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Urgent dental care in the Brazilian public health system: learning lessons from the COVID-19 pandemic for future situations

Atendimento odontológico de urgência no sistema público brasileiro de saúde: lições da pandemia da COVID-19 para situações futuras

La atención odontológica de urgencia en el sistema de salud pública brasileño: las enseñanzas de la pandemia de COVID-19 para situaciones futuras

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Abstract

This ecological study described the effect of the COVID-19 pandemic and socioeconomic development on the use and profile of urgent dental care (UDC). UDC rates per 100,000 inhabitants before (from March to June 2019) and during (from March to June 2020) the COVID-19 pandemic in 4,062 Brazilian municipalities were compared. Data were collected from official sources. COVID-19 mortality and hospitalization rates were indicative of levels of lockdown and Human Development Index (HDI) indicated socioeconomic development. Multiple logistic regression and relative excess risk due to interaction (RERI) were used for statistical analyses. The Student t-test was used to compare changes in the profile of UDC causes and procedures in the two periods. Lower UDC rates were found in 69.1% of municipalities and were associated with higher HDI (OR = 1.20; 95%CI: 1.01; 1.42). Mortality had OR = 0.88 (95%CI: 0.73; 1.06) for municipalities with HDI < 0.70 and OR = 1.45 (95%CI: 1.07; 1.97) for municipalities with HDI > 0.70. RERI between HDI and COVID-19 was 0.13 ($p < 0.05$). Municipalities with greater primary health care coverage had a smaller reduction in emergency rates. Endodontic treatment and dental pain were the most frequent factors both before and during the pandemic. The percentage of UDCs due to pain and soft tissue damage, as well as temporary sealing and surgical procedures, increased. Socioeconomic variables affected UDC rates during the most restrictive period of the COVID-19 pandemic and should be considered in the planning of health actions in future emergencies.

COVID-19; Health Systems; Emergency Medical Services; Socioeconomic Factors

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Introduction

The SARS-COV-2 virus (the virus that causes COVID-19), which was first identified in China in December 2019, created global challenges for health organizations and other sectors [1,2]. Testing strategies have been created [3], besides recommendations for preventive measures [4]. The state of emergency and the closure of non-essential retail businesses and non-emergency healthcare services, especially at the beginning of the pandemic, were interspersed with periods of easing restrictions for economic activities [5]. The COVID-19 pandemic has affected the economy, changed habits, and led to psychological problems [6]. Due to the uncertainty about the risk of infection for professionals and patients, the types of personal protective equipment recommended for dental appointments needed to change [6,7,8] and new protective devices were developed to reduce aerosol dispersion [9]. Endodontists received additional recommendations to adapt diagnoses, armamentarium, and treatment strategies [10].

A public calamity is expected to affect the use of dental care services. Studies that assessed the consequences of the 2011 earthquake in Japan showed that dental changes resulted in psychological distress, changes in eating habits, poor aesthetics, and communication problems [11,12]. Moreover, the prevalence of toothache was higher and associated with stress after the disaster [11,12]. Currently, dental care services were resumed in areas severely affected by the pandemic, with repercussions for endodontists [13]. Interestingly, a survey of Brazilian dentists [14] showed that – at the beginning of the pandemic – reduction or suspension of appointments was more frequent in public than in private dental clinics. A study performed in the general and emergency departments of the Wuhan University School and Hospital of Stomatology (China) [15] found that endodontic emergencies, such as symptomatic irreversible pulpitis, were more common in high-risk areas during the pandemic than at regular times. Another investigation [16] showed that the COVID-19 pandemic was associated with more dental and oral infections and less dental trauma. At the same time, non-urgent cases decreased in relation to the levels before the pandemic.

Understanding the effect of periods of exception, such as the most restrictive period of the COVID-19 pandemic, on dental care services may help anticipate needs and plan strategies to avoid the collapse of health services and ensure that people receive appropriate healthcare. In Brazil, the public health system provides healthcare without direct cost to users and urgent dental care (UDC) services are included in primary care [17]. The use of health services, including UDC, has several determinants and access and availability are essential [18]. In Brazil, the primary dental care coverage is significantly higher in the most developed municipalities [19]. As pandemic restrictions tend to limit access to primary care, the number of urgent dental procedures is expected to decrease. However, these restrictions may also increase the demand for public services, as the pandemics also increases unemployment rates and private dental care services reduced [14]. Two or more factors, such as pandemic restrictions and socioeconomic development, may interact synergistically or not when they affect an outcome – in this case, the use of UDC services – by the same mechanism, such as access to primary care [20]. Therefore, the reduction in the use of UDC services due to pandemic restrictions may be less pronounced in places with higher Human Development Index (HDI), since these places tend to have better public policies [21].

A recent bibliometric analysis [22] showed that most studies on COVID-19 had a low level of scientific evidence and not enough reliable high-quality evidence, which are both necessary elements for decision-making in clinical practice. It also may be true for public health services and policies during emergencies. To our knowledge, no study have assessed whether the pandemic affected more severely some places than others. Thus, this study assessed the use of UDC in the Brazilian public health system before and during the most restrictive period of the COVID-19 pandemic. We evaluated the interaction and effect of the pandemic and socioeconomic indicators (HDI) on UDC rates. Our secondary objective was to compare UDC causes and procedures before and during the pandemic.

Methodology

Study design

This longitudinal ecological study used all Brazilian municipalities as units of analysis. Two periods were compared: (a) before (from March to June 2019) and (b) during (from March to June 2020) the most restrictive period of the COVID-19 pandemic. Only municipalities that provided UDC at baseline were included (n = 4,062 out of 5,570). The profile of UDC causes and procedures before and during the pandemic were compared. UDC rates in the Brazilian health system were compared and analyzed to assess if geodemographic, economic, and pandemic indexes affected outcomes. This study did not require ethical approval, as it used only aggregate data.

Data source

Data were collected from the following Brazilian open-access secondary databases: Health Information System for Primary Care (SISAB), Outpatient Information System (SIA-SUS), Hospital Information System (SIH), Mortality Information System (SIM), Brazilian Institute of Geography and Statistics (IBGE), and General Register of Employment and Unemployment (CAGED). These databases are official sources of information and are made available by federal agencies on their websites. Data were collected in July 2020 and for municipalities.

Outcome variable

The reduction in UDC rates per 100,000 inhabitants in Brazilian municipalities before and during the COVID-19 pandemic was the main outcome variable. This outcome was dichotomized for each municipality as either "reduction" (code = 1) or "increase/stability" (code = 0), considering the differences between the periods analyzed. Data on the type of appointment, diagnosis and symptoms, and procedures were compiled to define dental urgencies according to the criteria of the American Dental Association (ADA) [23].

Main predictors and covariates

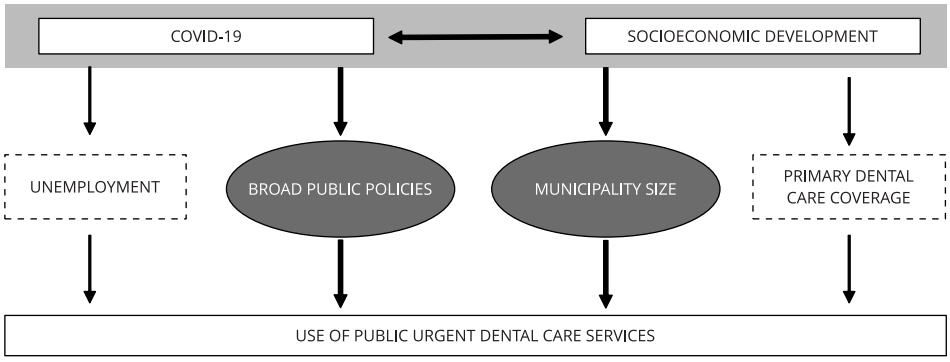
All Brazilian states implemented restrictions for municipalities based on several factors, including COVID-19 mortality and hospitalization. Restrictions were appropriate instrumental variables, as their only motivation was the pandemic. For example, many states used flags with colors ranging from yellow to black and the higher the intensity of the pandemic, the more severe the restrictions. This study used two instrumental variables for COVID-19 restrictions: (1) mortality and (2) hospitalization per 100,000 inhabitants. These variables were described as "none" or "at least one", as many municipalities had few or no cases in the first months of the pandemic. COVID-19 data, which are available in official health information systems, were collected from March to June 2020.

Socioeconomic development was measured using the HDI and estimated for each municipality based on the 2010 Brazilian census. HDI was classified as high or non-high, using 0.70 as a cut-off point. Gross domestic product (GDP) per capita in 2017 was also collected from official government sources and the results were similar to those for HDI. The correlation between HDI and GDP was moderate (r = 0.49); therefore, GDP data were not included because per capita income is already part of HDI.

According to our theoretical framework (Figure 1), important confounding variables were incorporated into the analytical model. Broad public policies [24] and municipality size were potential confounding factors. The former was classified into two categories according to national median values and the latter into five categories according to the number of inhabitants (< 10,000; 10,000-20,000; 20,000-50,000; 50,000-100,000; or > 100,000). The main mediators of the effect of COVID-19 (assessed by mortality and hospitalization rates) and socioeconomic development (classified according to HDI) were the primary dental care coverage and changes in the number of formal employees

Figure 1

Conceptual model of urgent dental care and related factors.



from March to June 2020. They were classified as "decrease", "stability", or "increase" (< -1%; -1 till +1%; > +1%), according to the municipality.

Statistical analysis

The mean and standard deviation of UDC rates in Brazilian municipalities per 100,000 inhabitants were estimated for the periods before and during the COVID-19 pandemic, according to covariates. Bivariate associations of crude rates were tested using the Kruskal-Wallis test (municipality size, primary dental care coverage, and number of formal employees) or the Mann-Whitney test (GDP per capita, HDI, public policy score, COVID-19 mortality, and COVID-19 hospitalization), since data were skewed and heteroscedastic and the significance level was set at 0.05 ($p < 0.05$). A chi-square test was used to assess the association between UDC rates.

Multiple logistic regression was used to evaluate the effect of covariates on the reduction of UDC rates before and during the most restrictive period of the pandemic. The M0 model showed crude results between COVID-19 indicators, covariates, and the outcome. M1 and M1B models included, separately, each COVID-19 indicator (mortality and hospitalization) adjusted for municipality size and broad public policies, which were potential confounding factors. M2 and M2B models included primary dental care coverage and changes in the number of formal employees, aiming to assess if mediator factors would reduce the strength of the association between COVID-19 indicators and UDC reduction before and during the pandemic.

Logistic regression (multiplicative interaction) was used to evaluate the interaction between pandemic and socioeconomic indicators. Relative excess risk due to interaction (RERI) was estimated as a departure from additivity. RERI indicates the additional percentage of risk in the group exposed to both factors compared with the expected risk, considering their independent effect. A RERI of 0 means that the joint effect equals the independent effects and positive values indicate synergy whereas negative values indicate an antagonistic effect. The equation is $RERI = RR11 - RR01 - RR10 + 1$ [25], where RR11 is the relative risk in the group exposed to both factors and RR01 and RR10 the relative risk in the groups exposed to each factor [26].

Data on the variance in the profile of causes and procedures before and during the pandemic were statistically compared using the Student t-test ($p < 0.05$). Procedures were grouped into five categories for comparison: (1) endodontics (endodontic access, intracanal dressing, pulp capping, pulpotomy, and abscess drainage), (2) surgery (tooth extraction, suture removal, and alveolitis treatment), (3) periodontics (scaling and root planning), (4) rehabilitation (definitive restoration), and (5) temporary procedures (temporary coronal sealing, temporary prosthesis fit, and cementation). UDC causes were

classified as dental pain, dental trauma, and soft tissue damage. The Stata 16.1 software (https://www.stata.com) was used for all statistical analyses.

Results

In most Brazilian municipalities (69.1%), UDC rates decreased in the public health system during the most restrictive period of the COVID-19 pandemic. The percentage of municipalities in which UDC rates decreased from March to June in 2019 and from March to June in 2020 by municipal covariates showed that, apart from the number of formal employees and COVID-19 hospitalization, all evaluated covariates significantly affected this outcome (Table 1). Bivariate analysis showed an association between UDC rates and all assessed covariates, except for COVID-19 mortality, which showed a borderline non-significant effect (Table 2). UDC rates in municipalities with HDI < 0.70 decreased from March to June in 2019 in comparison with March-June in 2020 and more developed municipalities (Table 3).

Table 1

Percentage of municipalities in which urgent dental care (UDC) rates decreased from March to June 2019 and 2020 in Brazil, according to some municipal covariates (n = 4,062).

Covariates	Municipalities		Changes in UDC 2019-2020	
	n	%	% of municipalities with a decrease	p-value
Municipality size in 2020 (inhabitants)				
< 10,000	1,572	38.7	67.8	< 0.01
10,000-20,000	1,031	25.4	67.7	
20,000-50,000	894	22.0	68.1	
50,000-100,000	288	7.1	73.6	
> 100,000	277	6.8	80.9	
GDP per capita in 2017 (USD)				
< 5,177	2231	54.9	66.2	< 0.01
> 5,177	1831	45.1	72,7	
Primary dental care coverage in 2019 (centers per 100,000 inhabitants)				
< 7.7	1,095	27.0	74.0	< 0.01
7.7-14.4	1,517	37.3	69.8	
> 14.4	1,450	35.7	64.8	
Municipal HDI in 2010				
< 0.70	2,835	69.8	67.1	< 0.01
≥ 0.70	1,224	30.1	73.7	
Changes in the number of formal employees in 2020 (March-June) (%)				
< -1	2,453	60.4	70.8	0.02
-1 till +1	917	22.6	67.2	
> 1	690	17.0	65.8	
Public policy score				
Better than the national median	1,958	48.2	71.0	< 0.01
Worse than the national median	2,065	50.8	67.2	
COVID-19 mortality rate per 1,000 inhabitants in 2020 (March-June)				
None	2,729	67.2	68.1	0.04
> 0	1,333	32.8	71.3	
COVID-19 hospitalization rate per 1,000 inhabitants in 2020 (March-June)				
None	1,737	42.8	68.2	0.295
0-5	956	23.5	68.5	
> 5	1,369	33.7	70.7	
Total	4,062	100.0	69.1	

GDP: gross domestic product; HDI: Human Development Index.

Table 2

Mean and standard deviation (SD) of urgent dental care (UDC) rates in two consecutive periods, according to municipal characteristics. Brazil (n = 4,062).

Characteristics	Total		UDC rate in 2019 (March-June)			UDC rate in 2020 (March-June)			Rate difference		
	n	%	Mean	SD	p-value *	Mean	SD	p-value *	Mean	SD	p-value *
Municipality size in 2020 (inhabitants)											
< 10,000	2,452	44.0	443.0	899.9	0.09	338.5	799.1	0.01	-104.5	809.5	< 0.01
10,000-20,000	1,344	24.1	316.3	546.8		205.1	369.9		-111.1	496.2	
20,000-50,000	1,101	19.8	302.4	808.7		177.0	313.1		-125.4	715.7	
50,000-100,000	349	6.3	265.4	403.7		139.4	226.9		-126.0	334.9	
> 100,000	324	5.8	169.0	286.4		79.2	141.4		-89.8	218.5	
GDP per capita in 2017 ** (USD)											
995-5,029	2,785	50.0	326.4	612.7	< 0.01	236.6	467.6	< 0.01	-89.7	604.2	0.04
5,030-104,500	2,785	50.0	388.7	884.1		257.0	686.8		-131.7	742.8	
Primary dental care coverage in 2019 (centers per 100,000 inhabitants)											
0.0-5.8	1,392	25.0	113.2	263.4	< 0.01	71.6	220.6	< 0.01	-41.7	240.9	< 0.01
5.9-11.0	1,392	25.0	339.6	601.5		189.6	367.4		-150.0	539.9	
11.1-16.0	1,393	25.0	442.2	699.4		288.8	506.7		-153.4	631.9	
16.1-257.0	1,393	25.0	535.1	1,139.9		437.2	932.0		-97.9	1,038.6	
Municipal HDI in 2010											
41.8-61.9	1,845	33.1	247.1	472.3	< 0.01	204.5	409.2	< 0.01	-42.6	505.8	< 0.01
62.0-70.1	1,855	33.3	425.3	765.9		291.1	709.6		-134.2	742.5	
70.2-86.2	1,865	33.5	400.0	953.0		245.0	600.7		-155.0	749.8	
Changes in the number of formal employees in 2020 (March-June) (%)											
< -1	3,354	60.2	368.5	836.3	0.78	234.8	610.0	0.07	-133.6	721.6	< 0.01
-1 till +1	1,257	22.6	322.7	578.6		248.2	503.9		-74.5	620.6	
> 1	957	17.2	365.3	692.9		287.5	608.2		-77.8	579.4	
COVID-19 mortality rate per 1,000 inhabitants in 2020 (March-June)											
None	3,865	69.4	379.2	726.6	0.78	268.5	585.9	0.90	-110.8	647.8	0.08
> 0	1,705	30.6	308.4	832.4		197.8	588.5		-110.6	740.1	
Hospitalization rate for COVID-19 per 1,000 inhabitants in 2020 (March-June)											
None	2,522	45.3	386.6	744.1	0.77	289.2	602.5	0.54	-97.3	695.9	0.04
0-5	1,199	21.5	283.1	470.5		168.0	278.5		-115.2	388.5	
> 5	1,849	33.2	366.3	917.9		240.1	698.7		-126.2	789.8	
Region of Brazil											
Southeast	1,666	29.9	550.3	1,089.3	< 0.01	313.5	750.8	< 0.01	-236.8	951.9	< 0.01
South	1,191	21.4	275.2	648.1		222.5	626.1		-52.7	522.9	
Central-West	467	8.4	419.1	678.2		259.5	478.7		-159.7	622.2	
Northeast	1,794	32.2	246.1	435.4		207.5	422.6		-38.5	452.3	
North	450	8.1	243.8	465.0		208.9	418.1		-34.9	538.8	
Total	5,570	100.0	357.7	761.5		247.0	587.8		-110.8	677.6	

GDP: gross domestic product; HDI: Human Development Index.

* Kruskal-Wallis test;

** On June 30, 2017: USD 1 = BRL 3.30.

Table 3

Percentage of cities that reduced urgent dental care rates from March to June 2019 and 2020, according to Human Development Index (HDI). Brazil (n = 4,062).

	HDI < 0.70			HDI > 0.70		
	n	%	p-value	n	%	p-value
Total	2,835	67.1		1,224	73.7	
COVID-19 mortality rate per 1,000 inhabitants in 2020 (April-June)						
None	1,985	67.5	0.51	742	69.5	< 0.01
> 0	850	66.2		482	80.1	
COVID-19 hospitalization rate per 1,000 inhabitants in 2020 (April-June)						
None	1,339	68.3	0.20	396	67.7	< 0.01
> 0	1,496	66.0		828	76.6	
Public policy score						
Better than the national median	1,050	68.2	0.30	908	74.2	0.47
Worse than the national median	1,760	66.3		305	72.1	
Municipality size in 2020 (inhabitants)						
< 10,000	1,177	67.6	0.28	394	68.0	< 0.01
10,000-20,000	823	67.1		206	69.9	
20,000-50,000	610	64.4		284	76.1	
50,000-100,000	160	70.6		128	77.3	
> 100,000	65	75.4		212	82.6	
Primary dental care coverage in 2019 (centers per 100,000 inhabitants)						
< 7.7	547	70.6	< 0.01	547	77.3	< 0.01
7.7-14.4	1,151	68.6		365	73.4	
> 14.4	1,137	63.9		312	67.6	
Changes in the number of formal employees in 2020 (March-June) (%)						
< -1	1,574	68.9	0.07	877	74.0	0.11
-1 till +1	727	64.5		190	77.4	
> 1	532	65.2		157	67.5	

Multiple logistic regression (Table 4) showed that higher HDI was associated with a higher reduction in UDC rates during the most restrictive period of pandemic compared with 2019 (odds ratio – OR = 1.20; 95% confidence interval – 95%CI: 1.01; 1.42) after adjustment for confounding factors in M1 and M1B. However, the effect disappeared after adjustment for mediators (OR = 1.14; 95%CI: 0.96; 1.35) in M2 and M2B. The effect of COVID-19 had a similar pattern.

Table 5 shows the interaction between HDI and COVID-19 indicators and RERI values. The OR of the effect of COVID-19 mortality was 0.88 (95%CI: 0.73; 1.06) for municipalities with HDI < 0.70 and 1.45 (95%CI: 1.07; 1.97) for municipalities with HDI ≥ 0.70. The difference in OR was statistically significant ($p < 0.01$), showing a qualitative interaction. We found similar results for COVID-19 hospitalization.

RERI showed a synergistic effect between HDI and COVID-19 mortality and hospitalization in both crude and adjusted models (M1). The expected joint effect of mortality and HDI was above a 1.13% higher risk of decreased UDC rates, however, the observed value was an 18.6% higher relative risk of a decrease. Therefore, RERI was 17.5% (RERI = 0.17; 95%CI: 0.09; 0.29) for crude risk and 13% for relative excess risk in the adjusted model (RERI = 0.13; 95%CI: 0.04; 0.23). Interactions between HDI and hospitalizations presented similar results.

Table 4

Odds ratio (OR) and 95% confidence interval (95%CI) of the reduction in urgency dental care rates before and during the COVID-19 pandemic, according to municipal factors in multiple logistic regression analyses. Brazil (n = 4,062).

	Crude model		Model 1 *		Model 1B *		Model 2 **		Model 2B **	
	OR ***	95%CI	OR ***	95%CI	OR ***	95%CI	OR ***	95%CI	OR ***	95%CI
COVID-19 mortality rate per 1,000 inhabitants in 2020 (April-June)										
None	1.00				1.00		1.00		1.00	
> 0	1.16	1.01; 1.34			1.00	0.84; 1.18			1.00	0.84; 1.18
COVID-19 hospitalization rate per 1,000 inhabitants in 2020 (April-June)										
None	1.00		1.00				1.00			
> 0	1.08	0.94; 1.23	0.95	0.81; 1.11			0.94	0.81; 1.10		
HDI										
< 0.70	1.00		1.00		1.00		1.00		1.00	
≥ 0.70	1.37	1.18; 1.59	1.20	1.01; 1.42	1.20	1.01; 1.42	1.14	0.96; 1.35	1.14	0.96; 1.35
Public policy score										
Better than the national median	1.00		1.00		1.00		1.00		1.00	
Worse than the national median	0.84	0.73; 0.96	0.88	0.76; 1.02	0.88	0.76; 1.02	0.85	0.74; 0.99	0.85	0.74; 0.99
Municipality size in 2020 (inhabitants)										
< 10,000	1.00		1.00		1.00		1.00		1.00	
10,000-20,000	1.00	0.84; 1.18	1.05	0.88; 1.25	1.03	0.87; 1.23	0.97	0.81; 11.6	0.95	0.80; 1.14
20,000-50,000	1.02	0.85; 1.21	1.06	0.87; 1.29	1.04	0.86; 1.25	0.92	0.75; 1.13	0.89	0.73; 1.10
50,000-100,000	1.33	1.00; 1.76	1.36	1.00; 1.84	1.32	0.97; 1.79	1.09	0.79; 1.52	1.06	0.76; 1.47
> 100,000	2.01	1.46; 2.76	1.93	1.37; 2.74	1.87	1.31; 2.68	1.53	1.05; 2.22	1.47	1.00; 2.17
Changes in the number of formal employees in 2020 (March-June) (%)										
< -1	1.00						1.00		1.00	
-1 till +1	0.85	0.72; 0.99					0.92	0.78; 1.09	0.92	0.78; 1.09
> 1	0.79	0.66; 0.95					0.86	0.71; 1.03	0.86	0.72; 1.04
Primary dental care coverage in 2019 (centers per 100,000 inhabitants)										
< 7.7	1.00						1.00		1.00	
7.7-14.4	0.81	0.68; 0.97					0.91	0.75; 1.10	0.90	0.75; 1.10
> 14.4	0.65	0.54; 0.77					0.70	0.57; 0.87	0.70	0.57; 0.86

HDI: Human Development Index.

* Model 1 and Model 1B include separately each COVID-19 indicator (mortality and hospitalization) adjusted for potential confounding factors (municipality size and broad public policies);

** Model M2 and M2B included mediator factors (primary dental care coverage and changes in the number of formal employees);

*** All variables mutually adjusted.

Endodontic procedures and dental pain were the most frequent UDC causes both before and during the pandemic. The percentage of all procedures was lower during the pandemic, except for surgery, which remained stable, and temporary sealing, which increased. The percentage of UDC trauma did not change during the pandemic, but UDC due to pain and soft tissue damage increased (Table 6).

Table 5

Relative excess risk due to interaction (RERI) between Human Development Index (HDI) and two COVID-19 indicators on the decrease of urgent dental care rates in Brazil from 2019 to 2020.

	HDI < 0.70			HDI > 0.70			RERI (crude)	RERI (adjusted M1)
	%	n	RR (95%CI)	%	n	RR	(95%CI)	(95%CI)
COVID-19 mortality								
None	67.5	1,985	1.00	69.5	742	1.03 (0.97-1.09)		
> 0	66.2	850	0.98 (0.93-1.04)	80.1	482	1.19 (1.12-1.25)	0.17 (0.09-0.26)	0.13 (0.04-0.23)
COVID-19 hospitalization								
None	68.3	1,339	1.00	67.7	396	0.99 (0.92-1.07)		
> 0	66.0	1,496	0.97 (0.92-1.02)	76.6	828	1.12 (1.06-1.18)	0.16 (0.07-0.26)	0.13 (0.03-0.22)

95%CI: 95% confidence interval; RR: relative risk.

Table 6

Proportional composition of procedures and causes in urgent dental care (UDC) before and during the most restrictive period of the COVID-19 pandemic in Brazilian municipalities (n = 5,570).

	% 2019	% 2020	p-value *	Difference	
				%	95%CI
UDC procedures: March-June					
Procedures					
Endodontics	25.9	23.7	< 0.01	-2.2	-3.0; -1.5
Periodontics	1.3	0.9	< 0.01	-0.4	-0.6; -0.3
Surgery	23.6	23.6	0.99	0.0	-0.8; 0.7
Rehabilitation	13.6	11.2	< 0.01	-2.4	-2.9; -1.8
Temporary	10.5	11.6	< 0.01	1.2	0.7; 1.6
Municipalities with reports	74.8	71.0			
UDC causes: March-June					
Common causes					
Dental pain	81.2	82.4	< 0.01	1.2	0.4; 1.9
Soft tissue damage	8.1	8.9	< 0.01	0.9	0.5; 1.2
Trauma	2.8	2.8	0.89	0.0	-0.3; 0.2
Municipalities with reports	92.1	94.1			

95%CI: 95% confidence interval.

* p-value based on a paired t-test.

Discussion

This study found that a considerable proportion of Brazilian municipalities reduced the use of UDC in public health services. Although this reduction may be assigned to restrictions to control the pandemic, it was more significant in highly developed municipalities.

We selected the period from March to June 2020 because it better represented this public emergency during pandemic. At that time, the first COVID-19 cases and deaths in Brazil were reported, more severe restrictions were in force, and adherence to social distancing was greater than in later periods [27,28].

Adjusted multiple regression models for confounding factors (public policy score and municipality size) and mediators (formal employment and primary dental care coverage) confirmed our study hypothesis. Municipalities with higher HDI were associated with higher reductions in UDC rates during the pandemic after adjustment for confounding factors. However, after adjustment for mediators, the effect disappeared, making primary dental care coverage a key mediator for the effect of HDI on UDC. The Brazilian public health system [17] has been increasingly providing equitable healthcare since its implementation [29]. However, the structure of public dental care services varies between municipalities, resulting in different frequencies of use by the population [30]. Public policy score was a confounding factor due to its apparent effect on population health and the use of public dental care services [21,29].

This study also showed a synergistic effect between HDI and COVID-19 mortality and hospitalization. Municipalities with higher HDI probably implemented broad restrictions, including public and private services, and successfully promoted the stay-at-home message, which might have reduced the levels of infection. Moreover, as action timing during emergencies is essential, municipalities with higher HDI might have implemented restrictive policies faster than municipalities with lower HDI at the very beginning of the pandemic, since it started spreading from municipalities with higher HDI. Although all places seem to have been affected simultaneously, some differences occurred.

Patient stress and fear may be associated with changes in the perception of oral health problems, leading to lower demand for dental treatment during the COVID-19 pandemic [31]. This hypothesis is acceptable especially for municipalities with higher HDI, where economic conditions allow more people not to work or work from home. On the other hand, in municipalities with lower HDI, pandemic restrictions (a COVID-19 indicator in this study) did not reduce UDC rates. People living in municipalities with low HDI may face difficulties in keeping social distance and working from home. Therefore, these restrictions may not be effective, since the population needs to leave home every day to earn their livelihood. This may explain the high mobility and risk of infection by COVID-19 observed in the Brazilian state of Amazonas [32]. Lower socioeconomic development may be associated with greater population mobility and pressures to open dental care services.

The results of this study highlight the need to provide access and availability of endodontic care during emergencies. In line with previous investigation [13], our study showed that UDC is frequently associated with endodontic problems. This category remained the most frequent even when the percentage of endodontic procedures decreased during the pandemic. On the other hand, the rate of dental pain and temporary sealing increased and surgical procedures did not change in this period, which is probably because – unlike endodontic procedures – temporary restoration and most surgical interventions do not require aerosol dispersion, which was highly not recommended at the beginning of the pandemic [9]. Moreover, the closure of non-emergency health care services during the most restrictive period [5] and the uncertainty about access to specialized care probably contributed to changes in UDC.

The increase in the percentage of soft tissue damage was probably associated with psychological distress during the pandemic [33] and an increase in diseases, such as mouth ulcers, oral lichen planus, herpes zoster, herpes simplex virus, xerostomia, aphthous stomatitis, and dysgeusia [29,34,35,36]. Restrictions on dental care due to the COVID-19 pandemic were also observed elsewhere [6,23,37]. This study found reductions in the rate of urgencies and elective procedures, which was also found for pediatric dental services in Australia [26].

The uncertainty about virus transmission during dental procedures, as well as the lack of personal protective equipment, led authorities worldwide to limit or forbid dental services. However, as part of essential health care, UDC had to be provided to avoid the increase in oral diseases [38]. Keeping adequate services open should meet population demands, but identifying indicators of demand and use of dental services is difficult, as their pattern is dynamic and may be affected by socioeconomic, cultural, and public policy issues [39,40,41].

COVID-19 affected more UDC rates in the most developed municipalities, as opposed to our initial hypothesis. In Brazil, municipalities are responsible for the local management and provision of health services [42]. The most developed municipalities were the first to be affected by the pandemic, but they were also expected to have better access to private dental services, which remained open and prevented a higher demand later. Municipalities with lower HDI may not be able to reduce dental

care services for their inhabitants during a pandemic for many reasons. A study with dentists working in private dental clinics found greater dental care coverage in more developed regions [43], and the larger the health insurance market, the lower the use of public services [44]. Moreover, previous studies assessed the effect of socioeconomic indicators on dental pain both before [12] and during the COVID-19 pandemic [23] and in both cases, the rates of dental pain increased during times of vulnerability caused by natural disasters or pandemics. Another possible explanation may be the higher prevalence of dental pain in municipalities with lower HDI [39]. During the COVID-19 pandemic, the proportion of dental and oral infections as reasons for dental urgencies tended to rise, becoming greater than traumatic causes [16].

Some limitations of this study might affect the interpretation of its results and its strength of association. Firstly, our results cannot be extrapolated to individuals due to the risk of ecological fallacy. For example, the fact that places affected by COVID-19 were more likely to have a reduction in the use of urgent services does not mean that affected individuals were more likely to avoid using these services. Moreover, data from health information systems may contain notification errors and missing reports. If these are random errors, our large sample size may compensate them.

A strength of this study was including all Brazilian municipalities, which eliminated any selection biases. Longitudinal studies may assess temporality and, therefore, in this case, causality may be more likely. However, several theoretical explanations may be applied to our empirical findings, which should be fully understood before implementing actions.

Conclusion

Socioeconomic variables affected UDC rates during the most restrictive period of the COVID-19 pandemic in Brazil. The implications of these findings are twofold. Firstly, if UDC is essential, policymakers should ensure that those who need access will have it even during extreme scenarios, especially since vulnerable populations tend to need access to UDC more than others. Secondly, further studies should assess the effect of reduced access to dental care on long-term oral health. Endodontic diseases and the effect of stress-related disorders on oral health require particular attention in the planning of health actions for future emergencies.

Contributors

H. G. Silva participated in data collection, interpretation of results, and writing of the article. P. M. P. K. Móra and R. K. Scarparo participated in the study design, interpretation of results, and review of the article. L. A. Zajkowski participated in data collection, interpretation of results, and review of the article. R. K. Celeste participated in the study design, data analysis, interpretation of results, and review of the article. All the authors approved the final version to be published.

Additional informations

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Resumo

Este estudo ecológico descreveu como a pandemia da COVID-19 e o desenvolvimento socioeconômico afetaram o uso da assistência odontológica de urgência (AOU) e seu perfil. Comparamos taxas de AOU para cada 100 mil habitantes antes (de março a junho de 2019) e durante (de março a junho de 2020) a pandemia da COVID-19 em 4.062 municípios brasileiros. Os dados foram coletados de fontes oficiais. As taxas de mortalidade e internação pela COVID-19 indicaram níveis restritivos de lockdown e Índices de Desenvolvimento Humano (IDH) indicou o nível de desenvolvimento socioeconômico. Foram utilizadas regressões logísticas múltiplas e risco relativo de excesso devido à interação (RERI) para análises estatísticas. O teste t de Student foi usado para comparar alterações no perfil das causas e procedimentos da AOU nos dois períodos. As taxas de AOU foram menores em 69,1% dos municípios e associadas a IDH maior (OR = 1,20; IC95%: 1,01; 1,42). A mortalidade apresentou uma razão de chances de 0,88 (IC95%: 0,73; 1,06) para municípios com IDH < 0,70 e de 1,45 (IC95%: 1,07; 1,97) para municípios com IDH > 0,70. O RERI entre IDH e COVID-19 foi de 0,13 (p < 0,05). Os municípios com maior cobertura de atenção primária à saúde apresentaram menor redução nas suas taxas de emergência. Procedimentos endodônticos e dor dentária foram os fatores mais frequentes antes e durante a pandemia. O percentual de AOUs aumentou devido à dor, danos nos tecidos moles, vedação temporária e procedimentos cirúrgicos. Variáveis socioeconômicas afetaram as taxas de AOU durante o período mais restritivo da pandemia da COVID-19 e devem ser incluídas no planejamento de ações de saúde em emergências futuras.

COVID-19; Sistemas de Saúde; Serviços Médicos de Emergência; Fatores Socioeconômicos

Resumen

Este estudio ecológico describió el efecto de la pandemia de COVID-19 y el desarrollo socioeconómico en el uso y el perfil de la atención odontológica de urgencia (AOU). Se compararon las tasas de AOU por cada 100.000 habitantes antes de la pandemia de COVID-19 (de marzo a junio de 2019) y durante la pandemia de COVID-19 (de marzo a junio de 2020) en 4.062 municipios brasileños. Los datos se recogieron de fuentes oficiales. Las tasas de mortalidad y hospitalización de COVID-19 fueron indicativas de niveles restrictivos de desarrollo socioeconómico e Índice de Desarrollo Humano (IDH). Para los análisis estadísticos se utilizó la regresión logística múltiple y el exceso de riesgo relativo (ERR) debido a la interacción. Se utilizó la prueba t de Student para comparar los cambios en el perfil de las causas y los procedimientos de AOU en los dos períodos. Las tasas de AOU fueron menores en el 69,1% de los municipios y se asociaron con un IDH más alto (OR = 1,20; IC95%: 1,01; 1,42). La mortalidad tuvo una OR de 0,88 (IC95%: 0,73; 1,06) para los municipios con IDH < 0,70 y de 1,45 (IC95%: 1,07; 1,97) para los municipios con IDH > 0,70. El ERR entre el IDH y el COVID-19 fue de 0,13 (p < 0,05). Los municipios con mayor cobertura de atención primaria tuvieron una menor reducción de las tasas de urgencia. Los procedimientos de endodoncia y la causa del dolor dental fueron los factores más frecuentes tanto antes como durante la pandemia. Aumentó el porcentaje de AOU por dolor y daños en los tejidos blandos, así como el sellado temporal y los procedimientos quirúrgicos. Las variables socioeconómicas afectaron a las tasas de AOU durante el periodo más restrictivo de la pandemia de COVID-19 y deberían incluirse en la planificación de las acciones sanitarias en futuras emergencias.

COVID-19; Sistemas de Salud; Servicios Médicos de Urgencia; Factores Socioeconómicos

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