then will it be possible to provide data on which to base decision-making regarding the continuation of social distancing measures and the right moment at which to relax them.

### **Collaborations**

EML Aquino, JM Pescarini, IH Silveira, R Aquino idealized the study, participated in data collection, research and wrote the manuscript, having also contributed as the first authors in this manuscript; JA de Souza-Filho participated in data collection and research and collaborated in writing the article. The other authors, AS Rocha, A Ferreira, A Victor, C Teixeira, DB Machado, E Paixão, FJ Oliveira Alves, F Pilecco, G Menezes, L Gabrielli, MCC Almeida, N Ortelan, QHRF Fernandes, RJF Ortiz, RN Palmeira, EP Pinto Junior, E Aragão, LEPEF de Souza, M Barral-Netto, MG Teixeira, ML Barreto, MY Ichihara and RTRS Lima participated in the data collection and critical review of this manuscript.

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