

Human Development Index and Primary Health Care restructuring in the COVID-19 pandemic

Índice de Desenvolvimento Humano e reestruturação da Atenção Primária à Saúde na pandemia de COVID-19

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ABSTRACT

Objective: to analyze the influence of the Human Development Index on the restructuring of primary healthcare services during the critical phase of the COVID-19 pandemic. **Methods:** a cross-sectional, analytical, and exploratory study was carried out with 1,474 primary care service managers from Brazilian municipalities. Data were collected using Google Forms and analyzed using prevalence ratios and a Poisson regression model with a random effect. **Results:** municipalities with a low development index had higher prevalence rates for adopting preventive measures, diagnosis, notification, implementation of protocols, active surveillance, and checking the availability of beds in a referral hospital. Guidance on preventive measures and active and ongoing surveillance was lower in municipalities with a medium development index than in cities with high and very high development indexes. On the other hand, active and ongoing surveillance was higher in municipalities with a high development index than in those with a very high development index. **Conclusion:** Poorer municipalities had greater organizational resilience to meet the high demand during the pandemic. **Contributions to practice:** collaborate in formulating public policies, protocols, and plans for dealing with public health emergencies, taking socio-economic indicators into account.

Descriptors: COVID-19; Primary Health Care; Public Health Surveillance; Health Management; Development Indicators.

RESUMO

Objetivo: analisar a influência do índice de desenvolvimento humano na reestruturação de serviços de atenção primária à saúde durante a fase crítica da pandemia da COVID-19. **Métodos:** estudo transversal, analítico e exploratório, realizado com 1.474 gerentes de serviços de municípios brasileiros da atenção primária. Os dados foram coletados no Google Forms e analisados por meio de razões de prevalência, utilizando modelo de regressão de Poisson, com efeito aleatório. **Resultados:** municípios com baixo índice de desenvolvimento apresentaram maiores prevalências na adoção de medidas de prevenção, diagnóstico, notificação, implementação de protocolos, vigilância ativa e verificação de disponibilidade de leitos em hospital de referência. A orientação de medidas de prevenção e realização de vigilância ativa e continuada foi menor em municípios de índice de desenvolvimento médio quando comparados aos de desenvolvimento alto e muito alto. Já a realização de vigilância ativa e continuada foi maior nos municípios com índice alto quando comparados ao muito alto. **Conclusão:** evidencia-se que municípios mais pobres apresentaram maior capacidade resiliente de organização para atender à elevada demanda durante a pandemia. **Contribuições para a prática:** colaborar na formulação de políticas públicas, protocolos e planos de enfrentamento de emergências em saúde pública, considerando os indicadores socioeconômicos.

Descritores: COVID-19; Atenção Primária à Saúde; Vigilância em Saúde Pública; Gestão em Saúde; Indicadores de Desenvolvimento.

Introduction

The COVID-19 pandemic has been the major global challenge of the 21st century, impacting health systems and economies. Its rapid spread has exposed the vulnerabilities of health systems and weaknesses in policies and service organizations⁽¹⁾. In Brazil, after the first case in February 2020, the disease spread rapidly, resulting in a significant increase in cases and deaths, overloading the health system and highlighting the complexity of the country's epidemiological scenario⁽²⁾.

The critical phase of the pandemic, between 2020 and 2021, was marked by high infection and mortality rates, a lack of effective treatment, and the start of vaccination. Primary Health Care (PHC) professionals rose to the occasion despite the health system being overloaded, demonstrating their adaptability and resilience during the health emergency. They acted as the gateway to the Health Care Network (HCN) and developed actions to prevent, diagnose, monitor, and treat mild cases⁽³⁾.

The pandemic has required redesigning health services and restructuring the care flow in the HCN to deal with COVID-19, including early identification and monitoring of suspected cases, procurement of supplies, testing, and vaccination⁽⁴⁾. These changes were necessary for all countries, but differently, considering cultural, regional, and political diversities, they were essential to contain viral proliferation and control the overload of high-complexity services⁽⁵⁾.

The restructuring of PHC during the critical phase of the pandemic was directly related to public health policies and territorial characteristics, responding differently to demands. The relationship between the dispersion of services and socio-economic aspects must be considered in each municipality's Human Development Index (HDI), which influenced the health system's ability to respond to the pandemic⁽⁶⁻⁷⁾.

COVID-19 has affected more populations in neighborhoods with a low HDI⁽⁸⁾. On the other hand, the higher the index, the higher the incidence rate of cases, deaths, and tests carried out⁽⁹⁾. Despite the different strategies adopted to deal with the pandemic's

vulnerabilities⁽¹⁰⁻¹²⁾, research has yet to be found on the relationship between HDI and PHC restructuring during the critical phase of the pandemic. In addition, they were carried out over a short time and of a local nature.

Thus, this study is characterized by its originality and cutting-edge nature and aims to minimize the gap in the literature regarding the analysis of the influence of HDI on the restructuring of PHC services during the health emergency imposed by COVID-19. In addition, it provides insights into how socioeconomic disparities can affect coping with a pandemic and the provision of PHC services in different Brazilian regions. Therefore, the objective was to analyze the influence of the Human Development Index on the restructuring of primary healthcare services during the critical phase of the COVID-19 pandemic.

Methods

This cross-sectional, analytical, and exploratory study was reported following the recommendations of Strengthening the Reporting of Observational Studies in Epidemiology (STROBE).

The target population was made up of PHC service managers from all over the country, and due to the large number of services and lack of official data on these people, the sample was established by convenience. Thus, 1,474 professionals from Brazilian municipalities who worked for at least three months during the critical phase of the COVID-19 pandemic (2020 and 2021) were included. Those in charge who were on leave /vacation and did not hold this position at the time did not take part in the study, and these were not considered exclusion criteria.

The researchers collected the data themselves from April to September 2022. The extended data collection period was justified by the difficulty of reaching participants from all Brazilian states.

A questionnaire based on the Ministry of Health's Protocol for the Clinical Management of Coronavirus in Primary Health Care⁽¹³⁾ was used and made available to participants via Google Forms. This instrument contained the following variables: measu-

res and guidelines to avoid contagion in health units; diagnosis and referral to urgent/emergency services or hospitals for severe cases; immediate notification; clinical monitoring; prevention measures and support for active surveillance. It should be noted that the HDI was considered the exposure variable and the variables relating to the reorganization of PHC services as outcome variables, the latter being of the composite type.

The researchers emailed the questionnaires to the municipal health departments so that they could inform the professionals eligible to take part in the survey. The National Council of Health and Municipal Health Secretaries also collaborated, emphasizing the importance of municipal participation and sending the instrument to the municipal health secretariats. The Council's supporters also helped to disseminate the information to the Regional Health Departments.

To analyze the HDI, the classification published in the Global Human Development Report was considered: low, index below 0.550; medium, between 0.550 and 0.699; high, between 0.700 and 0.799; and very high, above 0.800⁽¹⁴⁾.

The data was entered and analyzed using SAS 9.4 software. Absolute and relative frequencies were used to describe the qualitative variables. The Poisson regression model with random effects was used to estimate prevalence ratios (PR) and 95% confidence intervals (95%CI), considering the HDI range⁽¹⁵⁾. A significant level of 5% was adopted for all the analyses.

The Research Ethics Committee of the Universidade Federal de São Carlos approved the study under opinion no. 5.339.284/2022 and Certificate of Submission for Ethical Appraisal 52527521.8.0000.5504.

Results

A total of 1,474 PHC health service managers took part in the survey. Notably, the majority were female, accounting for 86.6% (1,276) of the participants. The average age was 38.9 years (standard deviation (SD)=8.49), and they were from municipalities all over the country, with 676 (45.9%) from the Sou-

theast, 311 (21.1%) from the Northeast, 258 (17.5%) from the South, 173 (11.7%) from the Midwest and 56 (3.8%) from the North. As for the HDI classification, 783 (53.1%) were high, 460 (31.2%) medium, 213 (14.3%) very high and 18 (1.2%) low.

The preventive measures adopted to care for patients with symptoms similar to COVID-19, such as the availability of a waiting room separate from other patients, were more significant in municipalities with a low HDI than in cities with medium and high HDIs, as were the conditions for caring for patients with suspicion or diagnosis.

Guidance on prevention measures and respiratory hygiene was more frequent in low HDI municipalities than in medium and high HDI municipalities, and hand hygiene was also more frequent in low HDI municipalities than in higher HDI municipalities. As for guidance on avoiding touching eyes, mouth, nose, sharing objects, and isolation, the prevalence was higher in municipalities with a low HDI than those with a higher HDI.

Notification of all confirmed and suspected COVID-19 cases, diagnosis by rapid and clinical-epidemiological testing, and implementation of a protocol in PHC for classifying suspected cases were also more prevalent in municipalities with low HDI than in those with medium, high, and very high HDIs (Table 1).

Among the results on case management in PHC, it should be emphasized that active and continuous surveillance of patients with a suspicion/diagnosis of COVID-19 and stabilization and referral of severe cases to referral centers were more prevalent in municipalities with a low HDI; however, this difference may not have a significant impact on clinical-epidemiological practice.

Recording patient information in medical records, checking the availability of beds in a referral hospital for hospitalization cases, checking the availability of disposable aprons and class 2 filtering facepiece masks (PFF2), N-95, and access to training on care procedures and the use of Personal Protective Equipment (PPE) were more prevalent in low HDI municipalities than in the others (Table 2).

Table 1 – Prevalence of variables related to COVID-19 prevention, diagnosis, and notification measures, according to the Human Development Index (n=1,474). São Carlos, SP, Brazil, 2023

Variable	Low vs. medium		Low vs. high		Low vs. very high	
	p-value*	PR (95% CI)†	p-value	PR (95% CI)	p-value	PR (95% CI)
Is the waiting room for patients with symptoms like COVID-19 separate from other patients?						
No	-	1	-	1	-	1
Yes	<0.010	1.15 (1.1; 1.21)	<0.010	1.15 (1.09; 1.21)	0.080	1.13 (0.99; 1.29)
Is it possible to treat patients with suspected or diagnosed COVID-19 in a separate ward from other patients?						
No	-	1	-	1	-	1
Yes	<0.010	1.42 (1.25; 1.61)	<0.010	1.33 (1.15; 1.55)	0.010	1.31 (1.06; 1.61)
During the care provided at the Health Unit, when the patient has a diagnosis or symptoms like those of COVID-19, they receive guidance on:‡						
Wearing a surgical mask	0.720	0.98 (0.87; 1.1)	0.850	0.99 (0.88; 1.11)	0.570	0.97 (0.86; 1.09)
Respiratory hygiene	<0.010	1.26 (1.11; 1.43)	0.030	1.15 (1.02; 1.31)	0.050	1.14 (1; 1.29)
Hand hygiene	<0.010	1.05 (1.03; 1.07)	<0.010	1.03 (1.02; 1.04)	<0.010	1.05 (1.02; 1.09)
Cough label	0.410	1.15 (0.82; 1.6)	0.780	1.05 (0.75; 1.46)	0.790	0.96 (0.68; 1.34)
Avoid touching eyes, mouth, and nose	<0.010	1.13 (1.09; 1.18)	<0.010	1.09 (1.07; 1.12)	<0.010	1.12 (1.07; 1.16)
Avoid sharing objects	<0.010	1.12 (1.08; 1.16)	<0.010	1.11 (1.08; 1.14)	<0.010	1.14 (1.09; 1.19)
Isolation	<0.010	1.06 (1.04; 1.09)	<0.010	1.04 (1.02; 1.06)	<0.010	1.05 (1.02; 1.08)
Does the health unit notify all confirmed and suspected cases of COVID-19?						
No	-	1	-	1	-	1
Yes	<0.010	1.04 (1.02; 1.07)	<0.010	1.05 (1.02; 1.07)	<0.010	1.07 (1.03; 1.11)
Does the health unit diagnose COVID-19?						
No	-	1	-	1	-	1
Yes	0.190	1.09 (0.96; 1.24)	0.090	1.13 (0.98; 1.29)	0.480	1.06 (0.9; 1.26)
If so, how is it done? ‡						
Clinical-epidemiological	0.970	1.01 (0.54; 1.9)	0.870	1.05 (0.56; 2)	0.710	1.13 (0.59; 2.16)
Laboratory RT-PCR	0.320	0.61 (0.23; 1.63)	0.200	0.52 (0.2; 1.4)	0.570	0.74 (0.26; 2.11)
Rapid and clinical-epidemiological testing	<0.010	1.3 (1.13; 1.5)	<0.010	1.21 (1.11; 1.32)	0.010	1.2 (1.04; 1.38)
Is there a protocol in PHC for classifying suspected cases as flu-like syndrome and severe acute respiratory syndrome?						
No	-	1	-	1	-	1
Yes	<0.01	1.2 (1.14; 1.27)	<0.01	1.12 (1.07; 1.17)	<0.01	1.1 (1.03; 1.19)

*Significant for p<0.05; †PR: Prevalence Ratio, CI: 95% Confidence Interval; ‡More than one answer is possible per respondent; PHC: Primary Health Care; RT-PCR: Real Time - Polymerase Chain Reaction

Table 2 – Prevalence of variables related to follow-up of COVID-19 patients and availability of personal protective equipment, according to the low, medium, high, and very high Human Development Index (n=1,474). São Carlos, SP, Brazil, 2023

Variable	Low vs. medium		Low vs. high		Low vs. very high	
	p-value*	PR (95% CI) [†]	p-value	PR (95% CI)	p-value	PR (95% CI)
Does the health unit carry out active and ongoing surveillance of patients receiving follow-up care?						
No	-	1	-	1	-	1
Yes	<0.010	1.16 (1.11; 1.21)	<0.010	1.25 (1.17; 1.32)	<0.010	1.95 (1.51; 2.53)
Has the health unit carried out telecare to monitor mild cases of COVID-19?						
No	-	1	-	1	-	1
Yes	0.280	1.14 (0.9; 1.43)	0.700	1.05 (0.83; 1.32)	0.340	1.15 (0.86; 1.53)
Are severe cases stabilized and referred to the referral center (emergency services or hospitals, depending on the organization of the RAS)?						
No	-	1	-	1	-	1
Yes	<0.010	1.01 (1; 1.02)	<0.010	1.02 (1.01; 1.03)	0.320	1 (1; 1.01)
Do health professionals record the patient's information in the medical record to enable longitudinal coordination of care and possible epidemiological investigation?						
No	-	1	-	1	-	1
Yes	<0.010	1.03 (1.01; 1.05)	<0.010	1.03 (1.02; 1.05)	0.050	1.01 (1; 1.02)
Does the health unit check that the referral hospital for COVID-19 hospitalization has enough beds available to receive the patient before referring them?						
No	-	1	-	1	-	1
Yes	<0.010	1.25 (1.08; 1.46)	<0.010	1.62 (1.38; 1.89)	0.020	1.69 (1.09; 2.63)
Does the health unit provide PPE for its staff?						
No	-	1	-	1	-	1
Yes	-	1 (1; 1)	0.14	1 (1; 1.01)	-	1 (1; 1)
If yes in the previous answer, which ones? ‡						
Procedure gloves	0.070	1.01 (1; 1.01)	<0.010	1.01 (1; 1.02)	-	1 (1; 1)
Apron Goggles	<0.010	1.07 (1.04; 1.1)	<0.010	1.03 (1.02; 1.05)	0.030	1.01 (1; 1.03)
Surgical mask	0.150	1.15 (0.95; 1.38)	0.890	0.99 (0.83; 1.18)	0.470	0.94 (0.79; 1.12)
PPF2 mask (N-95)	0.790	0.99 (0.88; 1.1)	0.700	0.98 (0.88; 1.09)	0.550	0.97 (0.87; 1.08)
Disposable cap	<0.010	1.14 (1.09; 1.2)	<0.010	1.08 (1.04; 1.12)	0.220	1.1 (0.95; 1.27)
Face shield	0.590	1.03 (0.93; 1.13)	0.910	0.99 (0.9; 1.1)	0.990	1 (0.9; 1.11)
Procedure gloves	0.080	1.12 (0.99; 1.27)	0.670	1.03 (0.91; 1.16)	0.820	0.99 (0.87; 1.11)
Has the health unit's work team had access to training on care behaviors and using PPE concerning COVID-19?						
No	-	1	-	1	-	1
Yes	0.030	1.16 (1.01; 1.32)	0.320	1.06 (0.94; 1.2)	0.350	1.06 (0.94; 1.21)

*Significant for p<0.05; †RP: Prevalence Ratio, CI: 95% Confidence Interval; ‡More than one answer is possible per respondent; PPF2: Class 2 filtering facepiece; RAS; Health Care Network; PPE: Personal Protective Equipment

Guidance for patients with a diagnosis or symptoms like COVID-19, such as respiratory hygiene and

cough etiquette, was lower in medium HDI municipalities than in high and very high HDI municipalities (Table 3).

Table 3 – Prevalence of variables related to COVID-19 prevention, diagnosis, and notification measures, according to the medium, high, and very high Human Development Index (n=1,474). São Carlos, SP, Brazil, 2023

Variable	Medium vs. high		Medium vs. very high		High vs. very high	
	p-value*	PR (95% CI)†	p-value	PR (95% CI)	p-value	PR (95% CI)
Is the waiting room for patients with symptoms like COVID-19 separate from other patients?						
No	-	1	-	1	-	1
Yes	0.910	1 (0.93; 1.07)	0.750	0.98 (0.85; 1.13)	0.800	0.98 (0.85; 1.13)
Is it possible to treat patients with suspected or diagnosed COVID-19 in a separate ward from other patients?						
No	-	1	-	1	-	1
Yes	0.380	0.94 (0.82; 1.08)	0.430	0.92 (0.75; 1.13)	0.860	0.98 (0.79; 1.22)
During the care provided at the Health Unit, when the patient presents with a diagnosis or similar symptoms of COVID-19, they receive guidance on: ‡						
Need to wear a surgical mask	0.370	1.01 (0.99; 1.03)	0.300	0.99 (0.97; 1.01)	0.050	0.98 (0.96; 1)
Respiratory hygiene	0.030	0.92 (0.85; 0.99)	0.010	0.9 (0.83; 0.98)	0.680	0.99 (0.92; 1.06)
Hand hygiene	0.100	0.98 (0.96; 1)	0.850	1 (0.96; 1.05)	0.190	1.02 (0.99; 1.06)
Cough etiquette	0.100	0.91 (0.82; 1.02)	<0.010	0.83 (0.74; 0.94)	0.100	0.91 (0.81; 1.02)
Avoid touching your eyes, mouth, and nose with not sanitized hands	0.170	0.97 (0.92; 1.01)	0.630	0.99 (0.93; 1.04)	0.380	1.02 (0.98; 1.07)
Avoid sharing objects with other people	0.770	0.99 (0.95; 1.04)	0.500	1.02 (0.96; 1.08)	0.320	1.03 (0.97; 1.08)
About isolation	0.210	0.98 (0.95; 1.01)	0.500	0.99 (0.95; 1.02)	0.640	1.01 (0.98; 1.04)
Does the health unit notify all confirmed and suspected cases of COVID-19?						
No	-	1	-	1	-	1
Yes	0.780	1 (0.97; 1.04)	0.280	1.03 (0.98; 1.08)	0.390	1.02 (0.97; 1.07)
Does the health unit diagnose COVID-19?						
No	-	1	-	1	-	1
Yes	0.490	1.03 (0.94; 1.13)	0.750	0.98 (0.85; 1.12)	0.460	0.95 (0.82; 1.1)
If so. How is it done? ‡						
Clinical and epidemiological diagnosis	0.780	1.04 (0.79; 1.37)	0.460	1.12 (0.83; 1.49)	0.660	1.07 (0.79; 1.46)
RT-PCR laboratory diagnosis	0.270	0.86 (0.66; 1.13)	0.380	1.22 (0.78; 1.9)	0.120	1.42 (0.91; 2.2)
Rapid test and clinical-epidemiological diagnosis	0.370	0.93 (0.78; 1.09)	0.400	0.92 (0.75; 1.12)	0.910	0.99 (0.84; 1.17)
Is there a protocol in PHC for classifying suspected cases as flu-like syndrome and severe acute respiratory syndrome?						
No	-	1	-	1	-	1
Yes	0.060	0.93 (0.87; 1)	0.070	0.92 (0.84; 1.01)	0.710	0.98 (0.9; 1.07)

*Significant for $p < 0.05$; †RP: Prevalence Ratio. CI: 95% Confidence Interval; ‡More than one answer is possible per respondent; PHC: Primary Health Care; RT-PCR: Real-Time - Polymerase Chain Reaction

Active and ongoing surveillance was higher in municipalities with a medium HDI than those with a high or very high HDI. Recording patient information in medical records was lower in municipalities with a high HDI than in those with a very high HDI. Checking the availability of beds in a referral hospital was higher in municipalities with a medium HDI than in those with a high HDI.

About the supply of PPE, disposable aprons, goggles, and face shields were less available in municipalities with a medium HDI than in those with high and very high HDI; access by health professionals to training on care procedures and the use of PPE was also lower in municipalities with a medium HDI than in those with a high HDI (Table 4).

Table 4 – Prevalence of variables related to the follow-up of COVID-19 patients and availability of personal protective equipment according to the medium, high, and very high Human Development Index (n=1,474). São Carlos, SP, Brazil, 2023

Variable	Medium vs. high		Medium vs. very high		High vs. very high	
	p-value*	PR (95% CI)†	p-value	PR (95% CI)	p-value	PR (95% CI)
Does the health unit carry out active and ongoing surveillance of patients receiving follow-up care?						
No	-	1	-	1	-	1
Yes	0.060	1.08 (1; 1.16)	<0.010	1.69 (1.3; 2.19)	<0.010	1.57 (1.2; 2.04)
Has the health unit carried out telecare to monitor mild cases of COVID-19?						
No	-	1	-	1	-	1
Yes	0.210	0.92 (0.81; 1.05)	0.910	1.01 (0.82; 1.25)	0.370	1.1 (0.89; 1.36)
Are severe cases stabilized and referred to the referral center (emergency services or hospitals, depending on the organization of the RAS)?						
No	-	1	-	1	-	1
Yes	0.530	1 (0.99; 1.02)	0.220	0.99 (0.98; 1.01)	0.080	0.99 (0.97; 1)
Do health professionals record the patient's information in the medical record to enable longitudinality, coordination of care, and possible epidemiological investigation?						
No	-	1	-	1	-	1
Yes	0.860	1 (0.98; 1.02)	0.030	0.98 (0.96; 1)	<0.010	0.98 (0.96; 0.99)
Does the health unit check that the referral hospital for COVID-19 hospitalization has enough beds available to receive the patient before referring them?						
No	-	1	-	1	-	1
Yes	<0.010	1.29 (1.15; 1.45)	0.170	1.35 (0.88; 2.07)	0.840	1.04 (0.68; 1.61)
Does the health unit provide PPE for its staff?						
No	-	1	-	1	-	1
Yes	0.140	1 (1; 1.01)	-	1 (1; 1)	0.140	1 (0.99; 1)
If yes. in the previous answer. which ones? ‡						
Procedure gloves	0.330	1.01 (1; 1.02)	0.070	0.99 (0.99; 1)	<0.010	0.99 (0.98; 1)
Apron Goggles	0.020	0.96 (0.93; 0.99)	<0.010	0.95 (0.92; 0.98)	0.120	0.98 (0.97; 1)
Surgical mask	<0.010	0.86 (0.8; 0.93)	<0.010	0.82 (0.76; 0.88)	0.030	0.95 (0.9; 1)
PPF2 mask (N-95)	0.590	0.99 (0.97; 1.02)	0.160	0.98 (0.96; 1.01)	0.280	0.99 (0.97; 1.01)
Disposable cap	0.070	0.95 (0.89; 1.01)	0.630	0.96 (0.82; 1.12)	0.820	1.02 (0.87; 1.18)
Face shield	0.060	0.97 (0.94; 1)	0.360	0.97 (0.92; 1.03)	0.800	1.01 (0.96; 1.06)
Procedure gloves	<0.010	0.92 (0.87; 0.97)	<0.010	0.88 (0.83; 0.93)	0.080	0.96 (0.92; 1)
Has the health unit's work team had access to training on care procedures and using PPE regarding COVID-19?						
No	-	-	-	-	-	-
Yes	0.020	0.92 (0.86; 0.99)	0.050	0.92 (0.85; 1)	0.990	1 (0.93; 1.07)

*Significant for p<0.05; †RP: Prevalence Ratio. CI: 95% Confidence Interval; ‡More than one answer is possible per respondent; RAS; Health Care Network PPE: Personal Protective Equipment; PPF2: Class 2 filtering facepiece

Discussion

The analysis suggests that municipalities with lower HDI have invested in reorganizing PHC to tackle COVID-19, with data indicating a higher prevalence of measures for prevention, diagnosis, notification, implementation of protocols, active surveillance, training in the use of PPE, and checking hospital beds, compared to municipalities with medium, high and very high HDI. These data corroborate that poorer municipalities tend to have better organized PHC and better indicators as a strategy to overcome regional inequalities⁽¹⁶⁾. Services in rural neighborhoods and cities with lower HDI had higher coverage of the Family Health Strategy and better PHC performance indicators during the critical phase of the pandemic⁽¹²⁾.

On the other hand, municipalities with average indicators had lower results when it came to adopting prevention measures compared to municipalities with better HDI. This scenario may be related to the concentration of investments in health and management of the pandemic in wealthier municipalities, which directed resources to emergency services and hospitals. Municipalities with specialized centers and large hospitals received more federal investments⁽¹⁷⁾.

In Norway, PHC services adapted rooms and offices to care for patients with respiratory symptoms and made PPE available. In Brazil, guidelines were included through information materials and the creation of specific flows to care for patients with respiratory symptoms⁽¹⁸⁻¹⁹⁾.

Despite the difficulty in finding studies that relate the adoption of measures to local development indices, it is essential to note that, both in Brazil and abroad, such actions have contributed to minimizing the transmission of COVID-19. However, Brazilian states with greater levels of socioeconomic vulnerability, especially in the North and Northeast, have increased the number of hospital beds and enacted more restrictive legislation to reduce the transmission curve during the initial phase of the pandemic⁽¹⁾.

During the critical phase, primary care in municipalities with low HDI showed better performance in

the availability of diagnostic tests. This contradicts the literature, which indicates that vulnerable areas with a higher concentration of slums faced gaps in testing compared to high-standard regions⁽²⁰⁾. In addition, rural and remote units faced challenges accessing diagnostic tests⁽²¹⁾. This discrepancy may be related to the proactive action of managers in municipalities with lower socioeconomic status, who coordinated resources efficiently, even in contexts of poor infrastructure.

Coordination between municipalities, redistribution of federal resources, and integration with public health policies helped mitigate the impacts of the pandemic. It ensured a better supply of diagnostic tests, highlighting the importance of local management in health crises⁽²²⁾.

Surveillance and monitoring of suspected and confirmed cases were more prevalent in municipalities with lower HDI. Primary care professionals, such as community health agents and multi-professional teams, carried out home visits and contributed to actively searching for and monitoring patients. The integration between PHC and health surveillance was essential in flattening the transmission curve at critical moments before vaccines were available, and the structuring of surveillance in PHC made it possible to implement control measures⁽²³⁾.

This highlights the importance of technical staff at all levels of health management, an integrated health education system, logistics for emergencies, technology available throughout the country, and a reliable information system, from notification to data publication. Community involvement in health education actions was crucial, with partnerships from the academic community overcoming barriers to accessing health care and reliable information, contributing to a more effective response to the pandemic⁽²⁴⁾.

Several challenges were identified during the critical phase of the pandemic at all levels of care, including regional inequality in bed availability and the ability of local health systems to respond to increased demand. The distribution of hospital beds, called "back-up beds," during the critical phase of the pandemic was carried out mainly through public policies

and coordinated actions between the different levels of government⁽¹⁷⁾.

This unequal distribution has revealed significant disparities, especially between the North and Southeast regions, which have a more substantial number of cities with a low HDI than other regions of the entire country⁽²⁵⁾. This reveals that the creation of new hospital beds, incredibly intensive care beds, has faced limitations due to uneven infrastructure and a lack of integrated planning at a national level, raising questions about the sufficiency and efficiency of bed distributions, highlighting the need for more comprehensive policies and more coordinated public health strategies to face future health crises more equitably and effectively.

The response capacity of municipalities with different HDI levels during the critical phase of the pandemic revealed important dynamics, especially in stabilizing patients and referrals to other levels of care. It is inferred that municipalities with a lower HDI need to optimize resources and have a greater dependence on local health units for emergency care. This highlights the relevance of regionalization and planning of the RAS, especially in health crisis scenarios⁽²⁶⁾.

Disparities between Brazilian regions in the capacity of local health systems are a pre-pandemic problem, indicating the importance of training and implementing effective clinical protocols to improve health outcomes in areas of greater socioeconomic vulnerability⁽²⁷⁾. It should be noted that training for health professionals has ensured the quality and safety of the care provided and is related to the organization of management in terms of continuing education policies and financial resources.

Primary care faced significant challenges during the initial years of the pandemic, including the discontinuity of routine care, the lack of adequate resources, and the overload of health professionals. There is a need to strengthen this level of care as the central axis for organizing post-pandemic health systems to deal with possible new public health emergencies and guarantee comprehensive and continuous care

for users. It is worth highlighting the inclusion of policies to value health professionals at this level of care, emphasizing their capacity to act, their ability to provide user-centered care, and the importance of continuing education and institutional support to ensure quality care.

Study limitations

This study has limitations typical of a cross-sectional design, such as lack of causality and prevalence bias. As most of the sample comprised municipalities with a high HDI and from the Southeast region, this may constitute a prevalence bias. Convenience sampling was another limitation, as it made it impossible to generalize the results.

In addition, data collection using a self-administered form can introduce response bias due to inadequate interpretation of the question and overestimation or underestimation of the data reported by the participants. Adherence by primary care service managers from the North and Central-West regions and the Brazilian capitals was low. However, the sample contains participants from all states. It presents consistent and robust results on the reorganization of Brazilian PHC during the critical phase of the pandemic, considering the influence of HDI.

Contributions to practice

The results of this study can contribute to formulating public policies, protocols, and plans for dealing with public health emergencies by PHC services, considering the heterogeneity and socio-economic conditions of Brazilian regions.

In addition, this study, considered cutting-edge, serves as an external evaluation of the reorganization of PHC services throughout the country during the critical phase of the pandemic.

Conclusion

The conclusion is that the Human Development

Index influenced the restructuring of primary health care services in Brazilian municipalities, with poorer municipalities facing disproportionate challenges; however, they also showed a resilient capacity to meet the high demand during the most critical period of the pandemic.

Authors' contribution

Conception and design: Corrêa APV, Uehara SCSA. Data analysis and interpretation: Corrêa APV, Cano RN, Silva BC, Uehara SCSA. Writing of the manuscript or relevant critical review of the intellectual content: Silva BC, Uehara SCSA. Approval of the final version to be published, responsibility for all aspects of the text, and assurance of the accuracy and integrity of any part of the manuscript: Corrêa APV, Cano RN, Silva BC, Uehara SCSA.

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