

Public Health Emergencies: concept, characterization, preparation and response

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Conceptual Aspects

In the last two and a half decades, the world has undergone major transformations that have impacted upon public health and affected the daily lives of people and the global economy. During this period, polio was eradicated and all other immunopreventable diseases were greatly reduced in the Americas and most other regions. However, there has also been an upsurge in epidemics of old and familiar illnesses like cholera, yellow fever and dengue, as well as the emergence of new diseases, such as Aids, ebola hemorrhagic fever, hantavirus, West-Nile virus, severe acute respiratory syndrome and bird flu, which have affected large contingents of populations or present risk of widespread dissemination. These epidemics have been associated with important changes occurring in the world, such as increased human transit and intensified trade and exchange among nations.

During this same period, perception and recognition of important changes in the pattern of infectious disease occurrence or the dynamic of transmission of their agents have stimulated intense reflection on the factors involved in this process. The signs of these changes have taken various forms, such as the emergence of new infectious agents or the modification of existing agents, conferring greater virulence and epidemic capacity; more capacity to infect different animal species; the development of antimicrobial resistance; an increase in the occurrence of infectious diseases due to known factors (migrations, climate change, lax public health measures) and even unknown variables; and the introduction of diseases into previously unaffected areas. The development of new diagnostic methods and clinical and epidemiological studies have made it possible to detect infectious diseases hitherto unknown and to draw etiological connections between agents and known diseases (Barreto et al., 2006).

In an attempt to contextualize this process, the American Institute of Medicine (1992) coined the term “emerging infectious diseases”, which was later modified by the Centers for Disease Control and Prevention (CDC) to “diseases

of infectious origin whose incidence in humans has increased within the past two decades or threatens to increase in the near future” (CDC, 1994). The concept here is imprecise, as by defining an emerging infection as one that surged within the last two decades artificially establishes a timeframe and does not determine the territory in which the event occurs. As the document was drafted around concerns for the problem of these infections in the United States, it is fair to assume that the unmentioned territory is indeed that country. Another imprecision is that any increase in incidence of an infectious disease can be characterized as an emergency, regardless of the magnitude and historical trends (Barreto et al., 2006).

In 2003, the Institute of Medicine updated its 1992 document, modifying its definition to “either a newly recognized, clinically distinct infectious disease, or a known infectious disease whose reported incidence is increasing in a given place or among a specific population” (Institute of Medicine, 2003, p.32). Whilst this update makes the concept more precise in spatial terms, the issue of what magnitude of incidence should be reached to qualify as an emerging infectious disease remains unresolved.

In order to achieve more precision in the definition of infectious diseases as emerging it would require a contextualized analysis of each disease that considers the population, territory and historical moment in which the spate occurs. As such, the best use of this concept ought to consider whether or not the infectious disease and its emergence or increase in incidence is epidemiologically significant to a given population or territory.

With the 2005 World Health Assembly’s approval of the latest International Health Regulations (hereinafter IHR 2005) (WHA, 2005), a new concept was established that was no longer limited to infectious diseases. Among the important challenges facing the revised IHR was to devise more adequate instruments for tackling public health problems that had surged, on a global scale, within recent decades, and to perfect the measures adopted to address old problems that had modified over time, while avoiding unnecessary interference with international traffic and trade (Fidler & Gostin, 2006). During the IHR 2005 revision, in a bid to establish measures to broaden national capacities to detect and respond to the risk of disease-spread between countries, a core focus of the discussion was on what were termed “public health emergencies of international concern”.

A public health emergency of international concern is defined under the IHR 2005 (WHA, 2005, p.6) as:

an extraordinary event which is determined, as provided in these Regulations:

- to constitute a public health risk to (an)other State(s) through the international spread of disease, and
- to potentially require an orchestrated international response

Also according to the IHR 2005 definitions, “Event means a manifestation of disease or an occurrence that creates a potential for disease” (WHA, 2006,

p.6). Events are not, therefore, limited to situations in which damage has actually occurred (cases or deaths), but also includes factors that pose such a risk. Nor are they restricted to transmittable diseases, but also consider health problems of a chemical or radionuclear nature, or those caused by environmental disasters, such as earthquakes, floods or drought.

As such, the new terminology adopted by the IHR (2005) might well provide a more precise and applicable definition (for national epidemiological surveillance systems) of events that warrant monitoring, containment strategies and action to avoid or diminish the risk of international disease-spread. Furthermore, in dealing with the risk of the dissemination of disease, it allows for the adoption of preventive measures to stave off damage to the population. With these characteristics, this concept proves more precise than the notion of emerging infectious diseases and broader than the concept of an epidemic, insofar as these are restricted to situations in which damage actually occurs. Furthermore, some emerging infectious diseases and outbreaks may constitute public health emergencies of international concern where there is a risk of cross-border dissemination.

For an event to be considered of international concern and therefore come under the scope of the Regulations, certain characteristics of the event and its context must first be assessed. This assessment follows a decision instrument (IHR 2005 Appendix 2) for the analysis of certain criteria. Assessable events range from specific diseases to those still pending nosological definition. There are two forms of assessment for specific diseases: (i) for diseases such as smallpox, poliomyelitis due to wild-type poliovirus, human influenza caused by a new virus subtype or Severe Acute Respiratory Syndrome (SARS), WHO notification is compulsory, regardless of the scope of its manifestation within the population; and (ii) for other diseases that, under certain conditions, pose a heightened risk of international dissemination, a decision algorithm should be run to ascertain whether the incidence or outbreak classifies as a notifiable event. A specific disease or event should always be notified to the WHO when certain contextualized criteria involving the population, timespan and range are satisfied, as well as aspects that may impact on international transit and trade.

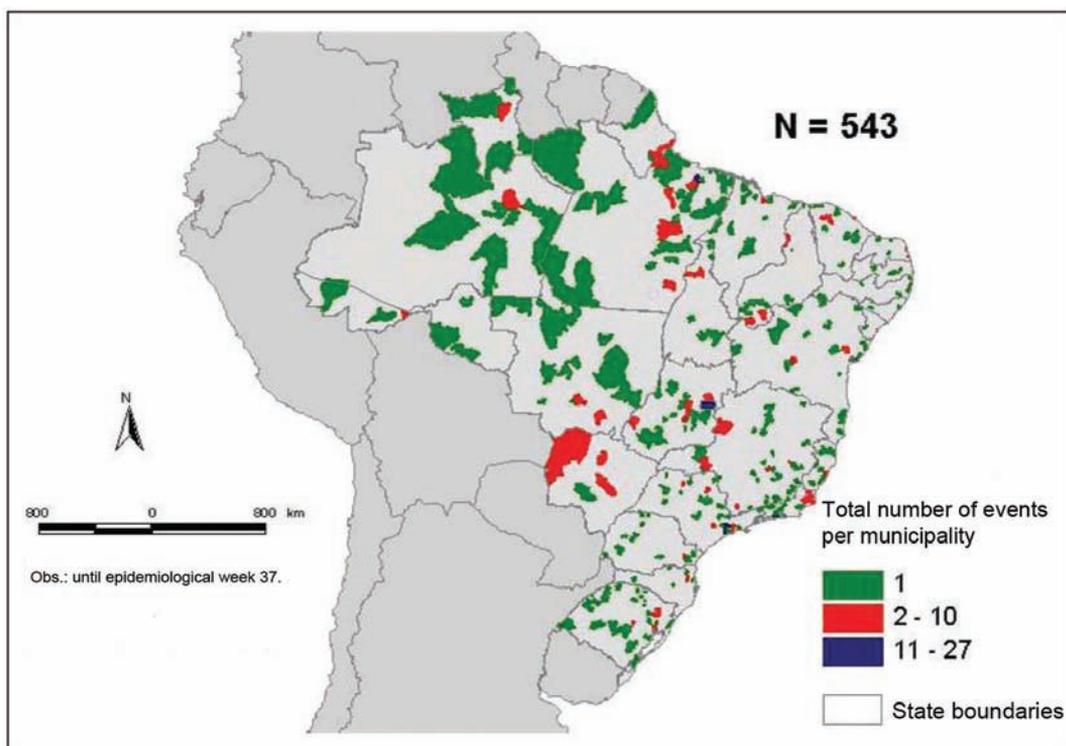
For the purposes of the present analysis we will use the concept of a public health emergency of national concern adapted from one established in the IHR (2005). This concept has been adapted by the Health Surveillance Secretariat of the Ministry of Health (SVS/MS) under the following terms: any event 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. According to the Health Ministry Declaration on immediately notifiable diseases (2006), an event is defined as: any case, whether suspected or confirmed, of an immediately notifiable disease; any group of cases that presents an unexpected or

unusual epidemiological pattern (for known diseases); any spate of new diseases; epizooty and/or animal deaths that may be associated with diseases that can occur in humans (for example, epizooty caused by yellow fever); other unusual or unexpected events, including risk factors with the potential to propagate diseases, such as environmental disasters and chemical/nuclear accidents.

Public Health Emergencies in Brazil

In what follows we shall look at public health emergencies of national concern that were notified to the SVS/MS through the implantation of the Center for Strategic Information and Response on Health Surveillance (Cievs) between March 2006 and September 2008. This center, which will be described further on, has enabled the continuous monitoring of events that considered potential public health emergencies of national concern after assessment similar to that adopted by the WHO and the decision instruments created by the IHR (2005).

During the specified period, the Center was notified of 543 cases of potential public health emergencies of national concern, with roughly three events per epidemiological week. It must be stressed that, in accordance with the definition of ‘event’ set down in Declaration 05/2006, each case of a notifiable



Source: MS/SVS/Cievs

Figure 1 – Distribution of possible public health emergencies of national concern per municipality. Brazil, March 2006 to September 2008.

disease represents a unit of analysis, which means that, when there is a spate of epidemiologically-related cases, the number of events is blown out of proportion.

The number of individuals affected by possible public health emergencies of national concern (except disasters) during the period was 281,060, with 765 deaths. Disasters affected a far greater number of people (888,540), but not necessarily causing death or injury. Of events involving infectious diseases, the most serious was dengue, which affected 214,091 people during the specified period, followed by seasonal influenza (26,236) and food-borne diseases (17,455).

If we look at the distribution of events per State and municipality (Figure 1), we can see that notifiable events occurred in every State, but in greater number in São Paulo (11%), Minas Gerais (9%), Rio Grande do Sul (9%) and Pará (8%). However, this distribution is not homogeneous throughout the period, whether due to improvements in detection capacity in the States or the concentration of emergencies in particular months or years.

Grouping the events per mode of transmission, similarity of clinical presentation or nature of exposure, we can observe a predominance of anthroozoonoses and diseases transmitted by food and water, representing 29.1% and 22.5% respectively (Table 1). Among the anthroozoonoses, 72% concerned public health emergencies sparked by outbreaks of yellow fever (where each human infection of epizooty constituted an event) between December 2007 and May 2008, as well as acute outbreaks of Chagas disease, mostly through oral transmission.

Preparation and Response to Public Health Emergencies

In this section we shall discuss the main Ministry of Health activities that have helped strengthen national capacity to detect, prevent and

Table 1 – Group of events notified to the Cievs between March 2006 and September 2008

Group of events (notification)	n	%
Zoonosis	158	29.1
Water/food-borne diseases	122	22.5
Neurological diseases	47	8.7
Epizootics	39	7.2
Events of unspecified etiology	30	5.5
Exanthematic diseases	29	5.3
Vector-borne diseases	25	4.6
Respiratory diseases	23	4.2
Adverse events related to products and medical procedures	21	3.9
Unusual events	15	2.8
Hospital infections	13	2.4
Exogenous intoxication	13	2.4
Disasters	8	1.5
Total number of events (up to SE 37):	543	100.00

Source: MS/SVS/Cievs

control public health emergencies. Alongside state and municipal initiatives, these have sought to provide the country and its population more adequate protection against such emergencies.

Implantation of the Strategic Information and Response Center on Health Surveillance (Cievs) and the National Public Health Emergency Alert and Response Network

The Center has been operating since March 2006 with the goal of detecting and managing public health emergencies and coordinating the appropriate response action alongside the Health Ministry and state and municipal health departments. An organ of the National Health Surveillance Secretariat, the Center functions 24 hours a day, 365 days a year and boasts a technological structure that allows it to maximize the use of strategic information and communication with other management organs, such as the Single Health System (SUS). The Center bolsters the system's capacity to respond to public health emergencies of national concern and may constitute a fundamental tool for tackling pandemics. It is a part of the Global Alert and Response Network – Goarn, made up of Centers dedicated to detecting and orchestrating swift action against public health emergencies with a view to stemming potential international disease dissemination. In addition to the Strategic Health Operation Center – SHOC, located at the WHO headquarters in Geneva, Switzerland, there are centers in the United States, Canada, Mexico, Chile and Switzerland (EU). Brazil was the third country in Latin America to structure its own alert and response center.

In order to improve alert and response capacity to public health emergencies nationwide, a great deal of investment has gone into establishing the Cievs Network, made up of monitoring units and rapid response teams in State Health Departments and Municipal Health Boards. These units are structured along the same lines as CIEVS and are adapted to suit the needs and capacities of each Secretariat. In October 2008, the Network already had twenty centers under implementation or already functioning, and the goal is to have centers operating in every state and capital municipality by 2011.

The Center uses information from notifications made by health professionals, services and municipal and state health Secretariats. Notification can come via institutional e-mail, a 0800 freephone number or directly through the SVS/MS website (www.saude.gov.br/svs), where there is a special field for this end. Unofficial notifications (rumors) are followed up through daily monitoring in the press (clippings), RSS feeds (eg: Google Alert, or similar), through Promed or by accessing the websites of international organization such as the WHO, CDC in the US and health institutions in other countries.

The Center's use of new indicators for tracking public health emergencies has made it possible to evaluate the Health Surveillance System's success in detecting and responding to emergencies. The following indicators were created:

(i) notification – time (in days) between the date of the onset of the event or the appearance of the symptoms of the first case(s) and the date of receipt of notification by the Center; and (ii) closure – time (in days) between the date of notification to the CIEVS and the closing of the case. According to these indicators, the average for notifications during the assessment period was ten days, while the average for closure was fifteen days. The continuation of the assessment of these indicators annually and their validation and improvement will make it possible to assess the performance of the CIEVS Network and other components of the Health Surveillance System in detecting and responding to public health emergencies.

Training of Health Professionals to Investigate and Respond to Public Health Emergencies

Since 2000, in collaboration with the CDC, the Ministry of Health has been running a program entitled Training in Epidemiology Applied to the Health Service (Episus), with 59 professionals already capacitated and 19 currently undergoing training. This two-year training program, with fieldwork and theoretical contents, prepares public health professionals to detect, investigate, analyze and respond to public health emergencies. Though initially geared toward future members of the Ministry of Health SVS teams, the program has recently been extended to professionals from other Health Service institutions (National Sanitary Surveillance Agency, state and municipal health Secretariats).

In recent years, there has been a drive to decentralize this training to include state health Secretariat staff, accompanying the implementation of State-based rapid response units, with the aim of ensuring that every State in the Federation has professionals suitably trained and equipped to detect, investigate and respond to public health emergencies in this field of work.

Today, the program is part of the CIEVS Network, allying the structure and the instruments needed to identify and monitor emergencies with professionals trained in epidemiological investigation and emergency response.

Since the program was set up, its staff have been responsible, in conjunction with other professionals from the Ministry of Health, state and municipal health Secretariats, for investigating, clarifying and resolving 157 public health emergencies, some in collaboration with international entities, such as the handling of a cholera outbreak in Guinea-Bissau in 2008.

In order to perfect the CIEVS Network, the Ministry of Health is structuring a specialization course in emergency monitoring and epidemiological fieldwork, designed to prepare for rapid emergency response and to re-format the Basic Course in Health Surveillance by adding remote-learning technologies and environmental and sanitary surveillance components. As such, alongside Episus, the CIEVS Network will have three complementary professional training strategies at its disposal in tackling public health emergencies.

Implantation of the Hospital Epidemiological Vigilance Network

To boost the early detection of serious diseases with potential for dissemination within hospital environments and to promote more interaction with hospitals as a source of notification in epidemiological surveillance, investment is being made in hospitals nationwide with a view to setting up and reinforcing hospital epidemiological surveillance units. Between implantation in 2005 and October 2008, a total of 192 units have been established or supported by Ministry of Health.

Strengthening Laboratory Capacity

In recent years, a network of public health laboratories has been built and expanded. Today, there are laboratories equipped to detect the main infectious diseases with potential for dissemination in all of the states of the Federation and in the Federal District, as well as three laboratories of national and international reference and fourteen located along the border. Through the Ministry of Health and State Health Departments, the network receives the funding and strategic supplies it needs to diagnose all the main diseases subject to epidemiological surveillance and to detect public health emergencies nationwide. In a strategic bid to better equip the network with modern and timeless methods for laboratory diagnostics, investment has been made to bring molecular biology to Central Laboratories throughout the federation. Furthermore, in order to assure biosecurity at the most strategic laboratories in the network, biosecurity norms were introduced and investment has been made to bring twelve laboratories up to security level 3.

Preparations for a flu pandemic

Given the possibility of an epidemic of influenza caused by some new virus subtype, the Ministry of Health, in conjunction with other health organs under Federal Government jurisdiction, has been structuring the health service to respond swiftly in the event of potential pandemics. Among the measures implemented are: the drafting and revision of a National and state-based pandemic preparation plans; the establishment of an Inter-ministerial Executive Group, responsible for managing the Plan and tracking the actions of the various Federal Government organs; the acquisition and production of provisions and supplies – such as the acquisition of anti-viral drugs and efforts to increase national capacity to produce influenza vaccines through the Butantan Institute, both for use during pandemics and for “seasonal” flu campaigns; the acquisition of supplies and training to equip the national public health laboratory network to detect influenza viruses, including potentially pandemic strains; the monitoring of flu viruses in migratory birds – in conjunction with the Ministry of Agriculture - through serological tests conducted at resting and wintering sites; the introduction of immediate notification of cases or outbreaks of a new subtype

of human influenza; the drafting of specific preparation plans in the areas of ports of entry (ports and airports), agriculture, communication, logistics, defense and civil defense.

Implementation of the International Health Regulations (2005)

Among the initial steps toward IHR 2005 implementation in Brazil, and with the aim of coordinating this process, the Ministry of Health nominated the SVS/MS as the National Focal Point. In order to secure permanent support in its strategic activities for IHR (2005) implementation, the SVS/MS, in turn, designated the Instituto de Saúde Coletiva (ISC/UFBA) as its Collaborator Center. Chief among the activities in-course at this Institute are the fine-tuning of the decision instrument for classifying public health emergencies and assessing the basic alert and response capacities outlined below.

Since 2002, the Ministry of Health has been evaluating and helping fine-tune the decision instrument for the classification of events that could constitute Public Health Emergencies of International Concern by analyzing the reports on investigations into epidemiological events detected across the country. Since 2006, the SVS/MS has been collaborating with the WHO in its assessment of the decision instrument and in the development of a guideline for its application. This guideline will make the decision instrument more precise and homogeneously applicable among and within nations.

Since 2000, Brazil has been developing concerted actions with Mercosul member states and other Latin-American nations, initially within the scope of IHR revision, but also, from 2005 onwards, with IHR implementation regionwide. Among the strategic activities under development is the assessment of basic alert and response capacities (Appendix 1, IHR 2005). The Mercosul member states drew up an instrument to evaluate basic epidemiological alert and response capacities at international points of entry (ports, airports and borders) and has been helping the Pan-American Health Organization/WHO to make it available for use by other American nations so that evaluations can be conducted in ways that are commensurate with the health service realities in the various countries of the region.

With the availability of this instrument, the SVS/MS, in conjunction with the ISC/UFBA, started evaluating these capacities in order to take a snapshot of the present state of epidemiological surveillance services, public health laboratories and network for public health emergency detection and response, and identify improvement needs and investment priorities. This activity is scheduled to continue until June 2009 and will cover all three levels of the alert and response network. Another instrument developed by Mercosul member states to assess basic capacities at international ports of entry is being implemented by Anvisa, the National Health Surveillance Agency, at ports, airports and border checkpoints handpicked according to epidemiological criteria and levels of flux of people, goods and merchandise.

The next step is to structure a National Prepare and Response to to Public Health Emergencies, as required by the IHR. This plan will aggregate all of the isolated initiatives and plans in order to identify common actions and strengthen specific measures with a view to optimizing resources and maximizing ability to respond as needed.

Discussion

The new epidemiological scenarios represented by the emergence of new transmissible diseases, modifications in the habitual patterns of transmission of existing diseases, an increase in the importance of non-communicable disease aggravators on the public health agenda, the emergence and propagation of diseases, injuries and disasters caused by environmental degradation, alongside new strategies for the prevention and control of diseases with potential for international propagation incorporated into the IHR (2005) indicate a need to readjust and refine concepts, structures, processes and practices in health surveillance in a manner that is articulated with the health service network.

Evidence of global climate change and its possible effects on the way diseases occur (Intergovernmental..., 2007), characterized by an increase in the magnitude and geographic distribution of vector-borne and zoonotic diseases and the intensification of environmental disasters all urge toward a reformulation of the strategies currently in place and reinforce the need for articulation with other areas, such as the environment, agriculture and civil defense.

This chapter has sought to introduce the new concept of public health emergencies, which could prove more practical for health surveillance systems to employ, as it can be applied to situations in which damage to public health has not yet been ascertained, thus enabling the adoption of more opportune measures that could curtail or avoid illness and death. By widening the scope of health surveillance action beyond (but including) transmissible diseases, it will be possible to boost the capacity of the health services to tackle a broader spectrum of health problems that imply a risk of disease spread. The use of this concept by nations within the scope of the IHR (2005), but also nationally through the Cievs Network and other state and municipal health service structures, will allow for its consolidation, honing and better application by public health services.

The analysis of public health emergencies of national concern in Brazil has made it possible to detect certain particularities in the epidemiological pattern and diversity present in different regions and states. Though comparison among countries is still not fully possible, to the extent that international publications have covered the distribution of emerging infectious diseases, it is possible to observe similarities in the various studies (Jones et al, 2008; Woolhouse, 2008), such as a predominance of zoonoses and vector-borne diseases, as also noted in Brazil. That said, another category of health events, those caused by environmental disasters, often neglected by health services and international publications, may come to represent a more relevant impact on the population,

whether in terms of the number of people directly affected, such as those injured/killed or rendered homeless, or indirectly, through infectious diseases or psychological traumas caused by flooding, landslides and other such disasters.

The new strategies for tackling public health emergencies will require ongoing assessment in order to monitor changes in the dynamic of the transmission and spread of diseases and agents, as well as to adjust and adapt them to health services with varying degrees of organization. As the goal is to structure the Brazilian system from the local level up, so that it is suitably equipped to detect, analyze, investigate and respond rapidly and efficiently to public health emergencies, the success of this task will depend on the adoption of measures that are sustainable and that favor the strengthening of the Single Health System (SUS).

Notes

- 1 The earlier version of the International Health Regulation was published in 1969.
- 2 A Party State to the IHR, i.e., member states of the WHO, under which the IHR came into effect.
- 3 Established through Declaration n. 5 of the Health Surveillance Secretariat on 21/2/2006

Bibliography

BARRETO, M. L. et al. Infectious diseases epidemiology (Glossary). *Journal of Epidemiology and Community Health*, v.60, p.192-5, 2006.

CENTERS FOR DISEASE CONTROL AND PREVENTION. *Addressing emerging infectious disease threats: a prevention strategy for the United States*. Atlanta, Georgia: US Department of Health and Human Services, Public Health Services, 1994. 47p.

FIDLER, D. P.; GOSTIN, L. O. The new International Health Regulations: An historic development for international law and public health. *Journal of Law, Medicine and Ethics*, p.85-94, 2006.

INSTITUTE OF MEDICINE. *Emerging infections: microbial threats to health in the United States*. Washington, DC: National Academy Press, 1992.

_____. *Microbial threats to health: emergency, detection and response*. Washington, DC: National Academy Press, 2003. 367p.

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE. Climate change: synthesis report. Valencia, Spain, 2007. Disponível em: <<http://www.ipcc.ch>>

JONES, K. E. et al. Global trends in emerging infectious diseases. *Nature*, v.451, p.990-4, 2008.

MINISTÉRIO DA SAÚDE. Secretaria de Vigilância em Saúde. Portaria n.5 da Secretaria de Vigilância em Saúde de 21.2.2006. Disponível em: <<http://www.saude.gov.br/svs>>

WOOLHOUSE, M. E. J. Emerging diseases go global. *Nature*, v.451, p.898-9, 2008.

WORLD HEALTH ASSEMBLY, 2005. *Revision of the International Health Regulations*, WHA 58.3 (May 23, 2005) Disponível em: <<http://www.who.int>>

ABSTRACT – During recent years, international concern about the spread of diseases or agents from infections and chemical or radio-nuclear sources has increased. Aiming to adapt the concepts and measures to prevent or reduce the risk of this spread, countries have adopted the new concept of “public health emergency of international concern” under the IHR (2005), and implemented new strategies for strengthening activities to prepare for and respond to such emergencies. Based on contextualized risk analysis of health events that can spread internationally, the aim is to be able to fall back on more appropriate tools for the timely identification of - and intervention in - these events. The adaptation of this concept for the purpose of national health surveillance and health care services in Brazil has allowed for a better management of health events that may pose a risk of disease-spread or injury/death in national territory and provide a more timely response. The analysis of these events presented herein shows that the occurrence of environmental disasters, even if in lower number than infectious events, poses a greater threat to the public and causes more widespread damage. On the other hand, infectious events, which usually occur as outbreaks or epidemics, affect a larger number of municipalities and reap a higher death toll. The measures adopted in the country to improve the health surveillance system in terms of detection, preparedness and response to public health emergencies are described here, as are the main challenges faced in managing the system.

KEYWORDS: Epidemics, Public health emergency, Emerging diseases, Public health preparedness and response.

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