Impacts of overlapping climate disasters and pandemics on childcare services

Impactos da sobreposição de desastres climático e pandemia nos atendimentos para puericultura

Impactos de desastres climáticos y pandemias superpuestos en los servicios de cuidado infantil

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Abstract

Objective: To estimate the impacts of the overlap of climate disasters and pandemic on childcare services.

Methods: This is a descriptive and analytical study with an ecological and cross-sectional design. The numbers of services provided to children under one year of age, in which the problem or condition assessed involved diagnoses related to childcare between 2016 and 2022 in Primary Care in the municipality of Petrópolis in the state of Rio de Janeiro, Brazil, were used. Petrópolis was hit by a climate disaster caused by rains that resulted in widespread destruction and 248 deaths during the COVID-19 pandemic in February 2022. The rates of services (/thousand) in the first six months of the overlap were compared with the rates before the climate disasters and pandemic and with the rates in the first six months of the pandemic alone, using percentage differences and average monthly rates with their respective 95% confidence intervals in a control diagram.

Results: A total of 45,819 childcare services were studied. Monthly care rates in the month of the climate disaster and the previous month, when heavy rains were already occurring, fell by 46.4% and 37.2%, respectively, compared to the period before the pandemic. These reductions were only lower than in the first months of the COVID-19 pandemic, when reductions of 79.3%, 57.8% and 42% were observed, also compared to the period before the pandemic.

Conclusion: The overlapping climate disasters and the pandemic had an impact on childcare services, increasing barriers to children's access to preventive health care during the pandemic.

Resumo

Objetivo: Estimar impactos da sobreposição de desastres climático e pandemia nos atendimentos para puericultura.

Métodos: Trata-se de um estudo descritivo e analítico, com desenho ecológico e transversal. Foram utilizados os números de atendimentos a crianças menores de um ano de idade, nos quais o problema ou a condição avaliada envolveu diagnósticos relacionados a puericultura entre 2016 e 2022 na Atenção Primária do município de Petrópolis no estado do Rio de Janeiro, Brasil. Petrópolis foi atingido por desastre climático provocado por chuvas que resultou em ampla destruição e em 248 mortos durante a pandemia por COVID-19 em fevereiro de 2022. As taxas de atendimentos (/mil) nos seis primeiros meses da sobreposição foram comparadas com as taxas antes dos desastres climático e pandemia e com as taxas nos seis primeiros meses da pandemia isoladamente, utilizando diferenças percentuais e taxas mensais médias com seus respectivos intervalos com 95% de confiança em diagrama de controle.

Resultados: Foram estudados 45.819 atendimentos de puericultura. As taxas mensais de atendimentos no mês do desastre climático e no mês anterior, quando chuvas intensas já aconteciam, reduziram 46,4% e 37,2%, respectivamente, em relação ao período antes da pandemia. Essas reduções somente não foram inferiores aos primeiros meses da pandemia por COVID-19, quando foram observadas reduções de 79,3%, 57,8% e 42%, também em relação ao período antes da pandemia.

Conclusão: Houve impactos da sobreposição de desastres climático e pandemia nos atendimentos para puericultura, aumentando as barreiras ao acesso de crianças a cuidados de prevenção à saúde durante a pandemia.

Resumen

Objetivo: Estimar los impactos de la superposición de desastres climáticos y pandemias en los servicios de cuidado infantil.

Métodos: Se trata de un estudio descriptivo y analítico con un diseño ecológico y transversal. Se utilizaron las cifras de atenciones a niños menores de un año, en las que el problema o condición evaluada involucró diagnósticos relacionados con el cuidado infantil entre 2016 y 2022 en la Atención Primaria del municipio de Petrópolis en

el estado de Rio de Janeiro, Brasil. Petrópolis fue golpeada por un desastre climático causado por lluvias que resultaron en destrucción generalizada y 248 muertes durante la pandemia de COVID-19 en febrero de 2022. Las tarifas de servicio (/miles) en los primeros seis meses de la superposición se compararon con las tarifas antes de los desastres climáticos y la pandemia y con las tarifas en los primeros seis meses de la pandemia solamente, utilizando diferencias porcentuales y tarifas mensuales promedio con sus respectivos intervalos de confianza del 95% en un diagrama de control.

Resultados: Se estudiaron 45.819 visitas de guardería. Las tarifas mensuales del servicio en el mes del desastre climático y el mes anterior, cuando ya se estaban produciendo fuertes lluvias, se redujeron un 46,4% y un 37,2%, respectivamente, en comparación con el periodo anterior a la pandemia. Estas reducciones sólo fueron inferiores a las de los primeros meses de la pandemia de COVID-19, cuando se observaron reducciones del 79,3%, 57,8% y 42%, también en relación con el periodo anterior a la pandemia.

Conclusión: La superposición de los desastres climáticos y la pandemia tuvo repercusiones en los servicios de cuidado infantil, lo que aumentó las barreras al acceso de los niños a la atención sanitaria preventiva durante la pandemia.

Introduction

Climate change has been increasingly debated around the world. These debates are partly related to the fact that climate change increases the frequency and intensity of natural disasters, such as storms, floods and droughts. One concern has been the possibility of natural disasters happening simultaneously with other disasters, creating overlapping impacts.[1-4]

Overlapping disasters can occur due to related events or independent events. One earthquake followed by the tsunami is an example of overlapping related events. And climatic disasters during a pandemic (biological disaster) exemplify the overlapping of independent events.[5-7]

The COVID-19 pandemic can be considered an important milestone for concerns about overlapping disasters. The pandemic has increased the chances of two or more threats overlapping, especially natural and biological. Occurring simultaneously, these threats interact and can hinder the necessary responses and exacerbate vulnerabilities. During the pandemic, in the first half of 2022, while almost 550 million cases and six million deaths from COVID-19 were recorded, 178 climatic disasters occurred worldwide, affecting, in addition to the pandemic, 50 million people and causing 6.3 thousand deaths.[2,8,9] During this same period, Brazil was among the top five countries with the highest ratio of COVID-19 cases and deaths per inhabitants and among the top ten countries in terms of the number of deaths from disasters, mainly from disasters caused by rainfall, giving the dimension of the importance of the overlapping disasters.[2]

In addition to the direct impacts on the number of people affected and deaths, overlapping disasters can increase the impacts on access to health services. In isolation, the pandemic was able to reduce access to various types of preventive health care, including children's access to Growth and Development Monitoring at childcare appointments in Primary Health Care (PHC) services.[10,11]

In Brazil, the National Policy for Comprehensive Child Health Care (PNAISC) establishes the monitoring of children's growth and development in childcare consultations in PHC services.[12] In well-childcare, periodic visits are carried out to promote health, immunization, monitor growth and development milestones according to the child's age, encourage breastfeeding and healthy eating, prevent the most prevalent diseases and diagnose pathological conditions at an early stage.

But despite the increasing possibility of two or more disasters having overlapping impacts on healthcare provision, there is very limited scientific literature. There is a lack of evidence to support preparedness and response to compound disasters, particularly when they are a hybrid of pandemic and natural hazards, such as rain-related hazards. At the time of writing, no studies had been found estimating the impacts of overlapping climate and pandemic disasters on access to well-childcare. Therefore, the aim of this study was to estimate the impact of overlapping climate and pandemic disasters on well-child visit.

Method

The Equator Network guideline for observational studies in epidemiology (STROBE) was carefully followed to write this article.

This article is the result of a descriptive and analytical study, with an ecological and cross-sectional design, using data from the Primary Care Information System (SISAB). SISAB is a system that receives, pro-

cesses and validates production data (number of visits) from all PHC teams. Sending monthly production data to the system is mandatory for all municipalities in Brazil. This system is part of the *e-SUS Atenção Básica* strategy.

The data studied were the monthly numbers of individual visits to children under one year of age for childcare in the PHC services of the municipality of Petrópolis, Rio de Janeiro. Petrópolis was studied because it suffered a climate disaster caused by rains during the COVID-19 pandemic in February 2022.

In this climate disaster, 260 mm of rain in just three hours caused temporary flooding, flash floods and landslides with debris. The disaster resulted in 248 deaths and thousands of homeless or displaced people.[13] In the month of the disaster, 650 mm of rainfall was accumulated, representing the highest monthly volume ever recorded in Petrópolis.[1]

The damage caused by the disaster imposed severe immediate difficulties in providing aid to the victims. These difficulties were partly due to the obstruction of the roads, damage to buildings and health services. Faced with widespread destruction, aid institutions and donations had to be mobilized to provide supplies and subsistence aid to the homeless and to rescue the injured. During the emergency phase of the climate disaster, 22 temporary shelters were set up in schools and nurseries, and at the end of February approximately 900 people were still homeless or displaced.

Petrópolis had 304,000 inhabitants. Primary Health Care services were organized into a health care network with different technological densities that sought to guarantee comprehensive care. Primary Health Care covered more than 65% of the municipality's population and the main model of care was the Family Health Strategy, with 47 teams.

Data was collected in September 2022 in an automated way and directly from SISAB, using *web scrapping* or *data scrapping* process.[14] The extraction process was carried out using Node.js software, with *javascript code* to access the page https://sisab.saude.gov.br.

The data was collected following a protocol that included detailing and standardizing the necessary filters in SISAB. In the protocol, the municipality was considered the "geographical unit" and each month, from January 2016 to June 2022, was the "competencies". These "competencies" were considered in the rows of the "reports" (extraction products) and the "problems or conditions assessed" were considered in the "columns". The number of childcare visits was computed by SISAB considering the number of consultations in which childcare-related diagnoses were assigned (Chart 1). Filters for "type of team" or "professional category" were not applied.

Descriptive analyses were carried out using absolute and relative frequencies. Well-child visit rates were calculated for every thousand children under one year old, considering population estimates for the municipality.[15] The monthly visit rates in the first six months of the overlapping disasters (February/2022 to June/2022) were compared with the previous rates. The previous rates were categorized like before the climate and pandemic disasters (January/2016 to Decem-

Chart 1. Table 1. List of International Classification of Diseases and Related Health Problems (ICD) and International Classification of Primary Care (ICPC-2) codes related to "problems or conditions assessed - Childcare", according to the Primary Care Information System (SISAB)

ICPC2	ICD10
P11 – feeding problems in children	Z001 – routine health check-up of children
P22 – behavioral signs and symptoms in children	Z002 – examination of children during the period of rapid growth
T04 – feeding problems in infants and children	Z134 – special screening test for certain developmental disorders in childhood
T10 – growth retardation	Z761 – supervision and health care of assisted children
A97 – no disease	Z762 – supervision of health care of other healthy children or newborns
A98 – preventive medicine and health maintenance	P92 – feeding problems in newborns
	P920 – vomiting in newborns
	P921 – regurgitation and rumination in newborns
	P922 – slow feeding of newborns
	P923 – underfeeding of newborns
	P924 – overfeeding of newborns
	P925 – difficulty in breastfeeding in newborns
	P928 – other feeding problems in newborns
	P929 – unspecified feeding problem in newborns

Table 1. Differences between the monthly rates of care for monitoring the growth and development of children under one year of age (/ thousand) during the COVID-19 pandemic and after the climate disaster, compared to the average rates before the pandemic

Month	Before the pandemic 2016-2019 Mean Tx (Standard deviation; 95% CI)	Pandemic				Overlapping disasters	
		2020		2021		2022	
		Tx	Diff. % compared to the average Tx	Tax	Diff. % compared to the average Tx	Tx	Diff. % compared to the average Tx
Jan	345 (59; 229-462)	..	..	243	-29.5	217*	-37.2
Feb	357 (89; 182-531)	..	..	233	-34.7	191	-46.4
Mar	358 (94; 173-543)	240	-33.0	332	-7.2	220	-38.5
Apr	405 (111; 188-622)	84	-79.3	247	-39.0	238	-41.3
May	437 (109; 223-652)	185	-57.8	324	-25.9	275	-37,1
Jun	426 (109; 211-640)	247	-42.0	271	-36.2	227	-46.7
Jul	414 (109; 201-628)	361	-13.0	312	-24.7		
Aug	457 (129; 204-710)	298	-34.9	320	-30.0		
Sep	420 (99; 226-614)	288	-31.4	279	-33.6		
Oct	432 (104; 228-635)	293	-32.1	235	-45.5		
Nov	350 (64; 224-475)	281	-19.5	304	-13.1		
Dec	332 (60; 213-450)	242	-26.9	270	-18.5		

CI = confidence interval; Tx = rate; Diff. = difference; * = month not considered part of the disaster overlap
Note: Note: January 2022 is not considered part of the disaster overlap
CI = confidence interval

ber/2019) and during the first six months of the pandemic alone (March/2020 to January/2022). For these comparisons, the percentage differences between the monthly rates during the first six months of the pandemic alone and during the first six months of the overlapping in relation to the average monthly rate before the climate disasters and the pandemic period were considered.

Month by month comparisons were also made using a control diagram, which is a statistical tool for studying variations in seasonal endemic levels. This diagram was a way of describing the behavior and results of the outcome chronologically in a time series format. Based on probability theory, the control diagrams made it possible to compare the observed incidence (in the first six months of the pandemic alone and in the first six months of the overlap) with the expected incidence limits based on the historical data (before the climate disasters and the pandemic). The control diagram was constructed with the monthly averages and 95% confidence intervals (95% CI) of the rates before the climate and pandemic disasters. This strategy made it possible to analyze whether the rates of visits during the disaster periods were above or below historical limits. SPSS software (Statistical Package for the Social Sciences, version 26) was used for all the analyses.

The study used data in the public domain, with unrestricted access and without identifying the individuals. For this reason, the study was exempt from the Research Ethics Committee of the Federal University of Minas Gerais (CAAE: 46914221.5.0000.5149).

Results

A total of 45,819 well-childcare visits for children under one year old were studied. Of this total, 5.1% were carried out during the period of overlap between the climate disasters and the pandemic. Immediately in the month following the pandemic announcement (April 2020), the visit rates, which had already fallen in the month of the announcement, fell by 79.3% compared to before the pandemic. This initial impact of the pandemic dissipated over the course of the first year, but did not reach the historical monthly rate average even after 12 months. Between the 12th month of the pandemic and the month with heavy rains that preceded the disaster (January/2022), there was a 29.3% reduction in the monthly rate of visits compared to the historical average (Table 1, columns: pandemic, 2020 and 2021) and (Figure 1, 2020 and 2021].

In the month that the climate disaster occurred (February/2022), and in the previous month when heavy rains were already being recorded in the municipality, the monthly visit rates reduced by almost the equivalent of the first months of the pandemic. These rates were not only lower than in the first two months
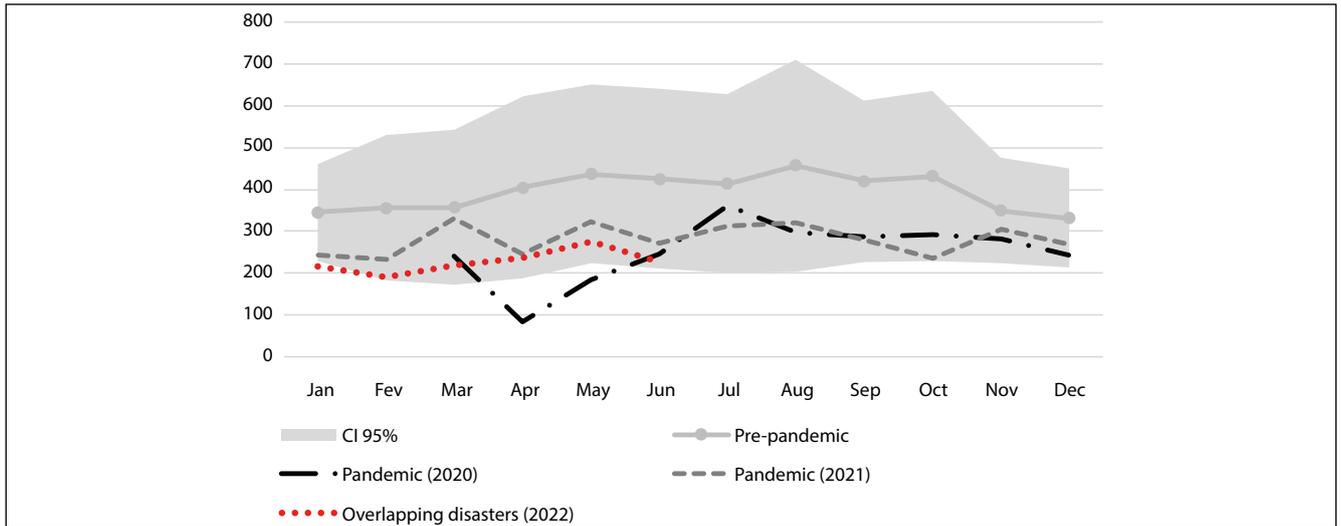
Figure 1. Control diagram showing the monthly rates of care for monitoring the growth and development of children under one year of age (/thousand) during the first and second year of the pandemic (2020 and 2021) and after the climate disaster (2022) in relation to the average rates for the period Before the pandemic (2016 to 2019)

of the pandemic. In these two months there were reductions in the monthly visit rates, which reached 37.2% in January and 46.4% in February compared to before the pandemic. In the month when the heavy rains began, even before the climate disaster (January/2022), the visit rate was below the historical lower limit, a result that had only been observed in the first two months of the pandemic (Table 1, overlapping disasters column and Figure 1, overlapping disasters).

Discussion

The results of this study showed the impact of overlapping climate and pandemic disasters on well-childcare visits. Monthly visits rates during the overlap period were only just below the rates observed in the first three months of the pandemic alone. It was also identified that the rains before the catastrophic event, which characterized the disaster and consequently the overlap, caused a large reduction in the number of visits.

In relation to the pandemic alone, previous studies have already shown impacts leading to reductions in childcare. In Brazil, in the first three months, the number of visits fell by half.[10] In other countries, such as South Africa, the reduction in the first three months was also lower, at around 30% compared to the previous year.[16] As the drop was greater in the munici-

pality considered in this study, it is likely that one explanation for the difference is differences in measures to deal with the pandemic. The information about the virus available at the time, the fear of contamination and the initial difficulties related to protective measures against COVID-19 may have contributed to reductions in the supply and demand for preventive healthcare for children.[17]

The resumption of health care for the population in health services observed in this study after the initial impact of the pandemic was also found by others. In African countries, where maternal and child health services were drastically interrupted in the first few months, progressive recoveries were identified until reaching the historic level of care in December 2020.[18] On the other hand, services for the growth and development monitoring of American children under two years old recovered more quickly than we observed in these studies, and were fully resumed in September of that year.[19] These gradual and distinct resumption of services may have occurred due to the different responses to the distancing measures, as they occurred in parallel with the reopening of sectors such as schools and commerce.[18,19]

The results showed that childcare was additionally impacted during the overlap of the climate and pandemic disasters. These impacts were observed both in the month of the extreme weather event and in the previous month, when the naturally rainy period

of the year had already arrived. These results may be related to overlapping difficulties in accessing health care services due to the two disasters together. Many of these difficulties are related to structural damage to essential services for the population, such as interruptions to access roads and transportation, communication, energy and public structures, including health care services.[20,21] In Pakistan, after a disaster caused by rains, seven out of every ten people affected needed health care services, and two out of every seven of those who needed it faced access difficulties.[3]

In this discussion, it is necessary to highlight the reduction in the number of visits in the month prior to the climate disaster. While February 2022 had the highest accumulated volume of rainfall in history, the previous January recorded the second highest volume.[13] This result confirms that heavy rains can bring additional barriers to access to care even if the phenomenon is not characterized as a disaster, as observed by a study in China.[22] These barriers in the previous rainy season may be related to the temporary impediments caused to the routines of families and professionals, hindering access and the normal functioning of services.

The reduced rates of care due to the overlapping disasters were not lower than the rates in the first months of the COVID-19 pandemic alone. When the disasters overlapped, the impacts of the pandemic intensified and may have led to consequences in various dimensions of the affected community, including increased exposure of children to social vulnerabilities, such as food insecurity.[23,24] Thus, attention to childcare can be a protective factor in overlapping disaster scenarios by identifying and preventing these impacts.

It should be noted that this study has some limitations, including the use of secondary data, which was not collected to specifically answer its objective. However, secondary data generally enables analysis in a shorter time, with a large volume of data and with fewer financial resources than studies using primary data. In addition, this study analyzed aggregate data for the affected municipality, not considering the most affected areas.

The impacts observed in this study may be related to difficulties in accessing health services due to interruptions, damage and temporary impediments directly and indirectly caused by the overlapping disasters.

This highlights the importance of making health care in PHC services more resilient to the impacts of climate change.[25,26] For all these reasons, the importance of meeting the targets of the Sendai Framework for Disaster Risk Reduction 2015-2030, making communities and health systems more resilient and reducing the impacts of potentially overlapping disasters, becomes even more evident.[27]

Conclusion

Barriers to children's access to preventive health care during the pandemic were intensified by a climatic disaster caused by rainfall, resulting in reduced opportunities to protect them against inequalities and vulnerabilities. The impacts arising from the combination of damage to infrastructure, limited access to health services and increased care needs can weaken health care recovery when disasters overlap.

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Contributions

Chagas NC, Silva LS, Andrade GN, D'Assunção ADM and Vieira EWR declare that they contributed to the study design, data collection, data analysis and interpretation, writing of the article, relevant critical review of the intellectual content and approval of the final version to be published..

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