CSP CADERNOS DE SAÚDE PÚBLICA
REPORTS IN PUBLIC HEALTH

ARTIGO
ARTICLE

The health burden of natural and technological disasters in Brazil from 2013 to 2021

A carga de saúde dos desastres naturais e tecnológicos no Brasil de 2013 a 2021

La carga sanitaria de los desastres naturales y tecnológicos en Brasil de 2013 a 2021

Abner Willian Quintino de Freitas [1]
Regina Rigatto Witt [2]
Ana Beatriz Gorini da Veiga [1]

doi: 10.1590/0102-311XEN154922

Abstract

Disasters deeply impact the health of the affected population and the economy of a country. The health burden of disasters in Brazil is underestimated and more studies are needed to underpin policies and actions for disaster risk reduction. This study analyzes and describes disasters that occurred in Brazil from 2013 to 2021. The Integrated Disaster Information System (S2iD) was accessed to obtain demographic data, disaster data according to Brazilian Classification and Codification of Disasters (COBRADE), and health outcome data (number of dead, injured, sick, unsheltered, displaced, and missing individuals and other outcomes). Database preparation and analysis were performed in Tableau. In total, 98.62% (50,481) of the disasters registered in Brazil from 2013 to 2021 are natural, with a significant increase in 2020 and 2021 due to the COVID-19 pandemic, a biological disaster. This disaster group also caused the highest number of deaths (321,111), as well as injured (208,720) and sick (7,041,099) people. By analyzing data for each geographic region, we observed differences regarding disasters frequency and their health outcomes. In Brazil, climatological disasters are the most frequent (23,452 events) and occur mainly in the Northeast region. Geological disasters have the highest lethality, which are more common in the Southeast; however, the most common disasters in the South and Southeast are those of the meteorological and hydrological groups. Therefore, since the greatest health outcomes are associated with disasters predicted in time and space, public policies for the prevention and management of disasters can reduce the impacts of these events.

Natural Disasters; Technological Disasters; Epidemiology of Disasters

Correspondence
A. B. G. Veiga
Programa de Pós-graduação em Tecnologias da Informação e Gestão em Saúde, Universidade Federal de Ciências da Saúde de Porto Alegre.
Rua Sarmento Leite 245, Porto Alegre, RS 90050-170, Brasil.
anabgv@ufcspa.edu.br

[1] Programa de Pós-graduação em Tecnologias da Informação e Gestão em Saúde, Universidade Federal de Ciências da Saúde de Porto Alegre, Porto Alegre, Brasil.
[2] Universidade Federal do Rio Grande do Sul, Porto Alegre, Brasil.

Introduction

Disasters deeply affect society, impacting the population, the environment, and the economy [1]. In Brazil – a large country covering tropical and temperate zones with diverse environmental conditions – disasters cause environmental and material damages and affect the health and lives of thousands of people every year [2]. As examples, in 2017, the Northeast Region experienced its worst drought of the past 100 years, when 600 cities declared state of emergency due to the lack of water, affecting 23 million inhabitants of the semi-arid Northeast [3]. In March 2019, rainfalls in the Southeast region destroyed entire neighborhoods, causing floods and killing 10 people [4]. In February 2021, Tarauacá (a city in Acre, North Region of Brazil) declared a public calamity due to a flood that covered 90% of the city, affecting 28,000 people [5]. In January 2022, the State Government of Mato Grosso do Sul, in the Central-West Region, declared state of emergency due to a serious drought that affected 79 cities of the state [6]. Besides natural disasters, the country also faces technological disasters, such as the fire at the Kiss nightclub in the city of Santa Maria (Rio Grande do Sul State) in the South Region of Brazil in January 2013, which accounted for 242 deaths of young people and 636 injured people [7].

Despite the occurrence of natural and technological disasters of several types in Brazil every year – fires, landslides, floods, draught, and others – studies compiling and analyzing data on disasters in Brazil and their consequences on the health of the affected population are scarce. Moreover, the capacity to prevent and respond to disasters and emergencies in public health has decreased in Brazil in the past years due to political and social changes [8]. The analysis of data related to the health outcomes from disasters is essential to understand the burden of disasters and to guide emergency response and recovery efforts [1].

This study aimed to better understand the impacts of disasters in Brazil on human health and to reinforce the need for adequate responses in face of a disaster event. We accessed data of disasters that occurred in Brazil from 2013 to 2021 and analyzed the health outcomes from exposure to natural and technological disasters. Furthermore, the study presents a comprehensive overview of varied types of disasters in the five geographical regions of the country and discusses the importance of knowing the regional differences to better prepare local communities and authorities.

Methodology

Disasters in Brazil are notified by the National Secretariat for Civil Protection and Defense and registered in the Integrated Disaster Information System (S2iD) [9]. The Brazilian Classification and Codification of Disasters (COBRADE) [10] is based on the Georeferenced Emergency Events Database (EM-DAT) classification of the Centre for Research on the Epidemiology of Disasters (CRED) [11].

This is a descriptive study that analyzed data about disasters that occurred in Brazil from 2013 to 2021, as well as their outcomes in the affected human population. The data were retrieved from the S2iD system, including demographic data (state, city, and population), disaster code based on COBRADE, and data about health outcomes (number of dead, injured, sick, unsheltered, displaced, and missing individuals, and other outcomes). The data for each year were obtained from the "Management Report – Reported Damages" [9]. Volcanic eruption was excluded because Brazil does not have volcanos. The data were cleaned and standardized, and the spreadsheets were combined to form the database, which were created using Tableau Prep Builder 2021.4 (https://www.tableau.com) and is publicly available [12].

Brazil has a territorial extension of 8,514,876km^2 and 5,570 municipalities distributed in 26 states, as well as the Federal District, where the national capital, Brasília, is located. The country is organized in five geographic regions: North, Northeast, Central-West, Southeast, and South; each one including three or more states. Considering that the data available on S2iD refers to each municipality, the data were analyzed for each Brazilian region for epidemiological analysis and interpretation.

Data analysis was performed in Tableau Desktop 2021.3 (https://www.tableau.com), which included type of disaster according to COBRADE (for exposure) and "death", "injured", "sick", "unsheltered", "displaced", "missing", and "others affected" (for outcomes). The outcomes "deaths", "injured", and "sick" were grouped as "directly affected"; whereas "unsheltered", "displaced", "missing", and

others were grouped as "indirectly affected". Since S2iD lacks demographic information of those affected, such as sex and age, it was not possible to define the population at risk, that is, total individuals who may have one of these outcomes due to exposure. Longitude and latitude coordinates were used to build maps.

Descriptive statistics estimations were performed on Tableau Desktop. To estimate lethality, the following equation was used, based on Bonita et al. [13]:

$$Lethality\,(\%) = \frac{Number\ of\ deaths\ in\ a\ given\ period}{Total\ number\ of\ directly\ affected\ individuals\ (dead + injured + sick)\ in\ the\ same\ period}\ X\ 100$$

Results

Data extraction from S2iD resulted in 51,184 disasters registered in Brazil from January 1st, 2013, to December 31st, 2021. Of these disasters, 50,481 were natural ones and 703 were technological ones. Considering that pandemics are classified as natural disasters of biological nature [10,11], a significant increase in natural disasters occurred in 2020 and 2021.

National disaster dynamics

Figure 1 shows a slight increase in disaster occurrences in Brazil from 2013 to 2019; however, we observed a dramatic rise in the number of natural disasters in 2020 and 2021. Such increase is most likely related to the high number of COVID-19 cases notified in Brazil during the pandemic, which is considered a biological disaster.

Climatological disasters are the most frequent among all natural disasters in Brazil, followed by those of biological, meteorological, and hydrological nature. By analyzing the national territory, we observed differences regarding the types of disasters between geographic regions. Thus, meteorological and hydrological disasters, when analyzed as a group, are more frequent in the South and Southeast, whereas climatological disasters, although also occurring in the South and Southeast, predominate in the Northeast Region (Table 1).

Figure 1

Natural and technological disasters in Brazil from 2013-2021.

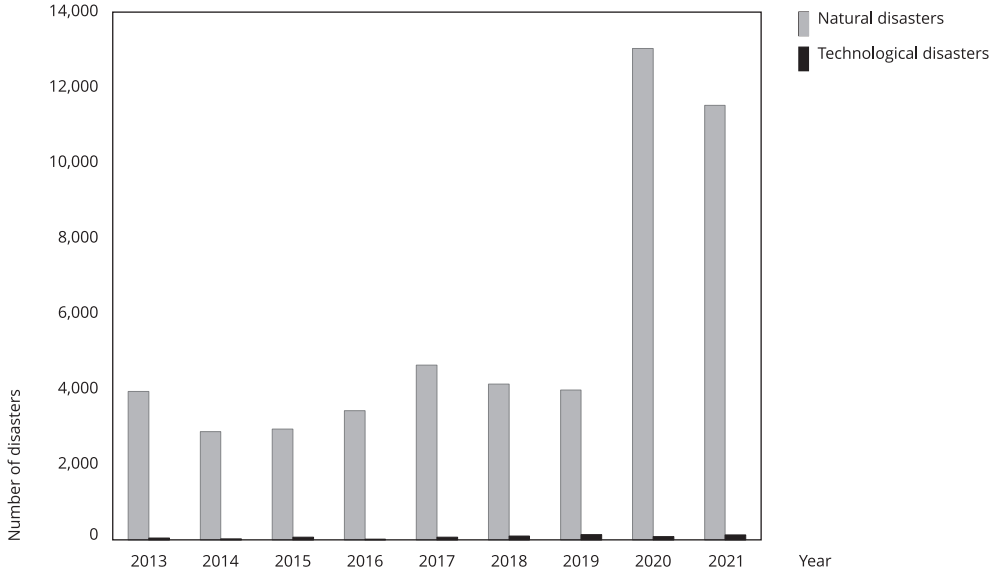


Table 1

Number of disasters in Brazil and in each Brazilian region (2013-2021).

Disaster group	Brazil	South	Southeast	Central-West	North	Northeast
Natural						
Climatological	23,452	1,265	3,430	1,627	307	16,823
Biological	14,574	1,546	4,801	1,193	699	6,335
Meteorological	6,567	2,890	1,495	1,474	282	426
Hydrological	4,687	1,966	938	294	965	524
Geological	1,201	194	439	103	212	253
Technological						
Civil works	290	38	139	33	49	31
Urban fires	157	23	5	79	49	1
Dangerous products	119	27	25	7	12	48
Passengers transport and non-dangerous cargo	36	5	2	10	17	2

Outcomes and lethality of disasters

Figure 2 shows the absolute values of health outcomes of the Brazilian population due to the exposure to disasters from 2013 to 2021. Natural disasters caused more human damage than technological ones, which was expected considering the high occurrence of natural disasters in Brazil.

Biological disasters (EM-DAT: epidemic, insect infestation, and animal accident) presented the highest numbers of deaths (321,111), injured (208,720), and sick (7,041,099) people. This group is followed by climatological (EM-DAT: drought, glacial lake outburst, wildfire; COBRADE: drought and wildfire) regarding the number of dead (28,408), injured (14,967), and sick (469,133) people. We observed the highest figures of unsheltered (410,849) and displaced (1,562,852) people for natural disasters of the hydrological group. Finally, the highest figures for others affected (216,163,965) is associated with natural disasters of the climatological group.

Table 2 shows the lethality of disasters in Brazil according to the disaster group. Despite the great number of climatological disasters, the severity of geological disasters was higher, reaching 70.98%. In this way, for every 100 people who were directly affected by a geological disaster, more than 70 deaths were accounted.

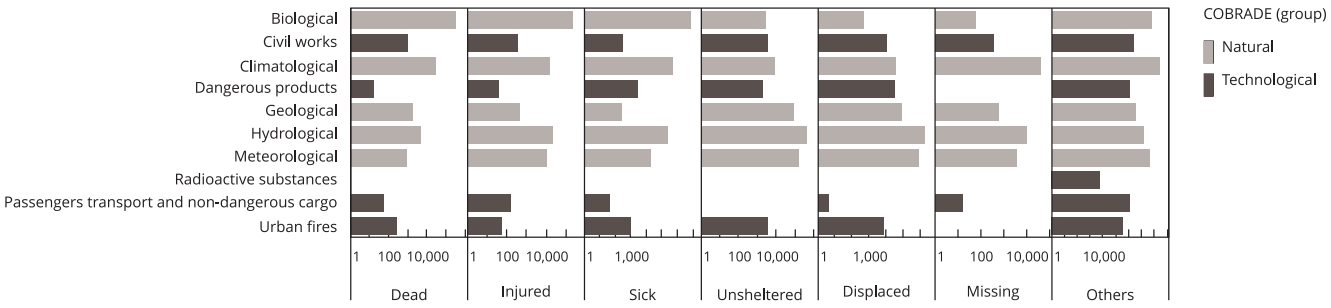
In the South Region, a single urban fire accounted for 237 deaths. Besides the significant number of deaths, this disaster left 186 people sick, 17 injured, 80 displaced, five unsheltered, and another 130 people indirectly affected (Figure 2). The Kiss nightclub fire occurred in January 2013, in the Municipality of Santa Maria. This single disaster killed more than the sum of all other disasters, showing the magnitude of this event.

The natural disasters of the meteorological group, such as storms and extreme temperatures, caused the most injuries in the South. Storms, including tornadoes, lightning storms, hail, heavy rains, and gales, are the events that, together with hydrological disasters, led to the highest number of unsheltered and displaced people. Thus, the occurrences of these natural disasters cause partial or total destruction of homes. Frequently, this destruction occurs with people inside their residences, which explains the high number of injured and the second largest number of deaths in the region. Regarding lethality, disasters of the urban fire group were the most lethal in the period (53.74%, Table 2). Given their lethality of 21.74%, geological disasters were the second most lethal. Although significant, this value is low when compared to the impact of geological disasters in the Southeast (90.25%).

In the Southeast Region, biological disasters had the highest death toll, victimizing 285,164 people (Figure 3). The COVID-19 pandemic was the main event related to this number, followed by climatological disasters, that caused 6,523 deaths. This group of disaster includes drought, wildfire,

Figure 2

Health outcomes from disasters in Brazil.



COBRADE: Brazilian Classification and Codification of Disasters.

Note: the numbers of dead, injured, sick, unsheltered, displaced, and missing people, as well as others affected are shown in logarithmic scale.

Table 2

Lethality (%) of disasters in Brazil and in each Brazilian region (2013-2021).

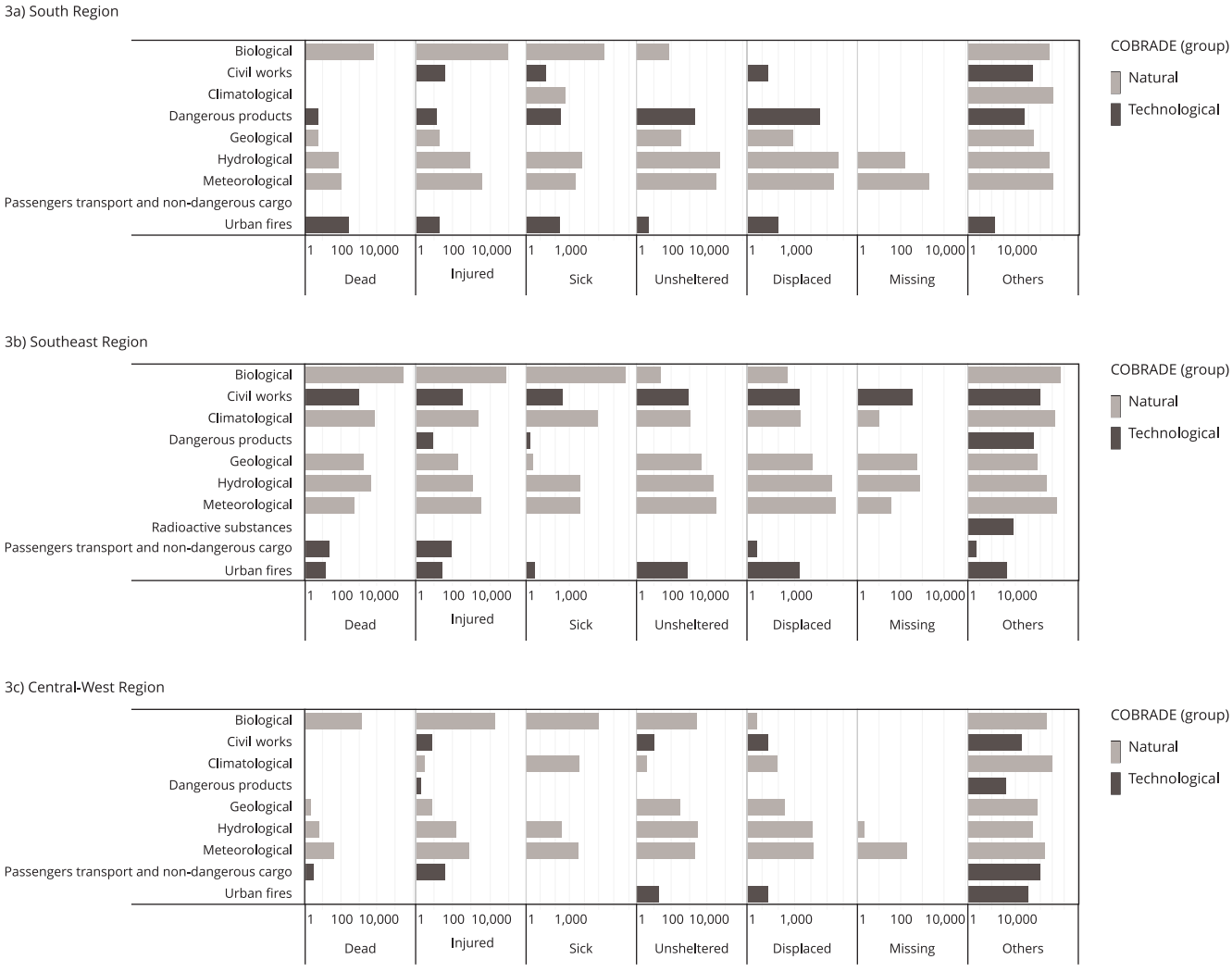
Disaster group	Brazil	South	Southeast	Central-West	North	Northeast
Natural						
Climatological	5.54	0.00	7.64	0.00	0.19	6.58
Biological	4.24	2.25	4.40	1.23	4.50	3.57
Meteorological	2.93	1.54	5.92	1.03	0.23	4.57
Hydrological	1.76	0.89	40.72	1.45	0.04	0.22
Geological	70.98	21.74	90.25	22.22	3.28	6.71
Technological						
Civil works	57.8	1.67	61.35	0.00	8.70	28.57
Urban fires	18.41	53.74	31.82	0.00	0.11	100.00
Dangerous products	0.44	2.11	0.00	0.00	0.36	0.00
Passengers transport and non-dangerous cargo	22.18	100.00	22.22	7.69	27.68	0.00

and low air humidity. Moreover, it was also responsible for the second highest number of injured and sick people. In turn, meteorological disasters left many people unsheltered, displaced, and injured (Figure 3). Natural disasters, especially hydrological and geological ones, accounted for 76.52% of missing people. Technological disasters of the civil works group were also a cause of missing people (Figure 3). Geological disasters were the most lethal in the Southeast (90.25%, Table 2), that is, for every 10 people affected by an earthquake, mass movement, or erosion, nine died. This number exceeds the national average of lethality (70.98%). The second most lethal group of disasters was the civil works, 61.35%, that is, 6 out of every 10 people died.

In the Midwest region, biological disasters had the highest death toll (Figure 3). Interestingly, this group left 2,500 people unsheltered. Notably, biological disasters include epidemics of infectious diseases (viral, bacterial, parasitic, and fungal) and insect infestation. Furthermore, "unsheltered" includes people whose homes were damaged or destroyed and who need temporary shelter. Thus, in the Central-West, 2,500 people with damaged homes by epidemics or infestations had to move to

Figure 3

Health outcomes from disasters in each Brazilian region.



(continues)

temporary shelters. Although biological disasters have the highest number of deaths, geological disasters show the highest lethality (22.22%, Table 2). This value is below the national average but above the lethality values of the Northeast.

In the North Region, biological disasters caused the highest number of deaths. Hydrological disasters also had drastic consequences, affecting approximately one million people, including injured, sick, unsheltered, displaced, and missing people. Meteorological disasters had the second greatest number of displaced people (58,625); however, their impact was much lower than the one from hydrological disasters (688,328) (Figure 3). Notably, regarding technological disasters, passengers transport and non-dangerous goods showed the highest lethality in the North Region (27.68%, Table 2), followed by civil works disaster.

In the Northeast Region, climatological disasters, including drought, wildfire, and low humidity, had the highest death toll, killing 21,721 people (Figure 3). Despite the significant death tolls in clima-

Figure 3 (continued)

COBRADE: Brazilian Classification and Codification of Disasters.
Note: the numbers of dead, injured, sick, unsheltered, displaced, and missing people, as well as others affected are shown in logarithmic scale.

tological disasters , those of civil works were also the ones with the highest lethality (28.57%, Table 2). The lethality related to urban fires was not considered in the analysis because it had a single death, creating a bias in the value of lethality.

Although geological disasters did not have the highest absolute number of deaths, they had the highest lethality in 3 of the 5 regions analyzed.

Discussion

Analysis of data related to disasters that occurred in Brazil from 2013 to 2021 showed that the country was affected mostly by natural disasters. Particularly, 2020 and 2021 presented disproportionate values regarding the historical series, which were expected considering the impact of the COVID-19 pandemic. Given the 2009 pandemic caused by influenza A virus (H1N1pdm09), Brazil strengthened its epidemiological surveillance system related to respiratory viruses, in accordance with the World Health Organization (WHO) guidelines for pandemic control and prevention [14]. Most of the COVID-19 cases in Brazil were notified by and hospitalized in public health institutions, overloading the public health system and impacting the assistance and management of other health conditions, including those caused by disasters [15,16,17].

Previous studies in Brazil show that more than 90% of natural disasters are associated with drought and prolonged dry spell; however, such studies only analyzed disaster data in the State of Ceará, located in the Northeast Region [18]. It is worth noting that primary health care has an important role in climatological disasters, since it is involved in all stages of management and assistance (prevention, preparation, response, mitigation, and recovery) [19]. This study shows that climatological

disasters are common and occur at high frequency in all geographic regions of Brazil. Thus, special attention must be given in preparing for these disasters, considering their high demand from the public health system.

Meteorological and hydrological disasters represent the third and fourth most common groups of disasters in Brazil, respectively. Floods are a common consequence of these disasters, impacting people's health and compromising the capability of the health system to provide care. In this sense, previous studies in Brazil have shown the importance of the Brazilian Ministry of Health in such emergency situations. However, the country still faces challenges such as human resources and capacity for timely action and even awareness of the vulnerable communities regarding disaster risk [20,21]. Furthermore, health surveillance, especially in hydrological disasters, must occur in a coordinated manner with the various levels of healthcare to reduce and control the impacts of disasters on public health [22].

This study showed the dynamics of disasters in Brazil, based on the number of events throughout the country from 2013 to 2021 (Figure 1), and analyzed the lethality of each type of disaster upon the exposed population (Table 2). Biological disasters had the highest numbers of death, injured, and sick people, whereas climatological disasters had the highest numbers of missing people and others affected.

The high numbers of people affected by natural disasters impose on health services the duty to be prepared for rapidly evolving health emergency situations, which increase exponentially after a disaster. For example, the COVID-19 pandemic is considered a biological disaster and overwhelmed the public health system, compromising health assistance directed to other health problems. Thus, it is essential to prepare health professionals to provide adequate healthcare to the population and overcome the challenges posed by critical emergency scenarios [23,24].

Technological disasters also cause human damage with an impact on public health. For example, the Mariana (Minas Gerais State) dam disaster, Southeast of Brazil, in 2015, has been associated with prenatal exposure to different sources of water for human consumption, leading to low birthweight [25,26]. Moreover, the fire at Kiss nightclub caused the death of 242 people, most aged form 20 to 30 years, and deeply impacted the mental health of those who survived and of first responders of the disaster [7,27]. In this study, we also found a significant number of injured and sick people associated with urban fires in the South, which were likely a consequence from the Kiss nightclub disaster.

This study reinforces the need to elaborate and to implement policies and guidelines to reduce risks and prevent disasters. A study discusses that government efforts must be undertaken to increase environmental quality, based on adequate planning and improvement of environmental indicators, as an elementary condition to provide the population with instruments to react to eventual natural disasters [28,29,30].

The epidemiology of disasters is a recent science and has not yet been clearly defined or recognized by some research centers and care institutions. The definition of epidemiology is conceptually mistaken with other concepts, such as disaster medicine and disaster management. This conceptual limitation leads to problems in the availability of data, such as lack of data, redundancies in information, among others. If the concept of epidemiology is not understood, the construction of a database that adequately collects information for the study of a disaster event is hampered. Some examples are the databases of this study and CRED – which is the main center of studies in disaster epidemiology. Another limitation in Brazil are the different systems that notify disaster events, which may lead to redundant information. Such redundancy is hard to identify due to the absence of a common variable among them that allows the evaluation of notifications registered in duplicates or triplicates. For example, accidents in the passengers transport and non-dangerous cargo are notified and registered in three different systems: one from the Federal Highway Police of the Brazilian Ministry of Justice and Public Security, one from the Brazilian Ministry of Health, and another from the National Secretariat for Civil Protection and Defense of the Brazilian Ministry of Regional Development. We considered unifying the data available in these banks; however, we chose to analyze only one database to avoid bias related to data redundancy.

To avoid problems such as redundant information, this study analyzed only data from the S2iD system, which includes information on disasters and their damage, with the absolute number of affected people in a defined period due to one or more disaster groups. However, the S2iD system

does not provide demographic information such as gender and age, therefore it was not possible to draw a profile of the affected individuals. Furthermore, regarding the impact of disasters on human health, it is essential to have clinical data related to victims of disasters integrated with data related to the occurrence of a disaster event. In Brazil, clinical and demographical data related to victims of disasters are usually reported to the Brazilian Ministry of Health, whereas disasters are notified by the Brazilian Ministry of Defense. Therefore, it is difficult to analyze the association between disasters and health outcomes, including the spread of diseases and the impact on mental health [31,32,33]. Besides limiting the study, the lack of specific demographic and clinical data makes it more difficult to plan health assistance for specific health conditions and to specific population groups. It is essential to have effective joint planning based on local knowledge to avoid disasters, to better prepare all sectors of society for disaster risk reduction, and to mitigate its consequences in face of a disaster [34,35,36,37].

Despite the fact that data about the impact of disasters on human health in Brazil are available on public databases, and that some studies have analyzed the relation between specific disasters and health, a more comprehensive analysis is necessary to better understand the dynamics of disasters in Brazil. Such analysis contributes to the planning and assistance in public health from low to high complexity [38]. Therefore, this study was carried out to address such necessity. The results of this study may support public managers in planning which services and supplies will be needed to provide assistance based on the dynamics of disasters in their region. Furthermore, the study adds to the understanding of the disease burden of disasters for the municipality, the state, and the federation.

Conclusion

This study found that from 51,184 disaster events that occurred in Brazil from 2013 to 2021, 50,481 (98.62%) were natural disasters, mostly climatological ones (23,452). Regarding human damage, the natural biological disasters led to the highest number of victims (321,111 deaths, 208,720 injuries, and 7,041,099 sick individuals). The COVID-19 pandemic had a dramatic impact on this scenario in 2020 and 2021. Other than COVID-19, Brazil was mostly affected by natural disasters, with more human damage associated with climatological disasters, and with the highest lethality associated with geological disasters.

Contributors

A. W. Q. Freitas contributed to the study conception and design, data analysis, acquisition, interpretation, writing, and review; and approved the final version of the manuscript. R. R. Witt contributed to the study conception and design, and review; and approved the final version of the muscript. A. B. G. Veiga contributed to the study conception and design, data analysis, interpretation, writing, and review; and approved the final version of the manuscript.

Additional information

ORCID: Abner Willian Quintino de Freitas (0000-0003-2913-7046); Regina Rigatto Witt (0000-0002-3893-2829); Ana Beatriz Gorini da Veiga (0000-0003-1462-5506).

Acknowledgments

The authors thank the Graduate Program of Technology Information and Health Management of the Federal University of Health Sciences of Porto Alegre. A. B. G. Veiga holds a Research Fellowship (PQ2) from the Brazilian National Research Council (CNPq, grant number 306369/2019-2).

References

1. Centers for Disease Control and Prevention. Disaster epidemiology & response. Disaster epidemiology. https://www.cdc.gov/nceh/hsb/disaster/epidemiology.htm (accessed on 04/May/2022).
2. Centro Universitário de Estudos e Pesquisas sobre Desastres, Universidade Federal de Santa Catarina. Atlas brasileiro de desastres naturais 1991 a 2012: volume Brasil. Florianópolis: Centro Universitário de Estudos e Pesquisas sobre Desastres, Universidade Federal de Santa Catarina; 2013.
3. Profissão Repórter. Nordeste brasileiro vive a pior seca dos últimos cem anos. G1 2017; 3 may. https://g1.globo.com/profissao-reporter/noticia/2017/05/nordeste-brasileiro-vive-pior-seca-dos-ultimos-cem-anos.html.
4. Maior chuva em 22 anos no Rio causa 10 mortes, deixa bairros submersos e provoca destruição. G1 2019; 9 apr. https://g1.globo.com/rj/rio-de-janeiro/noticia/2019/04/09/bombeiros-registram-deslizamento-no-morro-da-babilonia-rio.ghtml.
5. Nascimento A, Brasil J. Com 90% da cidade atingida pela cheia, Tarauacá decreta calamidade pública. G1 2021; 20 feb. https://g1.globo.com/ac/acre/noticia/2021/02/20/com-90percent-da-cidade-atingida-pela-cheia-tarauaca-decreta-calamidade-publica.ghtml.
6. Jornal Nacional. Mato Grosso do Sul decreta emergência em 79 cidades por causa da seca. G1 2022; 7 jan. https://g1.globo.com/jornal-nacional/noticia/2022/01/07/mato-grosso-do-sul-decreta-emergencia-em-79-cidades-por-causa-da-seca.ghtml.
7. Incêndio em boate provoca pânico e mortes em Santa Maria, no RS. G1 2013; 27 jan. https://g1.globo.com/rs/rio-grade-do-sul/noticia/2013/01/incendio-em-boate-provoca-panico-e-mortes-em-santa-maria-no-rs.html.
8. Freitas CM, Silva IVM, Cidade NC. COVID-19 as a global disaster: challenges to risk governance and social vulnerability in Brazil. Ambiente & Sociedade 2020; 23:e0115.
9. Ministério do Desenvolvimento Regional. Sistema Integrado de Informações sobre Desastres – S2iD. https://s2id.mi.gov.br/paginas/sobre.xhtml (accessed on 01/Dec/2022).
10. Ministério do Desenvolvimento Regional. Publicações da proteção e defesa civil – SEDEC. https://www.gov.br/mdr/pt-br/centrais-de-conteudo/publicacoes/protecao-e-defesa-civil-sedec (accessed on 01/Dec/2022).
11. Centre for Research on the Epidemiology of Disasters. What's the new. https://www.cred.be/ (accessed on 04/May/2022).
12. Quintino de Freitas AW. S2iD (2013 to 2020) disaster epidemiology. Mendeley Data 2021; 9 jul. https://data.mendeley.com/datasets/53wcx4y2y3/1.
13. Bonita R, Beaglehole R, Kjellström T. Basic epidemiology. 2nd Ed. https://apps.who.int/iris/handle/10665/43541 (accessed on 10/Aug/2022).

14. World Health Organization. Outbreak preparedness and resilience. https://apps.who.int/iris/bitstream/handle/10665/337959/9789240011373-eng.pdf?sequence=1&isAllowed=y (accessed on 10/Aug/2022).
15. Silva AD, Veiga ABG, Cruz O, Bastos L, Gomes MFC. Severe acute respiratory infection surveillance in Brazil: the role of public, private, and philanthropic health care units. Health Policy Plan 2022; 37:1075-85.
16. Rocha MW, Oliveira AB, Araújo DF, Queiroz ABA, Paes GO. Safe intra-hospital care in context of vulnerability to socio-environmental disasters: implications for nursing. Rev Bras Enferm 2021; 74:e20190223.
17. Costa IPA, Maêda SMN, Teixeira LFHSB, Gomes CFS, Santos MD. Choosing a hospital assistance ship to fight the covid-19 pandemic. Rev Saúde Pública 2020; 54:79.
18. Lima MAS, Lira MAT. Climate variability and natural disasters in the State of Ceará (1991-2019). Revista Brasileira de Meteorologia 2021; 36:603-14.
19. Manfrini GC, Treich RS, Rumor PCF, Magagnin AB, Moncada MA, Furtado JR. Primary health care actions in natural disasters. Texto & Contexto Enferm 2020; 29:e20180256.
20. Silva EL, Resende RMS, Frutuoso RL, Bezerra AB, Salvi BB, Rohlfs DB. Emergência em saúde pública por inundações: a atuação do Ministério da Saúde em ocorrências no Brasil de 2004 a 2017. Saúde Debate 2020; 44(spe2):176-87.
21. Santos R, Menezes JA, Souza CM, Confalonieri U, Freitas CM. Vigilância em saúde e desastres de origem natural: uma revisão da literatura. Saúde Debate 2020; 44(spe2):316-33.
22. Silva SLA, Martins MHM, Spink MJP. Percepção e hierarquia de riscos de inundação recorrente em área urbana regularizada: uma análise discursiva. Saúde Debate 2020; 44(spe2): 202-13.
23. Ferentz L, Fonseca MN, Pinheiro E, Garcias C. A utilização de instrumentos globais para a avaliação da resiliência a desastres na saúde. Saúde Debate 2020; 44(spe2):115-31.
24. Correia MITD, Ramos RF, Bahten LCV. The surgeons and the COVID-19 pandemic. Rev Col Bras Cir 2020; 47:e20202536.
25. Azevedo DCB, Toledo GA, Cohen SC, Kligerman DC, Cardoso TAO. Desastre de Brumadinho: contribuições para políticas públicas e gestão do saneamento em períodos emergenciais. Saúde Debate 2020; 44:221-33.
26. Defilipo EC, Chagas PSDC, Peraro-Nascimento A, Ribeiro LC. Factors associated with low birthweight: a case-control study in a city of Minas Gerais. Rev Saúde Pública 2020; 54:71.
27. Noal DS, Vicente LN, Weintraub ACAM, Fagundes SMS, Cabral KV, Simoni ACR, et al. Mental health and psychosocial care strategy for affected from Kiss nightclub. Psicol Ciênc Prof 2016; 36:932-45.
28. Carmo EH, Teixeira MG. Technological disasters and public health emergencies: the case of oil spill on the Brazilian coast. Cad Saúde Pública 2020; 36:e00234419.
29. Santos FA, Cruz MLB, Mendes LMS. Socioespatial vulnerability to droughts and floods in the Piracuruca River Sub-basin (Ceará-Piauí/Brazil). Sociedade & Natureza 2020; 32:321-34.
30. Batista FES, Pinheiro EG, Ferentz LMS, Stringari D. Biological disasters and their relation to public health: an analysis of articles published in the State of Paraná, Brazil. Ciênc Saúde Colet 2021; 26:1391-9.
31. Noal DS, Braga VMR, Leal MB, Vargas AR, Eliazar P. Desastre da Vale: o desafio do cuidado em saúde mental e atenção psicossocial no SUS. Saúde Debate 2020; 44(spe2):353-63.
32. Fernandes GCM, Bellaguarda MLR, Heideman ITSB, Meirelles BHS, Silva HL, Cárdenas AVR. Demands for psychosocial support from communities vulnerable to natural disasters. Rev Bras Enferm 2020; 73 Suppl 1:e20190213.
33. Carvalho MM, Oliveira SS. Aspectos psicossociais em desastres socioambientais de origem geoclimática: uma revisão integrativa da literatura. Saúde Debate 2020; 44(spe2):334-52.
34. Viana AS. Disasters and the historical recurrence of tragedies: implications for the health and aging process. Ciênc Saúde Colet 2021; 26:4471-82.
35. Freitas CM, Silva IVM, Xavier DR, Silva EL, Barcellos C. Desastres naturais e seus custos nos estabelecimentos de saúde no Brasil no período de 2000 a 2015. Cad Saúde Pública 2020; 36:e00133419.
36. Carvalho APM, Marques GL, Cunha JR, Pereira RA, Oliveira TS. A vigilância em saúde ambiental como resposta ao desastre do rompimento da barragem de rejeitos em Brumadinho. Saúde Debate 2020; 44(spe2):364-76.
37. Machado FV, Dowbor MW, Amaral I. Samarco disaster and health policies in Espírito Santo. Saúde Debate 2020; 44(spe2):145-58.
38. Fernandes GCM, Treich RS, Costa MFBNA, Oliveira AB, Kempfer SS, Abeldaño RA. Atenção primária à saúde em situações de desastres: revisão sistemática. Rev Panam Salud Pública 2019; 43:e76.

Resumo

Desastres afetam profundamente a saúde da população afetada e a economia de um país. A carga de saúde dos desastres no Brasil é subestimada e mais estudos são necessários para fundamentar políticas e ações para a redução do risco de desastres. Este estudo analisa e descreve desastres ocorridos no Brasil entre 2013 e 2021. O Sistema Integrado de Informações sobre Desastres (S2iD) foi acessado para obtenção de dados demográficos, dados de desastres, de acordo com a Classificação e Codificação Brasileira de Desastres (COBRADE), e dados de resultados de saúde (mortos, feridos, doentes, desabrigados, deslocados, desaparecidos e outros afetados). A preparação e a análise do banco de dados foram realizadas no Tableau. O estudo mostra que 98,62% (50.481) dos desastres registrados no Brasil entre 2013 e 2021 foram naturais, com um aumento significativo em 2020 e 2021 por causa da pandemia de COVID-19, que é um desastre biológico. Este grupo de desastres também causou o maior número de mortes (321.111), bem como de feridos (208.720) e doentes (7.041.099). Ao analisar os dados para cada região geográfica, observaram-se diferenças em relação à frequência e aos resultados de saúde dos desastres. Por exemplo, enquanto os desastres climatológicos são os mais frequentes no país (23.452 eventos) e ocorrem principalmente na Região Nordeste, a maior letalidade é observada para desastres geológicos, que são mais comuns no Sudeste. No Sul e Sudeste, os desastres mais comuns são meteorológicos e hidrológicos. Este estudo mostra que os maiores resultados de saúde estão associados a desastres previstos no tempo e no espaço e, portanto, os impactos podem ser reduzidos com políticas públicas de prevenção e gestão de desastres.

Desastres Naturais; Desastres Tecnológicos; Epidemiologia de Desastres

Resumen

Los desastres afectan profundamente la salud de la población y la economía de un país. La carga sanitaria de los desastres en Brasil está subestimada, y se necesitan más estudios para elaborar políticas y acciones para reducir el riesgo de desastres. Este estudio analiza y describe los desastres ocurridos en Brasil entre 2013 y 2021. Del Sistema Integrado de Información de Desastres (S2iD) se recogió datos demográficos, datos de desastres, según la Clasificación y Codificación Brasileña de Desastres (COBRADE), y datos de resultados de salud (muertos, heridos, enfermos, personas sin hogar, desplazados, desaparecidos y otros afectados). La preparación y análisis de los datos se realizó en Tableau. El estudio muestra que ocurrieron el 98,62% (50.481) de los desastres registrados en Brasil entre 2013 y 2021 fueron naturales, con un aumento significativo en 2020 y 2021 a causa de la pandemia del COVID-19, considerada un desastre biológico. Este grupo de desastre también causó el mayor número de muertos (321.111), así como el mayor número de heridos (208.720) y enfermos (7.041.099). Al analizar los datos de cada región del país, se constataron diferencias en cuanto a la frecuencia y los resultados en salud de los desastres. Mientras los desastres climatológicos son los más frecuentes en el país (23.452 eventos) y ocurren principalmente en la región Nordeste, los desastres geológicos frecuentes en el Sudeste son los más letales. En el Sur y Sudeste del país, los desastres más comunes son los meteorológicos e hidrológicos. Este estudio muestra que los mayores resultados en salud se asocian con los desastres previstos en tiempo y espacio, y que los impactos pueden reducirse con las políticas públicas de prevención y gestión de desastres.

Desastres Naturales; Desastres Tecnológicos; Epidemiología de Desastres

Submitted on 23/Aug/2022
Final version resubmitted on 06/Dec/2022
Approved on 15/Dec/2022