



Mining dam disasters: lessons from the past for reducing current and future risks

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On January 25th 2019, the municipality of Brumadinho, located in the metropolitan region of Belo Horizonte, capital of the Brazilian state of Minas Gerais, was devastated by the collapse of Dam 1 of the Vale company's Córrego do Feijão iron mine. The dam burst caused one of the world's worst mining dam disasters since 1960. Some 13 million m³ of mud containing mining tailings were spilled, causing huge environmental impacts, in particular on the River Paraopeba, as well as human losses comprising at least 300 deaths, considering that after one month, apart the 179 officially registered deaths, a further 129 people were still missing.

In order to understand this disaster and its significance for Public Health, three consequences need to be considered which may or may not be linked to each other: (i) disruption of normal local or regional everyday life, involving material, cultural, economic and environmental losses and harm, as well as increased risks, disease and deaths; (ii) overloading of local or state-level institutional capacity over and above their working capacity when using the own resources; (iii) alteration to contexts in which risks and diseases are produced arising after the event, with regard to both pre-existing and new characteristics, resulting in overlapping conditions of environmental and human risk and harm among affected territories and populations which may last for months or even years.¹

For the community of researchers and professionals who work with the issue of disasters, it is consensus that lessons should be drawn from them, so as to avoid the repetition of failures and mistakes, risks and diseases, losses and damage.

The Vale Company missed the opportunity of learning from an earlier disaster caused by Samarco Mineração S.A., a mining company in which it has controlling interests. In a space of just over three years, the Vale Company has been responsible for two of Brazil's worst mining dam disasters, which are also recognized as being among the world's worst ever disasters: the Mariana disaster in 2015, also in Minas Gerais state; and the Brumadinho disaster in 2019. Moreover, as a global company, it has committed violations and caused setbacks to the human rights of the people affected,² given the absence of preventive measures coupled to negligence regarding the safety of its dams, violating the rights to life, health, water, housing and employment. In addition to economic and social rights, political and civil rights have been brought to the fore, such as fair compensation, transparent information and participation of those affected in decision-making following both events.

For the community of Public Health professionals, it is also fundamental, in the medium term, to learn from these events and develop forms of prevention,

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immediate responses, rehabilitation and health recovery; and, in the long term, support the rebuilding of living conditions in these territories, based on the benchmark and reference of the right to health and its links with social and environmental rights.

Research into disasters, comparing morbidity and mortality patterns before and after events, provides certain lessons to be learned. In the six-month period following the November 2008 floods and landslides in the state of Santa Catarina, there was an increase in hospitalizations from cerebrovascular accidents (CVA), fractures and infectious diseases such as leptospirosis.³ In 2011, the sequence of disasters unleashed by the tsunami in Fukushima, Japan, led to an excessive and exceptional increase in mortality throughout the entire region, in particular due to cardiovascular diseases, as well as among the elderly, even among those hospitalized owing to the disaster. These findings point to a synergetic effect between the stress caused by human and material losses and health system collapse in the wake of the disaster.⁴ Hurricane Maria hit Puerto Rico in September 2017 and, in addition to the 64 immediate deaths, caused an exorbitant increase in mortality in the period up to five months after the event, considering the scenarios of population displacement: 2,975 deaths were attributed to the hurricane – 46 times greater than the 64 deaths directly caused when the hurricane hit –, as well as a significant increase of around 40% in mortality in the country's municipalities.⁵

In the case of disasters involving materials of chemical origin (such as the heavy metals present or mobilized in both the Samarco disaster in 2015 and the Vale disaster in 2019) or of radioactive origin, the effects can last for years, demanding long periods of health research, surveillance and care.⁶ Following the Samarco disasters, research has made evident two groups of individuals exposed to the event: (i) those who lived in the municipality of Mariana and had their houses destroyed, and contact with toxic mud, such as people living in the districts of Bento Rodrigues, Paracatu de Baixo and Gesteira; and (ii) those who lived in the municipality of Barra Longa, affected by the wave of mud that invaded part of the town and who also had contact with contaminated water or with dust from dried toxic mud. As if this were not enough, the Mariana disaster compromised the supply of water, fishing, farming and leisure activities

of cities and communities situated along the 650km of the River Doce.⁷

In the municipality of Barra Longa, analysis of care provided at health centers revealed growth in various health problems, diseases and conditions either diagnosed or with signs and symptoms recorded. In the period from November 5 (date of the disaster) and the first half of 2016 (almost eight months later), there was an 8 to 48-fold increase in some health problems, such as: dermatitis; parasitic diseases, diarrhea and gastroenteritis; anxiety; systemic arterial hypertension; diabetes *mellitus*; upper respiratory tract infections and dengue.⁷

Another study, this time using primary data, with the aim of characterizing the epidemiological profile of the population of the municipality of Barra Longa, revealed prevalence 60-80% higher of health problems such as insomnia, muscle pain and irritability among individuals directly affected – people whose homes had been hit by toxic mud or who lived nearby –, in relation to those not directly affected.⁷

These results are quite similar to those found by two other studies. The first study, conducted in Barra Longa, MG,⁸ aimed to evaluate the health situation of residents by administering questionnaires during a five-day period in 2016 exactly one year after the disaster. The second study was on mental health and was conducted in the districts of Mariana involving local residents or property owners.⁹ The study revealed effects on mental health and discrimination suffered by those affected and exposed, treated as being guilty of the losses caused by the temporary closure of the Samarco company and consequent impact on the municipality's economy, employment and income.

In short, disasters such as the Vale disaster in Brumadinho, apart from the immediate environmental and human harm, completely alter the lives of communities and the normal functioning of municipalities affected in the region. They cause overburdening of local health institutions and systems whilst also creating new scenarios of risks, harm and diseases alongside those that already exist. This produces a complex interaction of infectious diseases and other health conditions thus potentiating chronic diseases. The indirect and long-term complex effects are hard to identify and quantify, but will be felt by the population for years to come on a scale even greater than the area of the valley buried in the mud.

All the different levels and organizations of the Brazilian National Health System (SUS) remain in the Brumadinho region, notwithstanding the state of emergency having been suspended, and will shoulder the greater part of the efforts and expenditure implied by the disaster.

Care, both immediate and permanent, directed towards the most vulnerable population groups, such as those who lost their homes and no longer have water supply and sanitation services, as well as the elderly, children, pregnant women, people with chronic diseases and those with reduced mobility, among others, can help to reduce this impact on their health and the environment. In the medium and long term, prospective planning that takes into account risk scenarios and preventive actions is fundamental. In the medium term, strong articulation is required between

the different areas of surveillance (epidemiological monitoring, hygiene inspection, environmental and occupational health surveillance) and health care, in order to reduce the risks of outbreaks of infectious and parasitic diseases, the occurrence of eye and skin complaints, respiratory, endocrine and circulatory system diseases, mental disorders, injuries and external causes. In the long term there is risk of these diseases combining and overlapping with others, such as neoplasms and nervous system diseases, associated with exposure to heavy metals.

More than ever, articulated and long-term action is needed, involving SUS managers and workers, science, technology and innovation institutions, social movements and other sectors of the population, to prevent and reduce the risks of this disaster which are also lurking in Brazil's hundreds of mining dams.

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