

Technological disasters and public health emergencies: the case of oil spill on the Brazilian coast

Desastres tecnológicos e emergências de saúde pública: o caso do derramamento de óleo no litoral do Brasil

Desastres tecnológicos y emergencias de salud pública: el caso del derrame de petróleo crudo en la costa brasileña

*Eduardo Hage Carmo*¹
*Maria Gloria Teixeira*²

doi: 10.1590/0102-311X00234419

Introduction

In late August 2019, an oil slick began to wash up on the coast of Northeast Brazil. To date, the slick, later identified as crude oil/petroleum, is assumed to have come from a spill from some tanker ship in transit along the Brazilian coast. The first oil slick was reported in the states of Pernambuco and Paraíba¹, and as of late November the spill had hit all states of the Northeast, including more than 400 locations, subsequently reaching the Southeast in the states of Espírito Santo and the northern coast of Rio de Janeiro. The disaster thus covers a huge geographic area, with serious environmental harm and an impact on subsistence conditions for countless human communities that depend on fishing and tourism.

Despite the exposure of a large contingent of persons who struggled to contain or remove the oil slicks and residues from the sea and beaches and the fact that many of these people came into direct, unprotected contact with this toxic waste, there have been relatively few reports of human cases with acute clinical manifestations related to such exposure. However, these reports only refer to cases notified to the Brazilian Ministry of Health, probably failing to represent all the exposed individuals that developed symptoms. For example, the state of Pernambuco recorded some 90% of all the reports, while several other states seriously affected by the disaster failed to report any cases of acute toxicity at all². Data on the 149 cases notified in Pernambuco as of November 15 indicated that the exposure was mainly by the cutaneous and respiratory routes, and that the most frequent signs and symptoms were headache, nausea, dizziness, skin irritation, shortness of breath, itching, vomiting, and diarrhea³, with no reported serious cases or deaths to date.

Although the health sector's reports do not contain this information, according to the media coverage, the main individuals exposed to the oil waste can be classified in two groups: persons that worked in the containment and removal of oil and cleaning the beaches (volunteers, NGOs, environmental agency staff and defense and civil defense personnel) and workers involved in artisanal fishing (fishers and crab fishers and their families). Another source of exposure is consumption of contaminated fish and shellfish, as well as occasional exposure of tourists and bathers, although direct contact with the oil tends to be lower in these other groups.

The pollutants to which thousands of people were exposed are a complex mixture of hydrocarbons associated with highly toxic compounds like benzene, toluene, and xylene^{4,5}. It is thus crucial

¹ Fundação Oswaldo Cruz, Brasília, Brasil.

² Instituto de Saúde Coletiva, Universidade Federal da Bahia, Salvador, Brasil.

Correspondence

E. H. Carmo
Fundação Oswaldo Cruz.
Campus da UNB. Av. L3
Norte, Brasília, DF
70910-900, Brasil.
ehcarmo@gmail.com



to consider the risk of chronic effects, especially in more vulnerable population groups (pregnant women, elderly, and children), as reported in studies on the effects of disasters with oil spills, affecting large areas in other countries (Gulf of Mexico in 2010 and Alaska, USA, in 1989)^{6,7} and which led to teratogenic, neurological, carcinogenic, and psychological effects, among others.

However, a more precise estimate of this risk is difficult at present and depends on a series of factors such as the oil's specific composition, potential alterations occurring in such products due to atmospheric and marine conditions ("weathering"), interaction with other elements, the time the oil remains in the environment, and characteristics and time of the population's exposure, among others^{2,6}.

The repercussions from this environmental disaster involve products that are potentially toxic to human health in such an extensive area, associated with uncertainties concerning the long-term harmful effects for the affected populations and criticisms for the delay and insufficiency in the government's response. All this raises a question for the public health debate^{4,5}, namely, in the face of this disaster, should Brazil have declared a Public Health Emergency of National Concern?

To contribute to this debate, a preliminary question also needs to be answered concerning the possible classification of this disaster as a public health emergency. It is thus important to analyze some concepts and definitions used in the approach to events involving risk to the population's health and that require immediate public health measures.

On the concept of public health emergency

The term "public health emergency" had already been used in legislation and scientific publications in the United States since the 1980s⁸ to describe various acute situations such as disasters, epidemics, intentional events involving the use of chemical, biological, and nuclear weapons, or even public health problems involving drug addiction^{9,10}. In fact, whether in legislation or scientific publications, there is no clear definition of the term, but descriptions of the types of events that can be considered public health emergencies for purposes of using the term to justify immediate control measures, whether those restricting individual rights or those allowing the mobilization of human and financial resources.

However, it was not until the International Health Regulations (IHR) were approved in 2005 that the term "public health emergency" has been used more frequently. The Regulations present the procedures for analyzing events that may represent a Public Health Emergency of International Concern, defined as an "*an extraordinary event which is determined, as provided in these Regulations, to constitute a public health risk to other States through the international spread of disease and to potentially require a coordinated international response*"¹¹ (p. 9). The procedures developed in the sphere of IHR/2005 (which include a decision-making instrument and a guideline) facilitate the analysis of each health event in context for a specific population, time, and space.

Further according to IHR/2005, the events that can constitute public health emergencies are not limited to infectious diseases or to harms to the population's health (cases or deaths from a given disease). The events can also include risk situations for their occurrence (which is the definition of a public health event per se). Thus, the analysis of these events favors more timely definition and adoption of measures, before the harm to the population's health grows and becomes severe¹².

In Brazil, the term used in IHR/2005 was adapted to the detection, analysis, and response to events that represent risk of dissemination or spread in the national territory. From this perspective, the term was initially defined as an "*event that poses a risk of the dissemination or propagation of diseases to more than one Federative Unit (State or Federal District), with priority on immediately notifiable diseases, and other public health events (regardless of nature or origin), found, after risk assessment, that may require an immediate national response*"¹² (p. 21). In 2011, an Executive Order was issued that does not provide a definition but does specify three situations that can characterize a public health emergency: (a) epidemiological (outbreaks and epidemics); (b) disasters; and (c) failure in healthcare¹³. Except for the occurrence of disasters, an emergency would only be characterized by the presence of harm to human health, while other situations of immediate risk of production or dissemination of diseases would not be considered emergencies (for example, epizootics and risks related to health products and technologies).

As seen in various legal instruments and scientific publications, disaster situations can constitute a public health emergency. But this raises the following question: how to apply the definition of public health emergency to disaster situations?

Contribution to the classification of disasters as public health emergencies

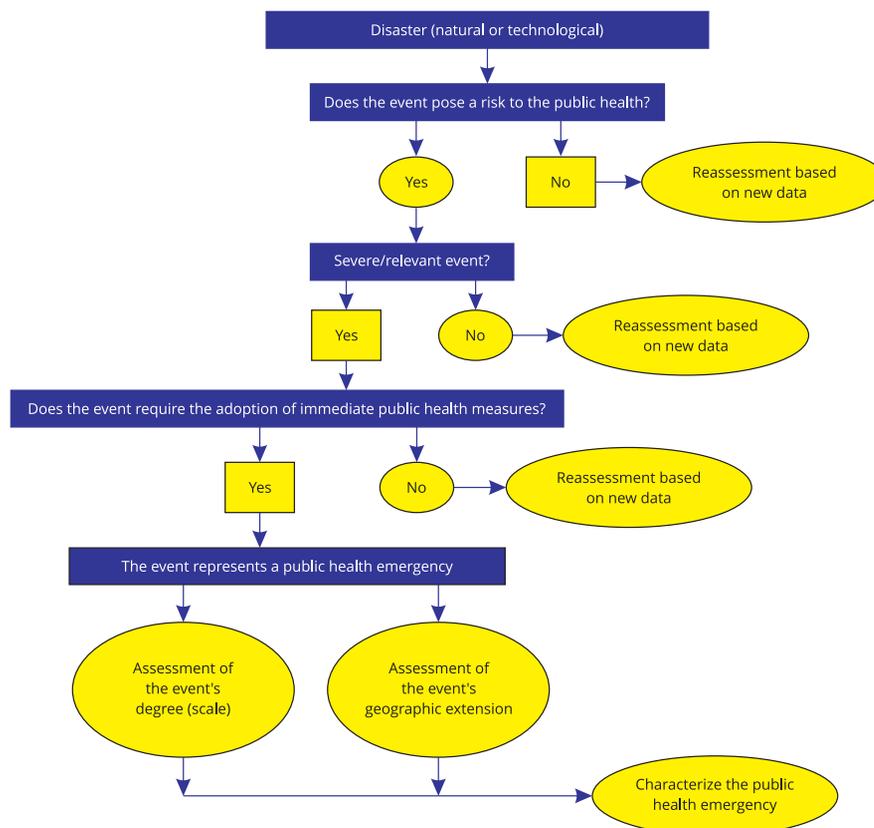
The definition of disasters that we adopt comes from international agendas for risk reduction in disasters, as follows: a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts¹⁴.

In order to contribute to the assessment and classification of disasters, we now present a proposal for an algorithm, consisting of leading questions formulated in stages (Figure 1).

The first stage should analyze whether the disaster involves a risk to public health. In this stage, a significant risk may not be present during the disaster, that is, although generating environmental or economic impacts, there would not be direct repercussions on the human population's health. An example would be a disaster occurring in an uninhabited area, without the consequences reach-

Figure 1

Flow chart for assessing and classifying disasters as public health emergencies.



ing human populations, or situations in which the population has been evacuated in time to other locations in which the dwellings, other installations, crops, and other assets are situated outside the risk area.

The second stage, if the disaster involves risk to public health, should analyze whether the impact (real or potential) to public health is relevant (the potential to affect large numbers of people, with severe cases, or large numbers of deaths).

The third stage assesses whether the disaster should trigger immediate public health measures besides those targeted to the disaster's containment/mitigation or its effects on the environment.

Based on these questions, which must be answered in each event's specific context, the event should be considered a public health emergency when a disaster is identified that involves risk to the public health, produces relevant impact (real or potential), and requires the immediate adoption of public health measures.

After the disaster's classification as a public health emergency, the next step is its qualification, where the proposal is to analyze two dimensions: (a) assessment of the emergency's degree, based on a qualitative and/or quantitative scale and (b) the event's geographic extension. These stages are important to the extent that they allow defining the disaster as a public health emergency of local, regional/state, or national concern, which implies the adoption of certain measures with their intensity, duration, and scope adjusted to their level of severity/relevance.

All these stages should be reassessed periodically, based on the data and information produced during the investigation, activities to control/mitigate the problems, and follow-up of the disaster's effects, which allows modifying the result of the analysis over time.

Since this is a theoretical exercise, its application and improvement should be assessed in real-world disaster situations, such as the oil spill on the Brazilian coast, which we present below.

The case of the oil spill on the Brazilian coast

Based on the proposed procedures, the analysis of this disaster indicates that:

- (a) The disaster involves risk to the public health: cases were detected with signs and symptoms consistent with acute toxicity by exposure to the oil;
- (b) The public health risk is relevant: although all the cases thus far have presented mild clinical symptoms, one cannot rule out the possibility of more severe medium and long-term effects, considering the nature of the exposure, type of product, and reports of events in other countries with similar characteristics;
- (c) The event required the adoption of immediate public health measures, especially the recommendation of avoiding exposure to the oil without adequate protection, immediate case notification, provision of medical care, and clinical, laboratory, and psychological follow-up of exposed persons, aimed at monitoring the potential occurrence of medium and long-term effects. Another measure that bears a direct relationship to the health of the affected populations, and which should be implemented, is to guarantee subsistence means for fishers, crab fishers, and their families that were seriously affected by the disaster, in order to prevent a state of food insecurity and psychological harms, among others.

Based on this assessment, consequently, this disaster should be classified as a public health emergency. The next step is thus its qualification. In this context:

- (a) At present, the degree of emergency can be defined as medium (if we adopt a scale with three levels), considering the current uncertainties as to the severity of the medium and long-term adverse effects; and
- (b) Considering the geographic extension of the disaster and its effects on the population, the event can be defined as having a national scope.

Importantly, this analysis does not aim to assess the pertinence of the Declaration of Public Health Emergency, for which there are established rules, which do not address the matter of definition of emergency, as mentioned. For this discussion, we propose that other factors should be included to support the decision, especially related to the need (purpose) of declaring the emergency.

As mentioned, according to the international literature and legislations, the term "public health emergency" is used to justify, support, or allow the adoption of timely measures to protect the public

health. Without the declaration, the adoption of such measures is not feasible or enforceable. In the specific case of the oil spill, the public health measures that have been adopted and those which will be (or should be) implemented¹⁵ do not necessarily require declaring a state of emergency. Equally relevant is that a state of public health emergency is only justified for a limited time, while for some measures that need to be adopted (monitoring exposed persons, for example), it is impossible to set this time limit. Importantly here, we are not analyzing the need, pertinence, and specificities of measures for containment, mitigation, recovery, and reconstruction related to the disaster, for which there are specific guidelines.

Regardless of whether a State of Public Health Emergency is declared, the government is responsible for adopting all measures to assist the affected populations with sufficient financial support to reduce the damages. This means environment cleanup, healthcare provision, monitoring of exposed individuals to detect medium and long-term adverse health effects, and support for sufficiently comprehensive and robust scientific studies to produce knowledge and provide inputs to deal with problems resulting from the disaster.

Conclusion

The definition of acute public health events in terms of their classification as public health emergencies is always challenging. While the criteria for infectious disease epidemics are well-established (even though there is always tension in their recognition by health authorities), the criteria and procedures are still insufficiently developed for other events. One factor we identify is the insufficient scientific input on the definition of public health emergency, although the concept's use is widely applied to the public health field in highly diverse situations.

IHR/2005 provided some parameters that allow adapting the Regulations to diverse events involving risk to the population's health. The adaptation of these criteria to disaster situations requires an additional effort, to the extent that the disaster per se represents a risk situation for the occurrence of public health emergencies, necessarily raising doubts as to whether every disaster should be considered an emergency. The greater the disaster's environmental impact, the more tenuous (and tense) the limits become for its classification. Another source of conflict in understanding the problem is that characterization of an event as an emergency is generally confused with declaring a state of emergency. In our opinion, these are different questions and should be treated appropriately, considering the implications and mainly the triggering of necessary measures to defend the affected populations' health.

We hope that the procedures proposed here can be improved to assist the assessment of other public health events, especially disasters, to promote a better understanding of their characteristics and the potential to pose public health emergencies, as well as to support urgent measures to reduce the harm to the affected populations' health.

This invitation is timely. Various international agendas, led by global efforts to prepare for climate changes, have highlighted the need for collaboration between different sectors on risk reduction efforts in disasters and public health emergencies^{16,17,18}.

Contributors

Both authors participated in the article's conceptualization, writing, and final revision.

Additional informations

ORCID: Eduardo Hage Carmo (0000-0001-6343-9967); Maria Gloria Teixeira (0000-0003-3318-3408)

References

1. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. Manchas de óleo/Litoral brasileiro. <https://www.ibama.gov.br/manchasdeoleo> (accessed on 06/Dec/2019).
2. Secretaria de Vigilância em Saúde, Ministério da Saúde. Vigilância em Saúde: monitoramento das manchas de óleo no litoral do Nordeste. *Boletim Epidemiológico* 2019; 50(32). <http://portalarquivos2.saude.gov.br/images/pdf/2019/outubro/31/Boletim-epidemiologico-SVS-32.pdf>.
3. Secretaria de Saúde do Estado de Pernambuco. Intoxicações exógenas relacionadas à exposição ao petróleo no litoral de Pernambuco. Informe nº 05/2019. <http://vigilanciatalhadorpe.blogspot.com/>.
4. Programa de Pós-Graduação em Saúde, Ambiente e Trabalho, Faculdade de Medicina, Universidade Federal da Bahia. Pela declaração do estado de emergência em saúde pública para controle dos riscos decorrentes da maior tragédia de contaminação pelo petróleo na costa do Brasil. <https://sat.ufba.br/pt-br/nota-do-ppg-sat-sobre-contaminacao-por-petroleo-na-costa-do-brasil> (accessed on 06/Dec/2019).
5. Flaeschen H. Derramamento de petróleo é risco para saúde da população. *Abrasco Notícias* 2019; 30 out. <https://www.abrasco.org.br/site/outras-noticias/saude-da-populacao/derramamento-de-petroleo-e-risco-para-saude-da-populacao/43706/>.
6. Goldstein BD, Osofsky HJ, Lichtveld MY. The gulf oil spill. *N Engl J Med* 2011; 364:1334-48.
7. Picou JS, Martin CG. Long-term community impacts of the Exxon Valdez oil spill: patterns of social disruption and psychological stress seventeen years after the disaster. <https://www.arlis.org/docs/vol11/B/243478793.pdf> (accessed on 06/Dec/2019).
8. U.S. House of Representatives. United States Code. 1982 Edition. Supplement I. Titles 42-50. Washington DC: Government Printing Office; 1984.
9. Haffajee R, Parmet WE, Mello MM. What is a public health "emergency"? *N Engl J Med* 2014; 371:986-8.
10. Salinsky E. Public health emergency preparedness: fundamentals of the "system". Washington DC: National Health Policy Forum; 2002. (NHPF Background Paper).
11. World Health Organization. International health regulations (2005). 3rd Ed. Geneva: World Health Organization; 2016.
12. Carmo EH, Penna G, Oliveira WK. Public Health Emergencies: concept, characterization, preparation and response. *Estud Av* 2008; 22:19-31.
13. Brasil. Decreto nº 7.616, de 17 de novembro de 2011. Dispõe sobre a declaração de Emergência em Saúde Pública de Importância Nacional – ESPIN e institui a Força Nacional do Sistema Único de Saúde – FN-SUS. *Diário Oficial da União* 2011; 18 nov.
14. United Nations Office for Disaster Risk Reduction. Terminology. <https://www.unisdr.org/we/inform/terminology> (accessed on 06/Dec/2019).
15. Secretaria de Vigilância em Saúde, Ministério da Saúde. Vigilância em Saúde: monitoramento das manchas de óleo no litoral do Nordeste. *Boletim Epidemiológico* 2019; 50(34). <http://portalarquivos2.saude.gov.br/images/pdf/2019/novembro/13/Boletim-epidemiologico-SVS-34-V1.pdf>.
16. United Nations Office for Disaster Risk Reduction. Sendai framework for disaster risk reduction: 2015-2030. Geneva: United Nations Office for Disaster Risk Reduction; 2015.
17. United Nations Office for Disaster Risk Reduction. Bangkok principles for the implementation of the health aspects of the Sendai framework for disaster risk reduction 2015-2030. Geneva: United Nations Office for Disaster Risk Reduction; 2016.
18. United Nations Framework Convention on Climate Change. Adoption of the Paris Agreement. Report n. FCCC/CP/2015/L.9/Rev.1. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement> (accessed on 06/Dec/2019).

Submitted on 07/Dec/2019

Approved on 13/Dec/2019