

## The crude oil spill on the Brazilian coast in 2019: the question of public health emergency

Derramamento de óleo bruto na costa brasileira em 2019: emergência em saúde pública em questão

Derrame de petróleo crudo en la costa brasileña en 2019: emergencia de salud pública en cuestión

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A crude oil spill was first identified on the Brazilian coast on August 30, 2019, and has reached 4,334 km of coastline in 11 states of the Northeast and Southeast, with 120 municipalities (counties) and 724 locations, as of November 22, 2019 <sup>1</sup>. The disaster is considered the worst oil spill in Brazil's history and one of the largest on record in the world. The sequence of the phenomena cannot be attributed to chance, rather expressing probabilities that increase as a function of an unsustainable development model, environmental crisis, institutional unpreparedness for the prevention of expanded social and technical events, with obsolete legal frameworks that rarely punish the large conglomerates responsible for them, and discriminatory policies against vulnerable populations, among other weaknesses <sup>2</sup>. The scale of the government's response, particularly that of the health sector, must be assessed in order to minimize the population's health problems and organize effective responses, given the potential occurrence of similar phenomena.

Brazil has been stage to major environmental disasters of global proportions in the last five years. In 2015, the collapse of the Samarco company's Fundão mine tailings dam in Mariana, state of Minas Gerais, considered the largest of its kind on record, contaminated approximately 650 km of riverine and marine territories, with material and health damage that will persist for years. In 2018, involving the same mining conglomerate, the Córrego do Feijão tailings dam collapsed in Brumadinho, also in the state of Minas Gerais, resulting in 254 deaths to date <sup>2</sup>. This represents the largest fatal work accident on record in Brazil. In the mining tragedies, the health sector at the three levels of government played a secondary role, without demonstrating the capacity to ensure quality healthcare for the affected communities.

In this same spectrum, the frequency of non-natural tragedies has increased around the globe, revealing the hazardous unpreparedness of the public health sector to deal with large-scale disasters. Bhopal (1984), in India, with more than 200,000 deaths, Chernobyl (1986), in Ukraine, and Fukushima (2011), in Japan, are examples of such expanded risks. Accidents of similar magnitude to that of the oil spill on the Brazilian coast have increased, underlining the severity of health impacts and the need for organized responses to events characterized as public health emergencies <sup>3</sup>. Examples of crude oil disasters of a global scale include Deepwater Horizon in 2010, which spilled 200 million gallons of oil into the Gulf of Mexico, considered the largest on record, Hebei Spirit in 2007 in South Korea, Tasma

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Spirit in Pakistan in 2003, Sea Empress in 1996 and MV Braes in 1993, both in the United Kingdom, Exxon Valdez in 1989 in Alaska (USA) <sup>4</sup>, and the destruction of the Niger Delta in Nigeria by more than 20 years of oil spills and uncontrolled drilling and production <sup>5</sup>. Accidents of similar magnitude to that on the coast of Brazil have grown, as have the severity of health impacts, highlighting the need to organize emergency public health responses <sup>3</sup>.

This article aims to present a preliminary summary of the possible health harms from the oil spill disaster on the coast of Brazil and reflect on the need to expand the regulatory framework in order for accidents of such magnitude to be considered public health emergencies.

Crude oil is a complex mixture of a variety of known toxins, including volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), hydrogen sulfide, and heavy metals. Exposure occurs by ingestion, absorption through the intact skin, and inhalation. The toxicological risks are severe, both acute and chronic, with special attention to the toxic fractions of petroleum that can lead to death by poisoning, especially associated with aromatic compounds. VOCs, particularly benzene, have been associated with cancers <sup>6,7</sup> and hematologic and immunologic toxicities and renal dysfunction, even at relatively low exposure levels <sup>8</sup>. Other effects such as hepatic and hormonal alterations, respiratory irritation, and mental disorders, especially depression, have been widely described in the literature <sup>9,10</sup>. PAHs include known carcinogenic substances and can alter reproductive and immune functions in women and men <sup>11</sup>, which aggravates risks of exposure for pregnant women and children <sup>12</sup>. Hydrogen sulfide can have acute and chronic effects on the central nervous system such as headache, attention deficit, and memory impairment <sup>10</sup>. The heavy metals found in crude oil such as arsenic, cadmium, chromium, manganese, copper, nickel, vanadium, and lead cause various diseases such as renal injury, neurotoxicity, carcinogenicity, and immunotoxicity <sup>13</sup>. The literature highlights that the true risks and impacts from the presence of spilled petroleum are difficult to measure precisely and that risk analyses underestimate the problems, which can last for decades. Impact assessments have shown the effect on the food chain in areas affected by petroleum pollution for more than 50 years. PAHs concentrations in bivalve species are significant, but they also persist at low levels in fish.

In addition to exposure to the crude oil itself, the economic consequences contribute to mental disorders, especially in populations with greater socioeconomic vulnerability <sup>14</sup>. To date, the crude oil spill has compromised the health of 144,000 artisanal fishers in Northeast Brazil, according to the Brazilian Environmental Agency (IBAMA) <sup>1</sup>, besides those living on the coast in the states of Espírito Santo and Rio de Janeiro in the Southeast. There is a long and important list of workers with workweeks of 90 to 100 hours, with family production in the capture and processing of fish and shellfish in sandy areas on beaches, mangroves, and estuaries that have suffered lasting contamination from the crude oil <sup>15,16</sup>. Approximately 724 fishing and shellfish areas have been hit so far. These are workplaces where families make their living, involving men, women, and children, and these places have not been properly mapped or monitored. Such situations of occupational exposure require emergency health protection measures to reduce long-term harms.

The most serious problem for this potentially exposed population is their financial vulnerability, with a mean monthly income of about BRL 400.00 ( $\approx$  USD 95.00), with extenuating workdays that aggravate relative risks due to the long time exposed to contaminated environments <sup>15,16</sup>. In addition, fishers, vendors, and other informal workers lack personal protection equipment and training in its adequate use. In cases of chronic exposure to chemical agents, there is no access to health services or orientation for conducting periodic tests <sup>15,16</sup>.

Considering the territorial extension and affected population, the oil spill disaster is the equivalent of hundreds of Brazilian refineries and petrochemical factories having their workplaces contaminated and being closed down due to sudden, uncontrolled exposure to petroleum and aromatic hydrocarbons, and without the health sector's protection. Unlike the artisanal fishers suffering from the current contamination with crude oil, in exposure to petroleum products like benzene and aromatic hydrocarbons, exposed formal workers in the petroleum industry work 48-hour weeks, and according to *Ruling n. 3,214/1978* <sup>17</sup>, they are subject to mandatory surveillance with biannual blood tests, even after retirement or job changes, and their patient charts must be kept on record for 40 years.

Three months after this enormous disaster, the Brazilian Ministry of Health had still not taken any emergency health measures. Thus, discordant information was issued by the authorities, predomi-

nantly opinions and commonsense commentary no technical basis, such as the recommendation for a widespread moratorium on the consumption of fish and shellfish in Northeast Brazil, alternating with reports authorizing such consumption. This haphazard approach exacerbated the crisis in the seafood market, drastically compromising the subsistence of hundreds of thousands of workers in the seafood production chain, including a sharp drop in the otherwise robust tourism industry in the affected states <sup>18</sup>.

The predominant official message was confused, disoriented, and thus ineffective in dealing with the disaster, with the dissemination of fake and alarming news, or even versions underestimating the real situation. There was no health crisis cabinet or hotline and social media contact to provide trustworthy real-time information to the population, or official communiqués on the safety of the beaches for bathing, fish consumption, preventive measures, instructions in cases of acute poisoning, or medical follow-up of chronic cases. There was also no availability of urgent and primary care services or precautionary measures to protect pregnant women, children, and the susceptible population in general. No funds were allocated for the specialized laboratory network to assess the quality of seafood and guarantee the food safety of fish and shellfish consumption, monitoring the affected workplaces, training personnel for urgent care and the Family Health Units with unified protocols and case reporting, or mobilization of health surveillance services to critical regions, including Referral Centers in Workers' Health. Only a few technical notes were issued, with insufficient information, and they were not even published until 60 days after the oil spill <sup>19</sup>.

The disorganization and inadequate response led to a widespread appeal to voluntarism, mobilizing thousands of people who were unprotected for removing oil waste, often by hand and without the necessary instructions or equipment – reflecting the lack of financial and human resources, alongside the organizational weakness of health activities. Given the desperate situation in the affected areas, fishers without knowledge of the risk attempted to defend their territories even without protective equipment, clearing the oil waste from the sea, beaches, and mangroves, also as volunteers. Such conditions of vulnerability, marked by financial deprivation and a lack of subsistence alternatives, underscore the need to immediately create a form of compensation for a fishing moratorium on health grounds, in order to avoid the epidemic expansion of the tragedy caused by the spread of poverty-related diseases, especially hunger and malnutrition and mental disorders like depression, observed in mining dam disasters <sup>2</sup> and oil spills across the world <sup>4</sup>.

The majority of the affected population is socioeconomically vulnerable and consists of African-descendent Brazilians, especially the artisanal fishers (with blacks comprising 90% of some fishing communities). This creates another component of iniquity in the form of institutional, health, and environmental racism that has characterized the weaknesses in the country's public policies <sup>20</sup>. The lack of an emergency health policy to protect fishing and maroon communities from this calamity is a symptom of systematic exclusion through policies that deny equal rights and compensatory equity.

Brazil's prevailing regulatory framework on the declaration of a State of Public Health Emergency is based on Ministry of Health *Ruling n. 2,952/2011* <sup>19</sup>, which focuses on infectious-contagious epidemic events, but which allows application to situations that require urgent measures for the prevention, control, and containment of public health risks, harms, and problems, particularly in paragraph "b": "*Disaster situation: event establishing a situation of emergency or state of public calamity acknowledged by the Federal Executive Branch under the terms of Law 12,340 of December 1st, 2010, and that involves direct action in public health*".

A public health emergency can be defined as the capacity of public health and health systems, communities, and individuals to prevent, protect, and respond quickly and recover health conditions, particularly those "*whose scale, timing, or unpredictability threaten to overwhelm routine capabilities*" <sup>21</sup> (p. S9). In the Brazilian context, the regulatory framework supports such a declaration. The absence of this measure delayed the health sector's preparedness in the surveillance and follow-up of the impacts, while ignoring the vulnerable population's protection.

Such government indecision generated unpreparedness, improvisation, inertia, insufficient action, and impromptu approaches by the health sector that greatly expanded the original accident's primary harms. Such political, socioeconomic, and cultural harms had perverse effects on health in the short, medium, and long run, creating conditions that consolidated the tragedy's epidemiological invisibility.

Succinctly, the characteristics of this oil spill disaster on the Brazilian coast clearly indicate the need to have declared a State of Public Health Emergency. The current regulatory framework, even though focused on emergency situations involving infectious-contagious diseases, would have allowed characterizing this as an emergency situation, with organization of the health sector to deal with the catastrophe adequately.

However, we propose a revision of the regulatory framework for emergency health action with greater clarity and in keeping with the references on emergencies in infectious-contagious diseases. The revision should consider the experiences with the health tragedies in Mariana, Brumadinho, and the Brazilian coast. Added to this is the context of potential catastrophes related to oil drilling on the coast of the Pre-Salt Reserve and the environmental crisis resulting from the effects of global warming, among other evidence.

Meanwhile, three tragic situations occurred on the coast of the state of Espírito Santo, virtually opening a Pandora's Box. In the first week of November 2019, the crude oil washed up on the beaches, mangroves, and marine estuaries, which were already contaminated by heavy metals in the toxic sludge from the dam collapse in Mariana in 2015. These two severe toxic components aggravated the events. This intersection was magnified by the lack of emergency health measures, adding a third problem suffered by fishers and the local population in general: government indifference and bureaucratic inertia to deal with health iniquities.

## Contributors

P. G. L. Pena, A. L. Northcross and R. C. F. Rêgo participated in the project's elaboration, the manuscript's preparation, and the final revision. M. A. G. Lima participated in the elaboration of the intermediate text and the final revision and approval.

## Additional informations

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Where it reads:

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It should read:

In addition to exposure to the crude oil itself, the economic consequences contribute to mental disorders, especially in populations with greater socioeconomic vulnerability <sup>14</sup>. To date, the crude oil spill has compromised the health of 360,000 artisanal fishers in Northeast Brazil, according to official data (Brazilian Ministry of Agriculture, Livestock, and Supply; <http://www.agricultura.gov.br/noticias/60-mil-pescadores-artesanais-do-nordeste-va-receber-seguro-defeso-em-novembro>, accessed on 07/Mar/2020), besides those living on the coast in the states of Espírito Santo and Rio de Janeiro in the Southeast. There is a long and important list of workers with workweeks of 90 to 100 hours, with family production in the capture and processing of fish and shellfish in sandy areas on beaches, mangroves, and estuaries that have suffered lasting contamination from the crude oil <sup>15,16</sup>. Approximately 724 fishing and shellfish areas have been hit so far. These are workplaces where families make their living, involving men, women, and children, and these places have not been properly mapped or monitored. Such situations of occupational exposure require emergency health protection measures to reduce long-term harms.