Challenges of Public Health in a Reference Municipality for High Complexity Care and Intensive Therapy in the Face of the COVID-19 Pandemic

Desafios da Saúde Pública em um Município de Referência para Atendimentos de Alta Complexidade e Terapia Intensiva Diante da Pandemia de COVID-19c

Desafíos de la Salud Pública en un Municipio de Referência para Atenciones de Alta Complejidad y Terapia Intensiva Frente a la Pandemia de COVID-19

RESUMO
O estudo teve como objetivo avaliar os desafios enfrentados pela saúde pública em Amparo, SP, durante a pandemia de COVID-19, analisando a alocação de leitos, respiradores, EPIs e profissionais de saúde, além da evolução dos indicadores epidemiológicos. Realizou-se um estudo epidemiológico observacional, transversal e descritivo, com dados secundários de 2019 a 2021 (DATASUS, IBGE, SEADE, Fiocruz). Calculou-se incidência e mortalidade por 100 mil habitantes, ocupação de UTI e densidade de profissionais por 10 mil habitantes. Os resultados indicaram sobrecarga hospitalar crítica, com ocupação de UTI acima de 100% no pico de 2021 e mortalidade superior à média estadual. Leitos de UTI aumentaram de 9 para 42 e respiradores de 21 para 45, mas a demanda permaneceu elevada. Médicos clínicos reduziram 80%, enquanto enfermeiros dobraram, ainda abaixo da densidade nacional. Concluiu-se que os achados evidenciaram a necessidade de planejamento integrado, fortalecimento da atenção primária, gestão eficiente de recursos humanos e engajamento comunitário, fornecendo subsídios para políticas públicas mais equitativas e preparação para futuras emergências sanitárias.
DESCRITORES: Administração Pública; COVID-19; Unidades de Terapia Intensiva (UTI); Profissionais da Saúde; Políticas Públicas.

ABSTRACT
The study aimed to evaluate the challenges faced by public health in Amparo, SP, during the COVID-19 pandemic, analyzing the allocation of hospital beds, ventilators, PPE, and health professionals, as well as the evolution of epidemiological indicators. An observational, cross-sectional, and descriptive epidemiological study was carried out using secondary data from 2019 to 2021 (DATASUS, IBGE, SEADE, Fiocruz). Incidence and mortality rates per 100,000 inhabitants, ICU occupancy, and health professional density per 10,000 inhabitants were calculated. Results indicated critical hospital overload, with ICU occupancy exceeding 100% at the peak in 2021 and mortality higher than the state average. ICU beds increased from 9 to 42 and ventilators from 21 to 45, but demand remained high. General practitioners decreased by 80%, while nurses doubled, still below the national density. It was concluded that the findings highlighted the need for integrated planning, strengthening of primary care, efficient management of human resources, and community engagement, providing support for more equitable public policies and preparation for future health emergencies.
DESCRIPTORS: Public Administration; COVID-19; Intensive Care Units (ICU); Health Professionals; Public Policies.

RESUMEN
El estudio tuvo como objetivo evaluar los desafíos enfrentados por la salud pública en Amparo, SP, durante la pandemia de COVID-19, analizando la asignación de camas hospitalarias, respiradores, EPP y profesionales de la salud, además de la evolución de los indicadores epidemiológicos. Se realizó un estudio epidemiológico observacional, transversal y descriptivo, con datos secundarios de 2019 a 2021 (DATASUS, IBGE, SEADE, Fiocruz). Se calcularon tasas de incidencia y mortalidad por 100.000 habitantes, ocupación de UCI y densidad de profesionales por 10.000 habitantes. Los resultados indicaron una sobrecarga hospitalaria crítica, con ocupación de UCI superior al 100% en el pico de 2021 y mortalidad mayor que el promedio estatal. Las camas de UCI aumentaron de 9 a 42 y los respiradores de 21 a 45, pero la demanda se mantuvo elevada. Los médicos clínicos se redujeron en un 80%, mientras que los enfermeros se duplicaron, aún por debajo de la densidad nacional. Se concluyó que

DOI: 10.36489/saudecoletiva.2025v16i100p17104-17123

los hallazgos evidenciaron la necesidad de una planificación integrada, fortalecimiento de la atención primaria, gestión eficiente de los recursos humanos y compromiso comunitario, proporcionando subsidios para políticas públicas más equitativas y preparación para futuras emergencias sanitarias.
DESCRIPTORES: Administración Pública; COVID-19; Unidades de Cuidados Intensivos (UCI); Profesionales de la Salud; Políticas Públicas.

RECEIVED: 08/28/2025 **APPROVED:** 09/13/2025

How to cite this article: Rossetti CA. Challenges of Public Health in a Reference Municipality for High Complexity Care and Intensive Therapy in the Face of the COVID-19 Pandemic. Saúde Coletiva (Edição Brasileira) [Internet]. 2025 [acesso ano mês dia];16(100):17104-17123. Disponível em: DOI: 10.36489/saudecoletiva.2025v16i100p17104-17123

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INTRODUCTION

In recent decades, the world has faced significant pandemics, such as SARS (2002), MERS (2012)[1] and, more recently, COVID-19. While SARS had a mortality rate of 11% and MERS of 34%, neither reached the magnitude of COVID-19[2].

The pandemic originated in December 2019 in Wuhan, China, and spread rapidly around the world[1,2,4]. Caused by Severe Acute Respiratory Syndrome (SARS-CoV-2), a single-stranded RNA coronavirus[5], the disease was transmitted by droplets and contact with surfaces, ranging from mild to severe symptoms, including pneumonia[6]. Its high affinity for the ACE2 receptor favored its rapid spread[3], while structural differences from SARS-CoV were decisive for vaccines and therapies[8,9].

In Brazil, the first case occurred in February 2020, in São Paulo[4,10]. By the end of the year, the country had already recorded 7.6 million cases and 190,000 deaths[11,12]. Emergency measures involved social isolation, expansion of ICUs, and distribution of PPE[2,4]. Vaccination began in January 2021, reducing cases and deaths[13], but the gamma variant (P.1) led to hospital collapse, bringing the total to more than 400,000 deaths in April[7]. Globally, as of November 2021, 257 million cases and 5 million deaths had been confirmed, with more than 612,000 in Brazil[14].

The crisis exposed regional inequalities associated with demographic and socioeconomic factors[8,9], with the risk of hospital exhaustion in smaller municipalities[15]. In the state of São Paulo, Amparo stood out as a regional reference in medium and high complexity, with a population of 72,195 inhabitants and a high aging index[16].

This study analyzed the management of beds and ventilators in Amparo, focusing on the incidence coefficient, availability of resources, expansion of the hospital network, and mortality from COVID-19[17].

METHOD

The research was based on primary and secondary data collected between March 2020 and December 2022, from the Brazilian Institute of Geography and Statistics (IBGE) and official systems of the Ministry of Health, such as DATASUS. The analysis, exploratory and descriptive in nature, used quantitative and qualitative approaches. Mortality and morbidity rates were observed by region and socioeconomic stratum, as well as access to and quality of health services in the country[16]. The results showed significant disparities: historically disadvantaged regions, such as the North and Northeast, had higher mortality rates, associated with a lack of infrastructure, supplies, and qualified professionals[20].

In contrast, urban areas in the South and Southeast performed better, highlighting the need for more equitable public policies[5].

Social determinants, such as education and income, directly influenced health conditions, according to the Dahlgren and Whitehead (1991) model. Populations with lower levels of education had less access to preventive information and difficulties in using available services. The findings reinforce the importance of health education as a strategy for reducing mortality in vulnerable groups[8].

In the field of mental health, there has been a significant increase in depressive and anxiety disorders associated with the impacts of the COVID-19 pandemic. The chronic lack of specialized services, especially in rural areas, highlighted the urgency of robust policies in this area[22]. Given this scenario, intersectoral coordination between governments, NGOs, and civil society was recommended, with actions such as expanding vaccination coverage, improving working conditions for health professionals, and permanent prevention and self-care campaigns[8].

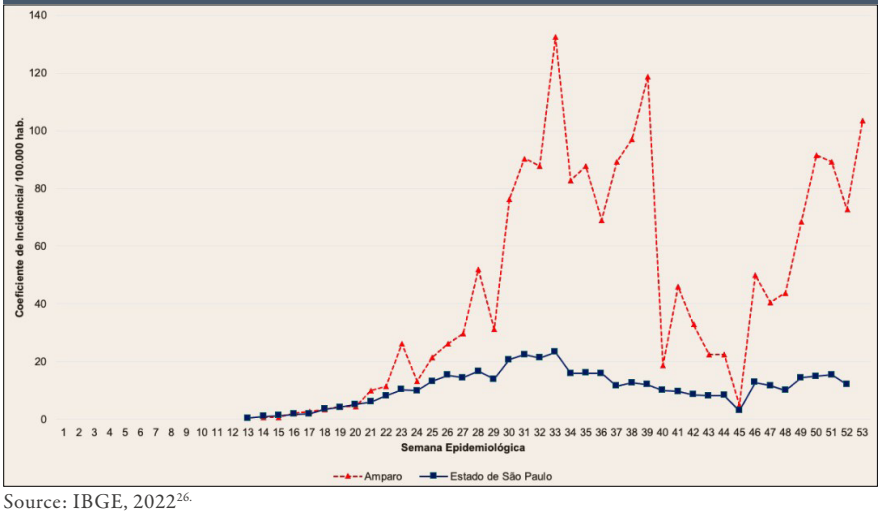
The study also proposed the creation of a permanent system for monitoring health indicators, supported by digital technologies and interactive dashboards, for real-time situational diagnoses and rapid interventions[23]. In summary, the analysis revealed persistent structural inequalities in the Brazilian health system, but also pointed to ways to overcome them. It was concluded that the consolidation of a more equitable and universal system requires an integrated social pact between different actors and spheres of public power[16].

RESULTS

The analysis showed that the most vulnerable populations, especially in the North and Northeast of Brazil, had significantly higher mortality rates, confirming historical inequalities in national public health. Unequal access to health services aggravated this scenario, resulting in mortality rates up to 2.5 times higher among the lowest socioeconomic classes compared to the highest[24]. The public policies implemented proved insufficient, with reports of overwhelmed hospitals and a lack of essential supplies, such as oxygen and medicines. Misinformation amplified by social media contributed to non-compliance with preventive measures and increased viral spread. In contrast, regions that invested in health education achieved greater adherence to preventive measures and lower mortality[2].

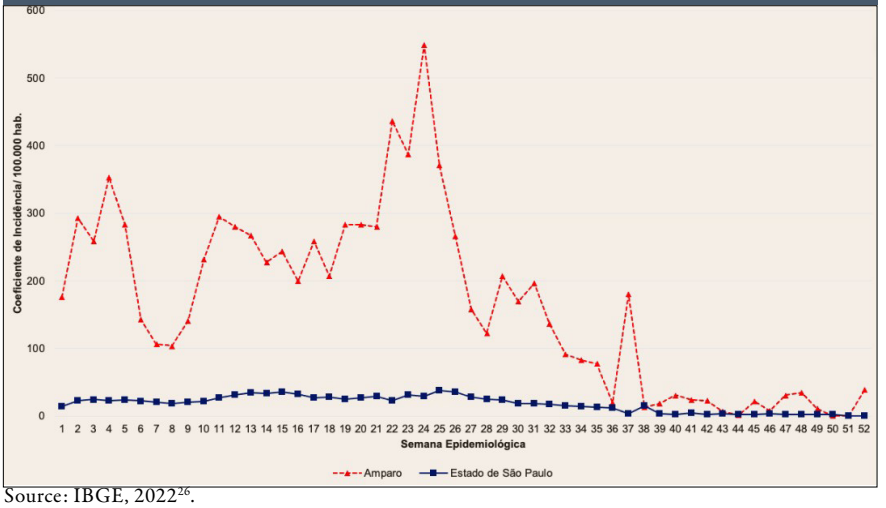
Thus, there is an urgent need for inclusive policies that consider socio-cultural and economic specificities, integrating health and social programs, with a focus on equity and system resilience[25]. Figures 1 and 2 show the incidence rates of COVID-19 cases in 2020 and 2021, respectively.

Figure 1 - Incidence coefficient of COVID-19 cases (per 100,000 inhabitants) in the municipality of Amparo versus the state of São Paulo, 2020



Source: IBGE, 2022[26].

Figure 2 - Incidence coefficient of COVID-19 cases (per 100,000 inhabitants) in the municipality of Amparo versus the state of São Paulo, 2021



Source: IBGE, 2022[26].

Figures 1 and 2 show the incidence rates in 2020 and 2021. In Amparo, the curve was steeper than the state curve, reaching peaks of over 130 cases per 100,000 inhabitants in 2020 and 550 in 2021[47]. These differences reflect factors such as mobility, population density, and local policies, reinforcing the need for surveillance strategies adapted to different contexts[25].

DOI: 10.36489/saudecoletiva.2025v16i100p17104-17123

Table 1 - Distribution of personal protective equipment (PPE) for the Southeast Region of Brazil. DATASUS, 2020

EPI	Março	Abril	Maio	Junho	Julho	Agosto	Setembro	Outubro
Álcool (litros)	10.900	101.489	3.462					
Óculos + Protetor facial (unidades)	12.080	28.180	244.300	84.200	101.440			
Avental (unidades)	164.500	243.867	205.100					
Luva	3.470.200	1.901.200						
Máscara Cirúrgica	3.407.500	2.381.750	5.354.450	4.857.100	10.734.200	2.958.300	3.899.700	1.332.400
Máscara N95	41.400	468.850	178.550	449.900	1.741.100	394.300	349.300	276.000
Pro pé e touca	2.669.100	312.600	403.900	80.000				115.400
Teste Rápido		925.620	697.380		75.520			

Source: DATASUS, 2020[28].

Table 2 - Total number of mechanical ventilators (MV) made available to the municipality of Amparo and the state of São Paulo in 2020 and 2021 to respond to the COVID-19 pandemic.

Municipality	2019*		2020		2021	
	No. of VM	VM/ 100,000 inhabitants	No. of VM	VM/ 100,000 inhabitants	No. of VM	VM/ 100,000 inhabitants
Amparo	21	29,09	37	50,58	45	61,52
SP Capital	7.173	58,55	8.141	72,34	8.944	79,48
State of São Paulo	18.807	40,96	22.757	48,78	24.958	53,50

Source: Tabet DATASUS, 2020[29]; IBGE, 2024[24]

In 2020, PPE and supplies were distributed (Table 1), with an emphasis on masks and rapid tests. There was also an increase in ventilators: Amparo went from 21 devices in 2019 to 37 in 2020 and 45 in 2021, while the state of São Paulo exceeded 24,000 units (Table 2).

Table 3 - Distribution of beds among municipalities in the state of São Paulo (n= 645). DATASUS, 2019

ICU beds	Number of municipalities (%)	Population of municipalities (%)
No ICU beds	513 (79,5%)	8.399.072 (18,3%)
≤ 10 beds	54 (8,4%)	4.268.570 (9,3%)
11 to 40 beds	49 (7,6%)	8.110.307 (17,7%)
41 to 100 beds	14 (2,2%)	3.690.049 (8,0%)

DOI: 10.36489/saudecoletiva.2025v16i100p17104-17123

101 to 300 beds	13 (2,0%)	7.994.955 (17,4%)
≥ 301 beds*	2 (0,3%)	13.456.096 (29,3%)
Total	645 (100,0%)	45.919.049 (100,0%)

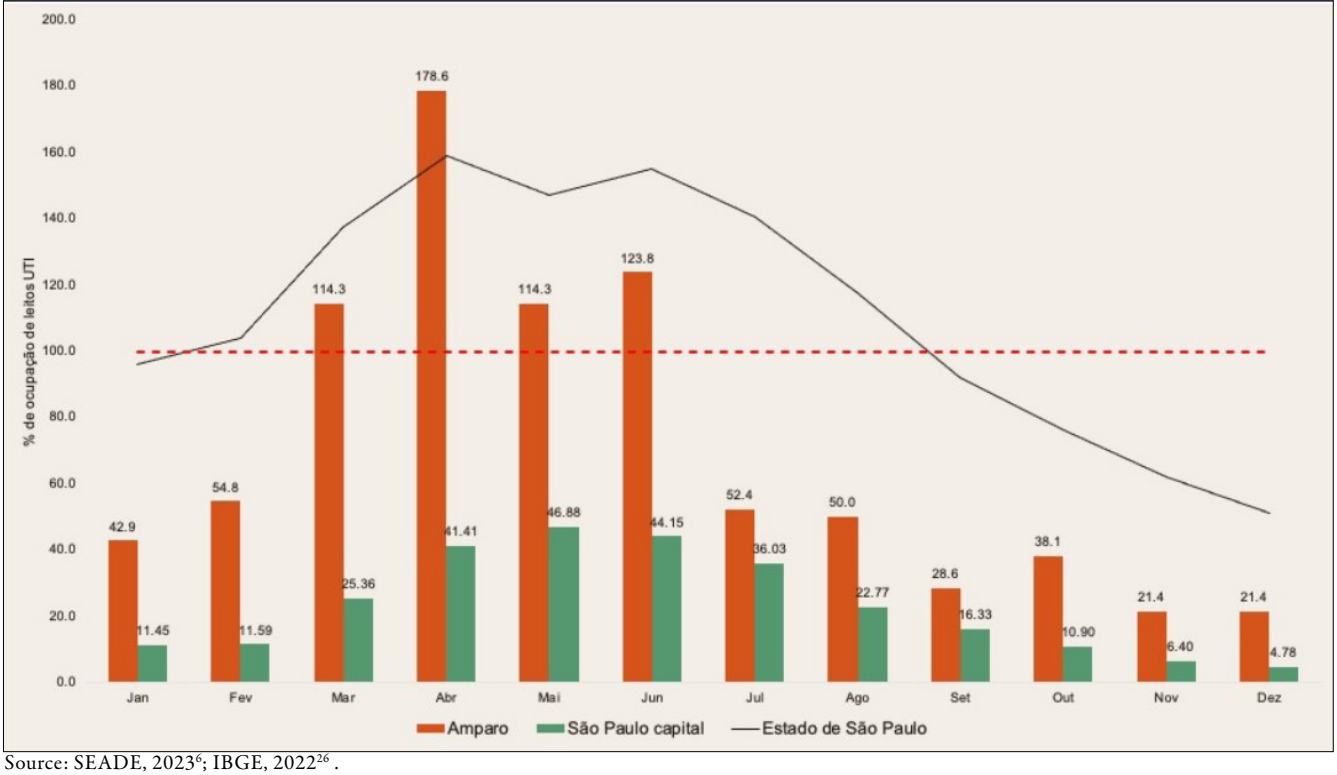
SOURCE: DATASUS, 2019[26].

Table 4 - Number of ICU beds in the municipality of Amparo, state of São Paulo, and capital

Location	Year					
	2019*		2020		2021	
	No. of ICU beds	ICU beds/100,000 inhabitants	No. of ICU beds	ICU beds/100,000 inhabitants	No. of ICU beds	ICU beds/100,000 inhabitants
Amparo	9	12,47	28	38,28	42	57,42
SP Capital	3.504	28,60	8.085	71,84	8.506	75,59
State of São Paulo	8.519	18,55	20.577	44,11	22.054	47,28

Source: CNES DATASUS, 2022[28] ; IBGE, 2024[24].

Figure 3 - Occupancy of ICU beds in the municipality of Amparo, São Paulo capital, and the state of São Paulo during the COVID-19 pandemic (2021)

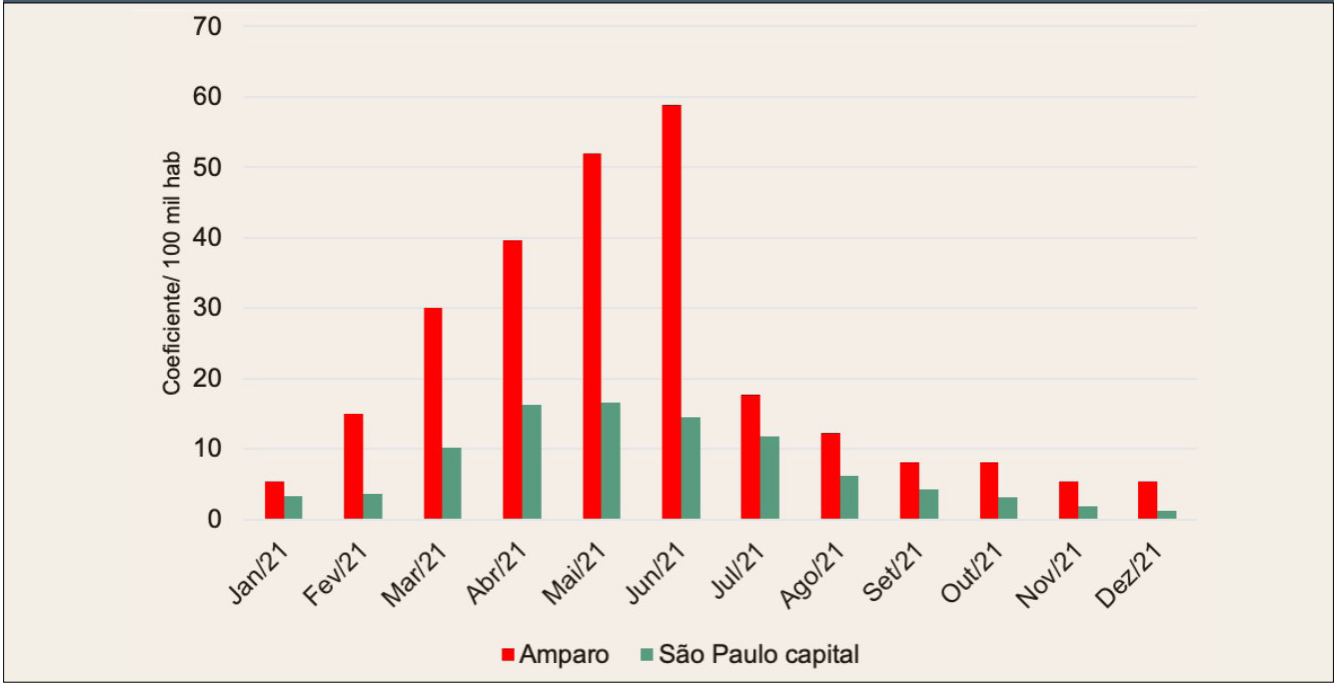


Source: SEADE, 2023[6]; IBGE, 2022[26] .

The unequal distribution of ICU beds was already evident in 2019, with 79.5% of municipalities in São Paulo lacking availability (Table 3). In Amparo, the number grew from 9 beds in 2019 to 42 in 2021, although occupancy exceeded 100% at the peak of the pandemic (Figure 3). In the state, the average was 112% in 2021, with maximums of up to 159%.

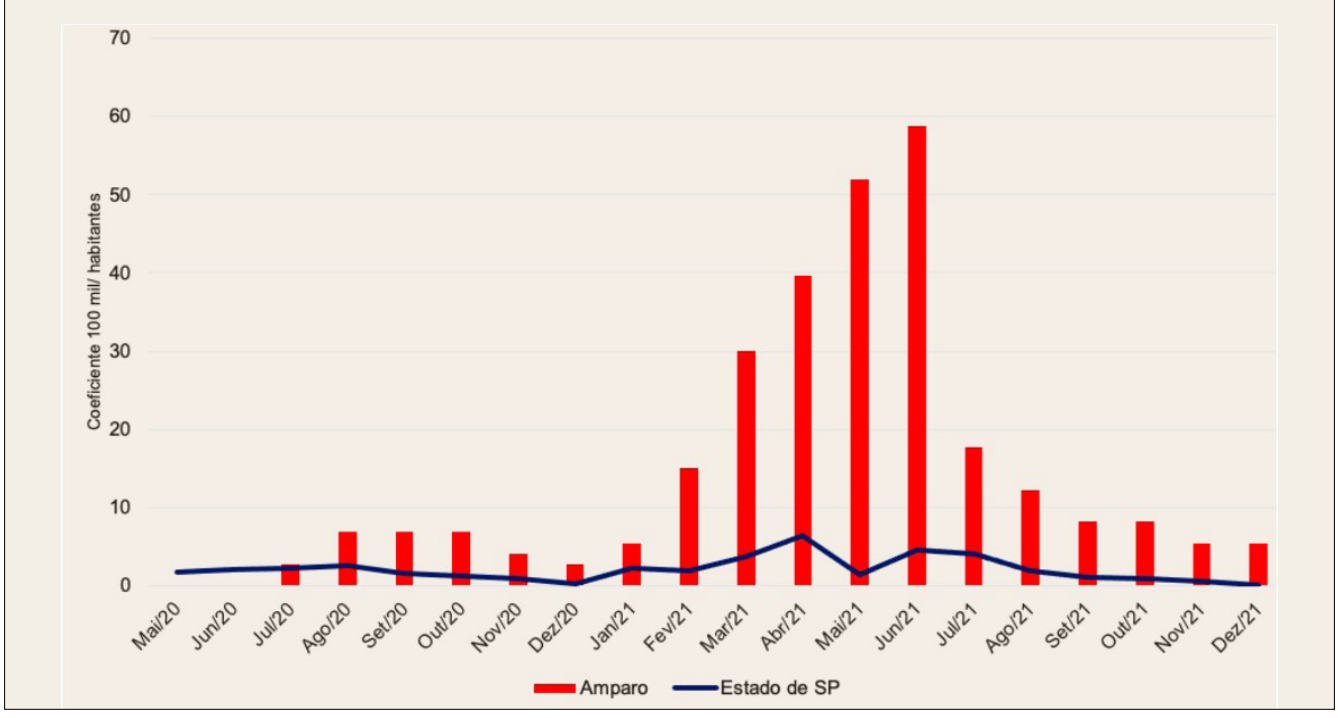
DOI: 10.36489/saudecoletiva.2025v16i100p17104-17123

Figure 4 - Intensive care mortality rate for COVID-19 per 100,000 inhabitants between the municipality of Amparo and the city of São Paulo



Source: IBGE, 2022[26]

Figure 5 - COVID-19 mortality rate per 100,000 inhabitants between the municipality of Amparo and the total for the state of São Paulo (May 2020 to December 2021)

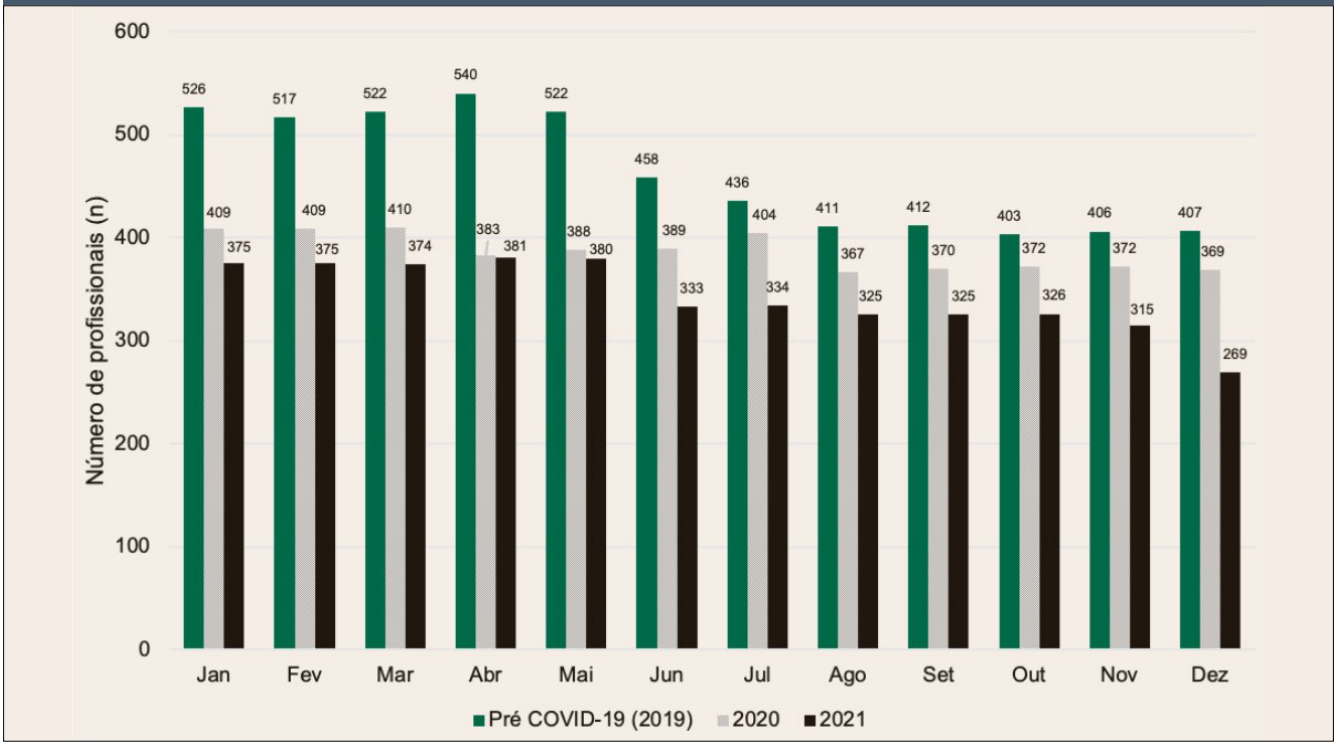


Source: IBGE, 2022[26]

DOI: 10.36489/saudecoletiva.2025v16i100p17104-17123

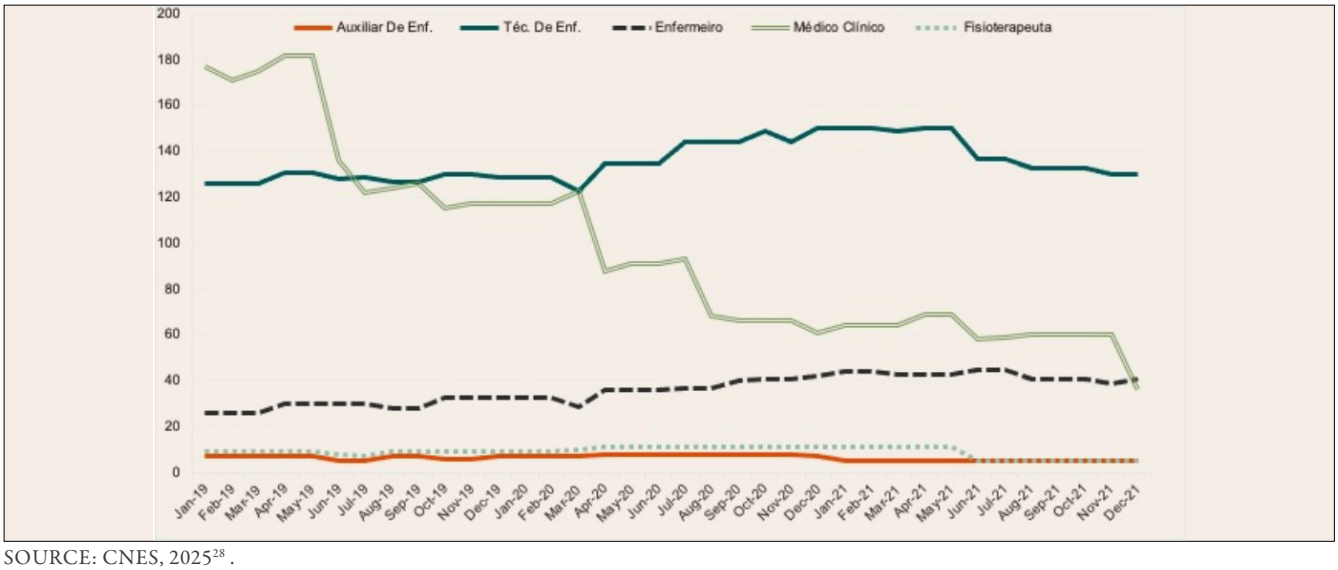
Figures 4 and 5 show that Amparo recorded higher mortality rates than the capital and the state, especially between March and June 2021, the period of greatest hospital overload.

Figure 6 - Comparison of the number of healthcare professionals of all specialties in the pre-pandemic (2019) and pandemic (2020-21) periods, Amparo/SP Circuito das Águas



SOURCE: CNES, 2022[30].

Figure 7 - Number of active healthcare professionals by category in the pre-pandemic (2019) and pandemic (2020-21) periods, Amparo/SP Circuito das Águas



SOURCE: CNES, 2025[28].

DOI: 10.36489/saudecoletiva.2025v16i100p17104-17123

There was a significant reduction in healthcare professionals: from 500 in 2019 to 269 in 2021, representing a drop in density from 72.8 to 37.3 professionals per 10,000 inhabitants. The most significant loss occurred among clinicians, who went from 177 to 36 in the period. Meanwhile, there was an increase in the number of nurses (20 to 40), but with stability or reduction in other categories (Figures 6 and 7).

DISCUSSION

The COVID-19 pandemic caused profound changes in the healthcare system, requiring the reorganization of services and an increase in the number of professionals after the declaration of a public health emergency in March 2020[31]. Between 2020 and 2021, the incidence of the disease in São Paulo showed great spatial variation, associated with factors such as individual susceptibility, presence of comorbidities, risk behaviors, and underreporting of cases due to limited testing[32]. In addition, population density influenced the spread and mortality, especially in large urban centers such as São Paulo and Rio de Janeiro, and capitals in the North and Northeast[20].

Initially concentrated in the capital, the pandemic spread inland along highways, with peaks in December 2020 and a new intensification in 2021[32]. To meet hospital demand, field hospitals were set up, adding about 6,300 beds by April 2020[9]. The waiver of competitive bidding, authorized by Provisional Measure 951 and Law 13,979/2020, expedited the acquisition of supplies, but Brazil faced high prices and difficulties in distributing PPE[2,4]. In the case of ventilators, supply was insufficient, leading to the risk of collapse in several macro-regions[1].

In early 2021, more contagious variants intensified the crisis, resulting in record hospitalizations and deaths in São Paulo. The municipality of Amparo had a mortality rate of 58.79/100,000 inhabitants and ICU occupancy of 178/100,000 inhabitants, reflecting the national overload, which reached up to 4,000 deaths per day[7]. Starting in July 2021, there was a sustained decline in indicators, associated with the progress of vaccination, with emphasis on the clinical trials of CoronaVac and AstraZeneca, which demonstrated significant efficacy and an acceptable safety profile[33,34].Despite the expansion of hospital beds and an increase in the number of nurses, Amparo faced a reduction in the number of doctors and physical therapists, revealing inequalities in the distribution of professionals. While the national average was 24.54 nurses per 10,000 inhabitants, Amparo recorded only 5.5 in 2021[22,35]. This deficit was aggravated by poor working conditions and a lack of continuing education[35].

The historical underfunding of the SUS, intensified by Constitutional Amendment No. 95/2016, limited its response capacity. Recent studies suggest that the efficiency of the system depends both on better management and on increased resources, especially in relation to the allocation of professionals[36].

Among the limitations of this study are the use of secondary databases with a risk of underreporting, the absence of data on case severity and local variants, and different population estimates[58]. Globally, by 2024, approximately 7 million deaths from COVID-19 had been recorded, with 700,000 in Brazil and 269 in Amparo. The pandemic revealed structural weaknesses in the healthcare system, highlighting the importance of reliable information, precautionary principles, and sustained investments in human and material resources[7,37].

CONCLUSION

The COVID-19 pandemic has highlighted and intensified health inequalities in Brazil, revealing how social inequalities directly impact the mortality and morbidity of the population. To address these disparities, it is essential to formulate public policies aimed at vulnerable populations, built with community participation and based on health education. Strengthening Primary Health Care (PHC), combined with investments in infrastructure and professional training, is strategic for reducing pressure on hospitals and offering more integrated and multidisciplinary responses.

Constant monitoring of health indicators and transparency in policy evaluation are equally crucial, as is the valorization of research and innovation as tools to support decision-making. Furthermore, the empowerment of civil society is indispensable for legitimizing social control and influencing significant changes, transforming health equity into a concrete reality.

In Brazil, the spread of the virus was largely conditioned by socioeconomic vulnerabilities, such as precarious housing and informal work, rather than clinical risk factors (Rocha et al., 2021). In cities such as Rio de Janeiro, mortality was higher in disadvantaged areas and among black and brown populations, reflecting historical inequalities in access to and severity of health conditions (Silva & Ribeiro-Alves, 2021; Baqui et al., 2020; Peres et al., 2021). Unequal access to health services, such as ICUs and ventilators, also aggravated the situation (Pereira et al., 2020), highlighting governance failures and accentuating the mortality burden (Castro et al., 2021). Groups considered "disposable," such as workers in precarious conditions, women, and vulnerable elderly people, were disproportionately affected, with loss of income, loneliness, and care overload (Pérez & Mendes, 2023; Romero et al., 2021). This context reinforces the urgency of policies that address structural inequalities and ensure equitable distribution of resources (De Oliveira Lima et al., 2024; Santos et al., 2022).

In the municipality of Amparo, for example, the pandemic exposed weaknesses in the health system, marked by hospital overload, a reduction in professionals, and collapse during successive waves of transmission. Despite the emergency expansion of beds and supplies, mortality rates remained high. Stabilization was only achieved with the vaccination program that began in January 2021, although case numbers continued to fluctuate until December of the same year. Thus, COVID-19 not only accentuated existing inequalities, but also highlighted the need for coordinated, inclusive, and equitable responses to strengthen the resilience of the health system in the face of future health crises.

DOI: 10.36489/saudecoletiva.2025v16i100p17104-17123

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ACKNOWLEDGMENTS, FINANCIAL OR TECHNICAL SUPPORT, DECLARATION OF FINANCIAL CONFLICT OF INTEREST AND/OR AFFILIATIONS:

Authors are responsible for providing information and authorizations regarding the items mentioned above. Cite the number of the call for proposals to which the research is linked. Due to CAPES Ordinance 206, dated September 4, 2018, which provides for the mandatory citation of CAPES, we recommend that all authors report the receipt of research grants in all manuscripts submitted.