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Covid-19 Fiocruz Observatory - an analysis of the evolution of the pandemic from February 2020 to April 2022

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Abstract *The COVID-19 pandemic had a significant impact on the living and working conditions of the entire population of Brazil, having a different and more intense effect on groups considered to be vulnerable. The objective of this article is to present an overview of the evolution of the pandemic in the country according to the bulletins of the Covid-19 Fiocruz Observatory in the period between the declarations of the beginning and end of the Public Health Emergency of National Concern (ESPIN, in Portuguese), February 2020 to April 2022. Several of the indicators adopted in the 69 bulletins published for the analysis of the pandemic were used, such as cases and deaths due to SARIs and COVID-19, age groups, % of occupancy of ICU beds, and vaccination, among others. The evolution analysis was organized between years and phases of the pandemic, seeking to highlight what characterized each moment. The closing statement of ESPIN in Brazil coincides with the discussions on the transition from a pandemic to an endemic scenario, without this representing the elimination of the virus, infections, and disease, posing the challenges of advances in vaccination processes in Brazil and around the world, as well as living with scenarios that may require the adoption of temporary protection measures in epidemic periods and periods of greater risk for vulnerable groups.*

Key words *COVID-19, Pandemic, Public Health Emergency, SARS-CoV-2*

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Introduction

According to Ordinances issued by the Ministry of Health, Minister's Office, COVID-19 as a public health emergency in Brazil officially lasted 809 days. A Public Health Emergency of National Concern (ESPIN, in Portuguese) was declared due to the human infection by the new coronavirus (2019-nCoV) on February 3, 2020, through Ordinance No. 188[1], and its end was declared on April 22, 2022, through Ordinance No. 9132[2]. If one considers the number of deaths per million inhabitants, which is an indicator of the impact of the pandemic and the countries' response capacities, the pandemic resulted in 701.42 deaths per million inhabitants globally as of April 22, 2022, with Brazil being one of the epicenters, with a number four times higher (n=2,895.78).

The COVID-19 pandemic profoundly affected the living and working conditions of the country's population, impacting differently and more intensely both groups considered vulnerable, such as older adults and people with comorbidities, as well as the poorest populations and those with precarious bonds and working conditions. As illustrated by Albuquerque and Ribeiro[3], if the first confirmed case of COVID-19 in Brazil involved a 61-year-old white man who recently arrived from Italy and admitted to the Hospital Israelita Albert Einstein, the first three deaths involved people with comorbidities (diabetes and hypertension) and adverse social conditions: a day laborer, a retired porter who lived with his parents and three brothers, and a domestic worker who helped her employer, who had recently arrived from Italy and was in quarantine[3].

The objective of this article is to present an overview of the evolution of the pandemic in the country, using the bulletins issued by the COVID-19 Fiocruz Observatory as a reference, considering their impact on the living and working conditions of the Brazilian population between the outbreak of the pandemic and the declaration of the end of the ESPIN in April 2022.

The COVID-19 Fiocruz Observatory Bulletins in monitoring the pandemic

The COVID-19 Fiocruz Observatory was established as a data-gathering platform to develop and make available integrated analyses, technologies, proposals, and solutions in response to the pandemic. It was an institutional innovation resulting from a decision by the institution's Presidency on March 22, 2020, after a meeting with researchers and managers who had already been working on topics related to public health emergencies and disasters. The website went live on April 1 (https://portal.fiocruz.br/observatorio-covid-19), organized into four axes: 1) Epidemiological Scenarios; 2) Measures of Control and Organization of Healthcare Services and Systems; 3) Quality of Care, Patient Safety, and Worker's Health; and 4) Social Impacts of the Pandemic. An extensive set of Bulletins, Technical Notes, Reports, Booklets, Guides, and Books were published (Five Instant Books published on Scielo in open access: https://books.scielo.org/informacaoparaacaonacovid19/), in addition to organizing Webinars on various topics relevant to the pandemic.

The COVID-19 Observatory Bulletins constituted a systematic means to monitor and produce analyses and action-oriented information on the pandemic. They began to be published during Epidemiological Weeks (SE, in Portuguese) 31 and 32 of 2020 (July 26 to August 8 of 2020). They started strictly when the data blackout by the Ministry of Health occurred in early June 2020, when accumulated data on the number of cases and deaths from COVID-19 ceased to be published because of the upward trends during the first wave.

They followed the logic of exposure to the virus/infection/illness/worsening/death, always involving a balance of measures for reducing exposure (non-pharmacological measures), reducing morbidity and mortality through vaccination, and surveillance measures with testing to minimize circulation of infected people and contacts through isolation and quarantine measures, identification of priority risk groups for prevention and care measures, along with an adequate supply of ICU beds, supplies, and professionals to treat severe cases (Chart 1). At the same time, the bulletins and indicators regularly combined analyses of critical topics during the pandemic, such as the situation of healthcare workers, indigenous peoples and COVID-19, *favelas*, the elderly population, education, and health in the pandemic, healthcare equity, income and work, public policies and social impacts, and vaccination.

An active communication strategy was integrated into the Bulletin production process and distributed through the Social Communication Coordination and Fiocruz News Agency to a broad media network (radios, TVs, newspapers, and magazines, from wide circulation to more regional and local ones) and social networks. This strategy broadened access to the Bulletins, mak-

Chart 1. Dimensions and indicators adopted by the Covid-19 Fiocruz Observatory.

Dimension of the indicators and the pandemic	Examples of data and indicators	Healthcare sector policies and actions to reduce risks	
Exposure	Homestay index (IPD)	- Reduce exposure of people and spread of the virus through *non-pharmacological measures*	Social policies and actions Identification of situations of social vulnerability Social support for vulnerable groups
Infection	Testing data	- Reduce infection of people through *vaccines* - Health surveillance to reduce the circulation of infected people, with *increased testing, active search and isolation of suspected cases, and monitoring and quarantine of contacts*	
Illness	Case notification	- *Identification of risk groups by* Family Health Strategy professionals and *reduction of vulnerability due to comorbidities by continuing treatments*	
Disease	Hospitalization in infirmaries and ICUs	- Measures to *adapt the supply of beds, supplies* for treatment, number of *health professionals*, and working conditions for the safety of patients and workers	
Death	Death certificate	- *Social support measures* for families with greater social vulnerability and *psychosocial and mental health support*	

Source: Covid-19 Fiocruz Observatory 2020 (6 months of pandemic) and 2021 (500,000 deaths in Brazil).

ing them one of the primary sources of information during the pandemic in Brazil, reaching different stakeholders (managers of state and local governments, the legislature and the judiciary, healthcare professionals, and other institutions involved in responding to the pandemic, entrepreneurs, NGOs, social movements, and society in general).

In all, Fiocruz Observatory published 63 bulletins: 34 every two weeks and 24 extraordinary editions (started in March 2021, when the indicator referring to the hospital bed occupancy rate signaled a collapse in the healthcare system, combined with very high daily averages of new cases and deaths), and five special editions (6 months into the pandemic, 500,000 deaths, 2020 balance sheet, 2021 retrospective, two years of the ESPIN).

An overview of the evolution of the pandemic in the country presented below is the result of more than two years of work comprising daily discussions, publication of bulletins, interviews, and meetings with various media concerning the different scenarios and contexts of COVID-19 in Brazil.

COVID-19 - Two-year review of the Public Health Emergency of International and National Concern

Two years after the WHO declared a Public Health Emergency of International Concern (PHEIC), the COVID-19 Observatory published a review of the pandemic in Brazil, with an analysis of its evolution in different phases, summarized in Figure 1 and described below[4].

The first year of the pandemic

The pandemic's first year and first phase began in February and lasted until August 2020 (Figures 1 and 2).

The declaration of the ESPIN[1] and the appearance of the SARS-CoV-2 virus in the nation's capitals occurred in February, with the first case registered on February 26 in São Paulo. The Public Health Emergency Operations Center (COE-nCoV) was set up during this initial phase as a national mechanism tasked with planning, organizing, and coordinating the emergency response; serving as a liaison with state, district, and local SUS managers; and disseminating information related to the pandemic to the population.

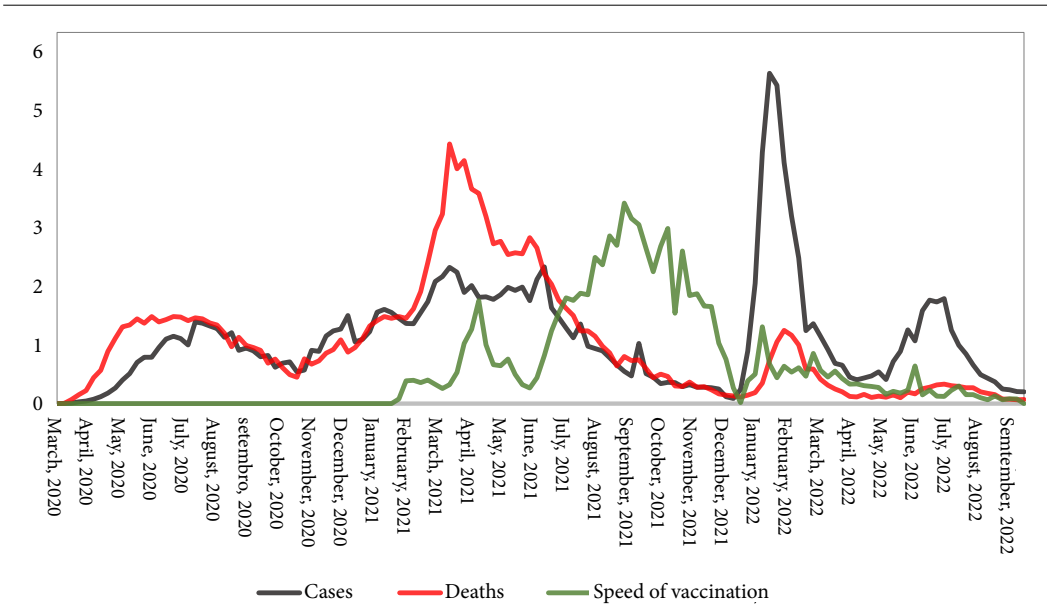

Figure 1. Evolution of the number of cases, deaths, and vaccine doses in values standardized by the mean and standard deviation of the entire series.

Source: Covid-19 Fiocruz Observatory.

In March, *Infogripe* warned of an increase in the number of cases of severe acute respiratory syndromes (SARS), which had already exceeded the pre-epidemic threshold in the first two weeks and, from the second two weeks onward, the incidence rate was at a very intense level. The transmission quickly reached Brazil's main capitals between the declaration of ESPIN and the first case, expanding in sequence: first in the capital cities' peripheral areas, then into the smaller cities and towns, and finally, the rural areas, resulting in a gradual interiorization of the pandemic.

Brazil took the first necessary steps in this phase to monitor the pandemic. However, poorly coordinated efforts to organize Primary Health Care actions at the local level followed it. Likewise, there were administrative and geopolitical conflicts in purchasing personal protective equipment (PPE) and respirators, with intense competition between countries and obstacles in providing clinical beds and ICU beds in the public and private sectors. Structural inequalities were already pronounced at this point, notably because more than 90% of the municipalities lacked the resources to properly care for severe cases, primarily in the North[5].

Some essential measures were adopted during this time, with the population observing physical distancing and restricting economic activities, usually by state or municipal initiative. However, there was also a gradual decline in compliance with these strategies, systematically disqualified as essential measures to reduce exposure and offer collective protection with the large-scale dissemination of fake news, often corroborated by government members. The absence of coordinated government campaigns at all levels (federal, state, and local) to encourage these measures contributed to their disqualification, along with the lack of campaigns to counter the so-called fake news.

Even after there were more SARS/COVID-19 ICU beds available and several field hospitals had been set up, the absence of broad, coordinated non-pharmacological measures to reduce exposure led to a long line of patients in need of ICU admission, contributing to a high death rate due to lack of access or delayed access to highly complex care. The severe first collapse of the healthcare system occurred between April and May in the capital city of Manaus, the only municipality in the state of Amazonas with the capacity to offer highly complex hospital care.

The expanding transmission, new cases, and deaths, first to the outlying areas of the capital cities and metropolitan areas, then spreading to

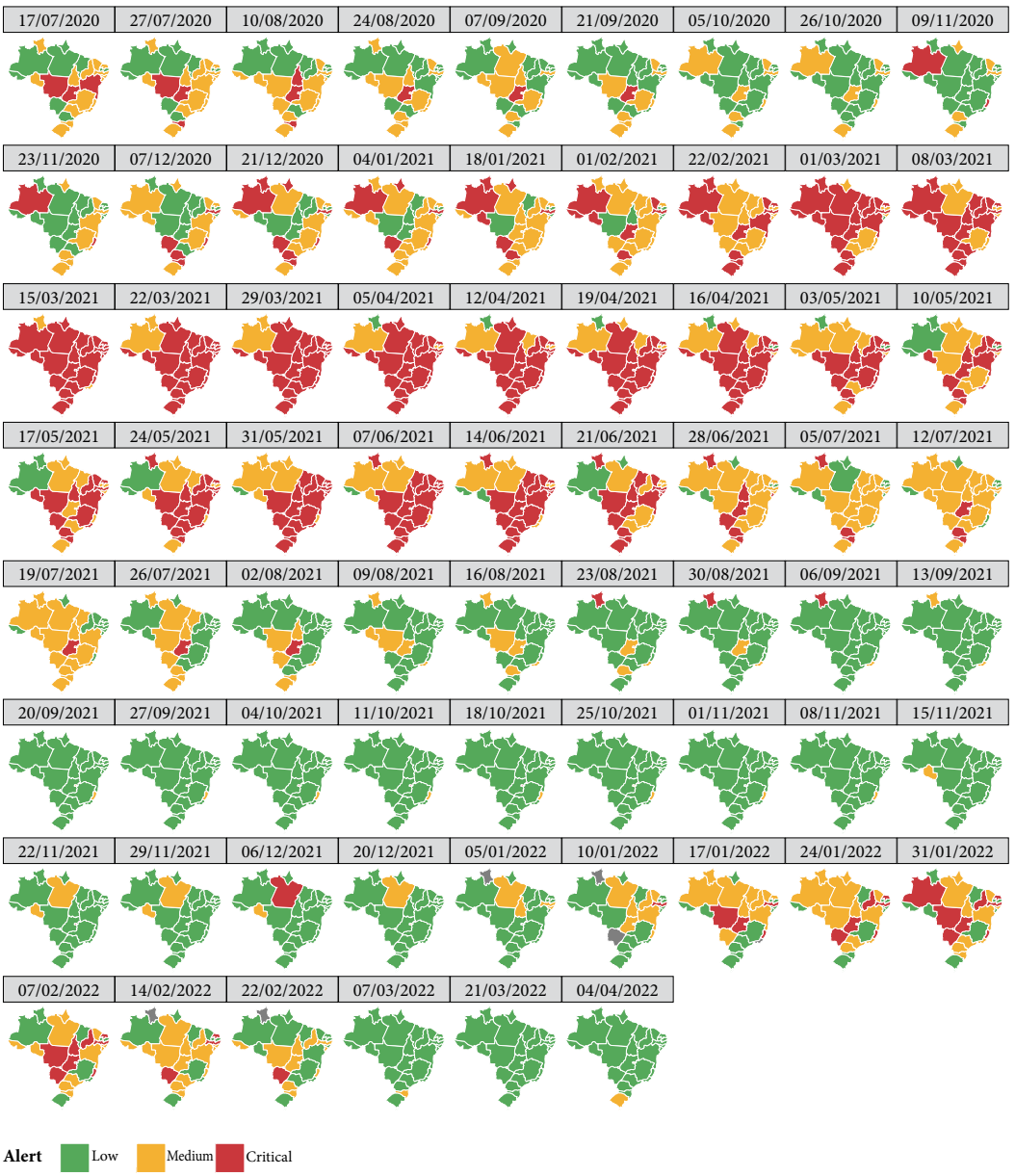

Figure 2. Occupancy rate of COVID-19 adult ICU beds - July 2020 - April 2022.

Source: Covid-19 Fiocruz Observatory.

cities and towns in the countryside with a smaller, less robust healthcare infrastructure, was followed by a continuous decline in non-pharmacological measures and this period marked a second phase (August 2020 to February 2021) (Figures 1 and 2), resulting in an intense level of transmission, characterized by high mortality rates, with around 1,000 deaths daily, which affected the entire country without differences between the incidence of new cases in the large metropolitan areas and smaller cities and towns. Local crises were observed with the ICU bed overcrowding, particularly in some states in the Midwest and Southern regions, which had been spared during the previous phase. Consequently, high death rates, some even occurring outside of the hospital environment, were observed, raising alarm due to a sharp rise in mortality rates.

There was a transition period between the first and second waves through a relative decline in the number of cases and deaths, with several state and local governments adopting isolated measures of physical and social distancing and using masks without being nationally and regionally coordinated. The number of cases began to rise again in November 2020, with a substantial impact on ICU bed occupancy concentrated in the South, and Midwest, and again in the state of Amazonas (Figure 2). During this period, the amount of Emergency Aid (EA) was cut in half. The EA played an essential role in offsetting the loss in family income between May and September, and its reduction may have contributed to more excellent circulation of people.

The average age of ICU hospitalization throughout 2020 was above 60 years; likewise, the average age of death mainly affected older patients and those with comorbidities. However, there were some spatial variations, with some states and municipalities reporting more cases, including hospitalization, ICU bed occupancy, and deaths during this period. The greater vulnerability of the older adults and patients with comorbidities was decisive in recommending that these groups be classified as a priority to receive the first dose of the COVID-19 vaccine as soon as it had been approved.

Healthcare workers in Brazil were heavily affected during the first year, as they had been in other countries. One of the topics addressed in the six-month pandemic review bulletin, published on October 16, 2020, was the "Situation of healthcare workers in the face of Covid-19", highlighting that in the first phase of the pandemic, healthcare workers were one of the groups with the highest risk of illness, due to direct contact and exposure to high viral loads, work overload due to the increased demand for care, and abrupt changes in protocols and routines, not always in adequate physical spaces and confronted with a shortage of PPE[6,7].

In addition to healthcare workers, some other segments were strongly affected by COVID-19[8], such as those working in slaughterhouses and the oil industry. The National Agency of Petroleum, Natural Gas, and Biofuels reported that production in April and May was temporarily interrupted in 38 and 34 petroleum fields, respectively, because of the COVID-19 pandemic, which substantially impacted the country's oil industry. The National Confederation of Food Workers estimated that around 125,000 workers had been infected by August 2020, which led to bans in several states. It immediately affected the country's economy, with China suspending meat imports from some of Brazil's meatpacking plants.

The health outlook of these workers and sectors, with their visibility and importance in the national economy, revealed the extreme vulnerability they were subject to, whether due to the shortage and inadequacy of PPE or to strenuous work hours and processes and inappropriate, high-risk environments.

Furthermore, a large contingent of precarious, informal, and formal workers could not stay at home, sheltering in place. The combination of greater exposure to the risk of infections due to the types of work, vulnerability in holding onto jobs and income, and age or chronic disease profiles led to a sharp rise in the number of workers in situations of risk to health[9]. In this context, a survey carried out by Lagom Data, the data intelligence studio for *El País*, a daily newspaper in Spain, detected high mortality among employees who could not remain at home for any length of time. While Brazil's mortality rate stood at 22% in 2020, for some occupations, such as gas station attendants, supermarket cashiers, bus drivers, security guards, and outsourced workers who monitor the temperature of people entering shopping centers, it was higher than 59%[10].

It was in this context that, still in 2020, the last bulletin of the Fiocruz COVID-19 Observatory[11], published in December, focused on the health of healthcare workers through the title "Preserving the lives of healthcare workers is the greatest gift that can be offered at the end of the year", warning that, at the end of that year, while millions of people would remain at home for the Christmas and New Year festivities, more than 3.5 million workers would continue to report to work at hospitals, clinics, laboratories, and healthcare units, underscoring the fact that a healthcare system does not exist without its workers, who are vital to ensuring that the population receives quality care.

The second year of the pandemic

A "second wave" of transmission began at the end of 2020, starting in the summer and coinciding with the end-of-the-year holidays, accompanied by the relaxation in social distancing, primarily in November and December. At this time, the Gamma variant emerged and quickly spread, reaching its peak in April 2021, with high numbers of new cases and deaths from March to June, peaking at 3,000 deaths per day (by moving average). It was the third phase of the pandemic (Fig-

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ure 1), marked by the collapse of the healthcare system, as shown in Figure 2 (occupancy rate of adult COVID-19 ICU beds), and local health crises, owing to the lack of ICU equipment and supplies, and exacerbated by overworked medical teams.

December 2020 and January 2021 saw critical ICU bed occupation rates for adults in SUS, mainly in the Northern and Southern states. The state of Amazonas, where physical and social distancing measures had been vigorously attacked in December in the form of counter-demonstrations, suffered a new collapse of its healthcare system, with patients dying without access to necessary care and, even if they were hospitalized, succumbing due to lack of basic supplies, such as oxygen. The crisis in Amazonas was a harbinger of the crisis and collapse of the healthcare system that would spread throughout the country, having been detected in early March, when eighteen states were in the critical alert zone and seven in the intermediate alert zone, an indicator referring to the occupancy rate of ICU SARS/COVID-19 beds for adults in the SUS.

Given the immense demand that arose between February and May 2021, it was possible to see a sharp increase in occupied ICU SARS/COVID-19 beds. However, as before, except for a few metropolitan areas, such as Salvador and Fortaleza, where state and local governments worked together, there was a lack of national coordination around straightforward, structured campaigns urging the adoption of non-pharmacological measures. These measures involved physical and social distancing and, at certain times during the crisis and collapse of the healthcare system in almost every country, the number of new cases and hospitalizations continued to climb, even with lockdown, together with campaigns for the free distribution of masks and incentives to use them.

The vaccination campaign against COVID-19 in Brazil started on January 17, 2021. However, a small number of doses were initially available (6.2 million), so only from March onward was the country able to provide a sufficient number of doses to speed up the vaccination process (27.5 million). Yet this advance did not occur quickly enough to prevent the rapid growth of new cases, hospitalizations, and deaths or the collapse of the healthcare system, which hit the country between March and July 2021 (Figure 2). Thus, even having a National Immunization Program with more than 40 years of experience in offering safe, effective vaccines for all population groups, the shortage of doses at the beginning of the vaccination process, the divergence in vaccination schedules, and criteria for prioritizing groups between state and local governments contributed to delays and led to looking for the vaccine in other municipalities, which, in some instances, compromised the application of the second doses.

The context that led to the crisis and collapse of the healthcare system involved social policies, public health measures (pharmacological and non-pharmacological), and the emergence of new variants of the SARS-CoV-2 virus. Although the EA ensured a temporary income in 2020 and helped mitigate the pandemic's social impact, especially on society's most vulnerable segments, it's being cut in half in the last quarter of 2020 and not being paid in the first quarter of 2021 compelled people to go out in search of work. Added to this context were the easing of non-pharmacological measures in many states and municipalities, the emergence of the Gamma variant with its more significant potential for transmission, and more severe cases without enough vaccines to protect the population.

It was in this context that the National Council of Health Secretaries (Conass) included in the Letter from the State Secretaries of Health to the Brazilian Nation[12], dated March 2021, the need for "approval of a National Economic Recovery Plan, with immediate return of emergency aid", which directly involved issues related to work and income.

It was not possible to prevent the health crisis. Yet, at the same time, the vaccination process had a positive impact as it helped reduce the number of severe cases, hospitalizations (clinical and ICU), and deaths, especially among the elderly. The mean and median ages of clinical admissions, ICU admissions, and deaths between May and June 2021 were below 60 years. A resurgence of the pandemic marked the end of this phase. This phenomenon was gradual and occurred concomitantly with the resumption of in-person work. While there was a proportional reduction in severe and fatal cases among older people, the absolute number of cases among adults who made up the economically active population soared, affecting different types of formal and informal workers.

The country experienced a fourth phase of the pandemic between August and December 2021 (Figure 1), distinguished by a downturn in the number of new cases, severe cases, and deaths, giving the healthcare system some much-needed relief. While the Delta variant was spreading and

becoming predominant, the effectiveness of vaccination became increasingly evident in reducing transmission and the severity of COVID-19 cases, resulting in a drop in occupancy rates for COVID-19 ICU beds for adults (Figure 2). The decline in the test positivity rate coincided with a lower transmission of the SARS-CoV-2 virus as an outcome of vaccination, which had already reached 20% of the population with two doses. In this way, the daily moving average of deaths was reduced to numbers close to those of the first wave, around one thousand deaths. With 40% of the eligible population vaccinated in September, Brazil reached a daily average of 500 deaths. In November, vaccination coverage reached 60% of the population, and the daily average was around 250 deaths.

The pandemic in 2022 and speculation about its end

A third "wave" of transmission began in December 2021, coinciding, as in 2020, with the holiday season, vacations, and the relaxation of mobility restriction measures. In this scenario, the Omicron variant first appeared and quickly became the dominant strain. This fifth phase (Figures 1 and 2) was also marked by an Influenza A virus epidemic that broke out in several municipalities, leading to an increase in SARS cases, along with several weeks of interruption in receiving surveillance data, which compromised the monitoring and analysis of the pandemic and how it was evolving. The number of cases proliferated in this phase, preceded by an increase in tests with positive results, much more quickly than in the first waves, with more COVID-19 ICU beds for adults being occupied, even with the gradual reactivation of beds that had been deactivated, resulting in a rising number of deaths, albeit in smaller proportions, with lower mortality rates than in the previous phases. Many healthcare professionals were also testing positive at this stage, making physical isolation necessary and putting more pressure on the system and its workers.

At this point, intense speculation began circulating about a possible way to end the pandemic. February saw a peak in registered cases, with a moving average of 189,000 cases by the end of January, falling to around 13,500 on April 22. The moving average of deaths peaked in mid-February, with a moving average of 808 (close to the first wave but much lower than the second wave), falling to 92.5 on April 22. This phase also coincided with more tests being made available; many municipalities adopted large-scale testing, which contributed to isolation measures among infected people, quarantine among those directly exposed, and the expanded administration of vaccine booster doses among different population groups.

During the Omicron wave, which started in December 2021, speculation, discussions, and decisions about the end of the pandemic began to intensify. In December 2021, Robertson and Doshi[13] published an article in the *British Medical Journal* calling attention to the fact that, contrary to its beginning, the end of the pandemic would not be televised, with no universal definition of epidemiological parameters to define it. In January 2022, Murray[14] argued in a commentary published in the *Lancet* that the impacts of future transmission of SARS-CoV-2 would be more negligible considering the immunity acquired by previous infections, vaccines regularly adapted to new antigens or variants, the advent of antivirals, and the knowledge and experiences gained with the adoption of non-pharmacological protection measures, especially for the most vulnerable groups, making COVID-19 a recurrent disease that healthcare systems and societies will have to manage. According to Murray, new variants of SARS-CoV-2 would certainly emerge, with COVID-19 remaining, but the end of the pandemic was near. In Brazil, Ethel Maciel *et al.*[15] published an article in the *Revista da Sociedade Brasileira de Medicina Tropical* raising some critical arguments, such as: 1) from an operational standpoint, it could not yet be considered safe to abolish prevention and control measures, configuring an inter-epidemic and non-endemic phase; and 2) endemicity will depend on herd immunity (through vaccines and previous infections), which is uncertain, considering new variants, the appearance of vaccine-resistant strains, and the duration of protection.

Although the Ministry of Health declared the end of the Public Health Emergency of National Importance (ESPIN) on April 22, 2022[2], it is essential to note that it occurred in the absence of established consensual parameters defined by international health authorities to formally call an end to the COVID-19 pandemic decree[15].

Final considerations

Each year and phase of the pandemic presented new challenges. If in the first phase, non-pharmacological measures, diagnosis, and adequate

treatment were significant issues, in later phases, the need to maintain these measures as a means of reducing exposure and infection, together with the adaptation processes of hospitals and other health establishments, were crucial in lessening the disease's impact. Vaccination became part of the public debate at the end of 2020, placing itself as a priority for disease control to this day.

The Omicron variant was the prevailing variant when the end of the ESPIN was declared, with an estimated propagation capacity of about 70 times greater than other variants, such as Delta. However, it was less aggressive since the hospitalizations and death rates did not follow the case growth curve, contrary to what had happened with the Gamma and Delta[16] variants, with no consensus as to whether this was the result of lower pathogenicity or the protective effects of vaccines or a combination of both. In any event, one cannot forget that the main objective of expanding vaccination coverage was to abate severe and fatal cases[17]. While they could provide a modest amount of protection against SARS-CoV-2 infection, their most incredible benefits were associated with easing the burden on the healthcare system, keeping schools and workplaces open and functioning, and protecting vulnerable population groups, especially older adults and people with comorbidities[18]. If, in the first waves of the pandemic, fatality was between 2% and 3%, during the predominance of the Omicron variant and with most of the adult population having been vaccinated, this indicator dropped to values close to 0.3%.

Some countries and health agencies were discussing the transition of the disease from a pandemic to an endemic. First, there are other stages of classification between the status of pandemic and endemic that equally impose changes in monitoring and surveillance. Second, the classification of "endemic" would incorporate social and care practices into the routine of citizens and healthcare services. This change in classification happened after a drastic reduction in transmission by the new variants and through a worldwide vaccination campaign.

As Maciel *et al.*[15] observed in an article published in the *Revista da Sociedade Brasileira de Medicina Tropical,* in which they asked if the end of the pandemic were close at hand, the transition to an endemic would mean society's ability to "live with the virus", without additional restrictions and protective measures due to vaccines. However, since the virus and the disease will remain, the public would have to live with the eventual need to use individual preventive measures considering certain situations, epidemic periods, and risk groups.

Collaborations

This article is the result of the collective work of the authors at the COVID-19 Fiocruz Observatory. CM Freitas was responsible for the design and structure of the article. All others participated in writing the document, analyzing and interpreting the data, and approving the final version for publication.

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