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Disasters and icebergs: we must go beyond

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The study by Freitas et al. [1] published in this issue of CSP is another effort to systematize and warn about the different types of disasters that Brazil has been recording, covering a more recent period than that analyzed in previous studies [2]. These studies have shown how often these disasters occur, because if every year pictures and news call out the "disaster of the time", over time, all municipalities of Brazil and their populations will be affected by different disasters.

Regarding natural disasters, the intense rains caused floods and landslides, which impacted 38 municipalities in Santa Catarina in 2008, killing 106 people and affecting more than 400,000 people, thus being considered a very serious event [3]. However, in 2011, in the Serrana region of Rio de Janeiro, a new disaster affected 11 municipalities, resulting in 916 deaths and more than 30,000 displaced and homeless people [4], being considered the most serious disaster ever recorded so far regarding immediate mortality. In the following year, one of the longest droughts began in the country, affecting mainly the Brazilian semi-arid region from 2012 to 2017 [5], which impacted thousands of municipalities and had its effects mitigated by a series of social policies (income transfer, food and nutritional security, and access to water by cisterns and water trucks) [6]. Moreover, even in this context, hundreds of children died due to outbreaks of acute diarrhea in 2013 in the states of Alagoas and Pernambuco [7]. In 2010, these same states suffered with heavy rains and floods that impacted 44 municipalities in Pernambuco and 20 in Alagoas, resulting in 56 immediate deaths and affecting more than 1,000,000 people [8,9]. Finally, the extreme floods and severe droughts in the Amazon, with two of the largest marks of monitoring between 1903 and 1921 in the 21st century, in Negro River, in the fenders of the port of Manaus (Amazonas). In 2010, the mark of the largest historical ebb (13.63m) and, in 2021, the largest historical flood (30.02m), with both events impacting on health and food and nutritional security [10].

Regarding technological disasters, we stress the rupture of mining dams in 2015 and 2019 [11]. The first, from the Samarco company in Mariana (Minas Gerais), resulted in 19 immediate deaths and reached 45 municipalities (36 in Minas Gerais and 9 in Espírito Santo) in Doce River Basin, extending for 650km. The second, from the Vale company in Brumadinho (Minas Gerais), resulted in 270 immediate deaths (most recent records) and reached 25 municipalities in the Paraopeba River Basin, an extension of 300km. Both di-

sasters placed Brazil as responsible for the most serious disasters in mining dams regarding spatial extent and immediate deaths worldwide [12]. Moreover, in 2019, a new event involving the crude oil spill of approximately five tons into the sea reached 724 fishing and shellfish extraction zones, as well as those dedicated to tourism, in 120 municipalities and 11 states of the Northeast and Southeast in a 4,334km-long coastal strip. This event resulted in environmental impacts and health risks for fishermen, shellfish gatherers, and countless other workers and populations whose main financial sustain come from the sea or the affected beaches and those who worked to remove waste from the beaches without adequate information and protection [13]. This disaster is considered one of the most serious involving the oil spill regarding territorial extent and directly exposed population.

Furthermore, at the end of 2019, the identification of the novel coronavirus (SARS-CoV-2) and a new disease (COVID-19) indicated the risk of a pandemic. On January 30, 2020, the World Health Organization (WHO) declared the outbreak of the novel coronavirus as a public health emergency of international concern (PHEIC). On March 11, WHO characterized it as a pandemic. Until June 30, 2021, Brazil was second in cumulative deaths among the 10 most populous countries and the 15 largest economies in the world, and the first in deaths per million inhabitants [14]. According to data of Our World in Data [15], on December 31, 2022, the pandemic registered 6.7 million deaths worldwide, with 693,734 in Brazil. Since the country has 2.7% of the world's population, Brazil recorded 10% of deaths worldwide, becoming one of the epicenters of the pandemic globally.

These different types of disasters and the data analyzed by Freitas et al. [1] should be interpreted as signs and warnings of a broader crisis, in which health threats such as emerging diseases and pandemics, climatic emergencies and natural and technological disasters are part of our lives, and their impacts are concentrated mainly in the most vulnerable populations and territories , suggesting structural processes.

If each disaster, whether natural or technological, has its uniqueness as an event, they present patterns and characteristics that must be stressed in order to advance toward more systemic analyses.

Firstly, every disaster is an update of latent risk conditions. Thus, when disasters occur they produce new risk scenarios that amplify in time and/or space. The records of impacts caused by disasters, particularly in the Integrated Disaster Information System (S2iD), analyzed by Freitas et al. [1], concentrate data produced by Brazilian Civil Defense agencies and mainly circumscribed to the immediate periods of disasters (days or weeks after), although important, are limited and should be treated as the tip of an iceberg. Xavier et al. [3], when analyzing the records of hospitalizations in Santa Catarina for the 2008 disaster, showed that infectious diseases, stroke, and fractures extended over months after the event. Another example involves the study conducted on the excess mortality resulting from hurricane Maria that hit Puerto Rico in September 2017, with winds of about 250km [16]. The initial record had 64 deaths and after the request of the governor of Puerto Rico for an independent study on excess mortality, the total was 2,975 deaths until February 2018. Moreover, 40% of the municipalities presented excess mortality, considering the migration from the capital to the other municipalities due to the destruction of houses, precarious living conditions, and disruption of health services. These two studies show impacts that go beyond the first hours, days, or weeks, and extrapolate the municipalities most directly affected when they involve the destruction of housing and infrastructure.

Regarding disasters in mining dams, a set of diagnoses made by Getúlio Vargas Foundation (FGV) for the Samarco disaster in 2015 and by Oswaldo Cruz Foundation (Fiocruz) in Minas Gerais for the Vale disaster present important data about the effects on health beyond the immediate mortality and morbidity after the event. The analysis made by FGV [17] compared the incidence per 100,000 inhabitants between 45 affected and 85 control municipalities, from 2015 to 2019, projecting not only a 3-year reduction in life expectancy in the exposed population, but also a positive association regarding the change in the expected pattern of mortality associated by arboviruses and a significant increase in cases of respiratory diseases and dengue in the affected municipalities, as well as emphasizing an increase on domestic and sexual violence, among other diseases and injuries. Fiocruz Minas Gerais leads the Brumadinho Health Project, which aims to monitor and to evaluate the impact of the Vale disaster on the health of the population in a 10-year follow-up. The first results were published in the *Revista Brasileira de Epidemiologia* (volume 25, supplement 2: https://www.scielo.br/j/rbepid/i/2022.v25suppl2/), showing the impact of chronic respiratory diseases and respiratory symptoms on mental health and use of psychotropic medications and also prevalence of metal levels above the reference values.

While disasters create new risk scenarios, there is a process that can result in the overlapping of diseases and illness, aggravating and enhancing those of greater prevalence, but also in risks and damages with disasters that can occur simultaneously. Brumadinho, one of the most impacted municipalities by the Vale disaster, regularly suffers from floods that affect its population. In March 2011, Fukushima (Japan) was impact by three events: an earthquake, a tsunami, and a nuclear power plant leak. The COVID-19 pandemic did not prevent other disasters from occurring during the most critical periods, requiring non-pharmacological physical distancing measures. Moreover, in this disaster peaking from 2020 to 2021, WHO estimates showed an excess mortality of approximately 14.9 million in these two years, combining those directly associated with COVID-19, as well as those indirectly associated with it and involving other health conditions with discontinuity or interruption of care [18].

Studies such as those conducted by Freitas et al. [1] should be understood as a warning about the changes that are underway in the 21st century, since disasters and their overlaps tend to become more frequent and intense. If each of the disasters has its own set of dangers and/or threats (a drought, a heavy rain, a virus, heavy metal contamination, among others), its multiple ways of exposure, risks, and diseases are mediated by structural processes in which social, political, and economic dynamics reproduce in multiple territories a relatively common pattern of events and their effects, demanding more systemic approaches in academic studies and public policies on disasters [19].

Every disaster is like an iceberg, in which what is immediately accessible and visible is only the tip or the surface of the iceberg. The detachment of the A68 iceberg, which had an area of almost 6,000km^2 when it separated from Antarctica in 2017, is a good example. Although the iceberg was the size of a small country, it should be seen as a sign and warning of climate change and consequent melting of the polar ice caps, with more small-sized icebergs – but highly significant – detaching, and researchers increasingly advocating the need to treat climate change not as a risk factor, but as a totalizing event that should be declared a PHEIC, due to its impacts on morbidity and mortality by 2050, which includes disasters of natural origin [20]. Technological disasters should be also accounted, since the

three largest disasters between from to 2015 and 2019 are associated with a developmental-productive model, in which lower standards of safety and environmental and health protection were adopted with immense social, environmental, and human costs.

Disaster risk reduction is one of the essential functions of public health. To carry out this function, studies that contribute to a better understanding of disaster risks, which is the first priority of the *Sendai Framework 2015*, are essential to formulate and implement broader and systemic public policies. The study by Freitas et al. [1] is one more step along this path.

Additional information

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