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Natural Hazards: Pandemic Threats by Infectious Diseases

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Definition

Human hazard: Threats to human populations where the authentic source of the occurrence is technological or human made.

Natural hazard: Threats to human populations where the authentic source of the occurrence is found in the natural world. Biological natural hazards include the ecological emergence of infectious disease.

Pandemic: The global outbreak of an infectious disease where no vaccine, or natural resistance, exists that is able to stabilize the threat.

Introduction

In 2018 the World Health Organization (WHO) identified a group of priority diseases and pathogens for research and development purposes in the years ahead. Each one represents a unique threat to public health, although it cannot be said with certainty that large-scale outbreaks will necessarily occur. These threats either have no current countermeasures or countermeasures that are known to be lacking for preventing spread of illness. The list included Crimean-Congo hemorrhagic fever (CCHF), Ebola virus disease and Marburg virus disease, Lassa fever, Middle East respiratory syndrome coronavirus (MERS-CoV) and severe acute respiratory syndrome (SARS), Nipah and henipaviral diseases, Rift Valley fever (RVF), Zika, as well as Disease X (World Health Organization 2018a).

Disease X holds a special place on the list, for it reflects an understanding that catastrophic infectious diseases are far from comprehensively identified at this point in time. As such the possibility of new pandemics emerging is not far-fetched, but quite conceivable.

There has been disagreement about what the term "pandemic" should encompass for many years. One concise definition posits that a global outbreak of a novel disease is necessary to invoke the word (World Health Organization 2010). Less

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compact explanations suggest pandemics involve countrywide spread at the very least or consider regional impact on one or more continents as acceptable for the term to be applied. In any nuanced discussion, case levels are usually seen as being considerable, and immunity limited. For the purposes of this submission, the World Health Organization approach offered above will be employed. As a result of accepting this definition, the review to follow keys more on international, rather than regional, national, local, and individual approaches to these types of public health threats.

New pandemics are not the only health concerns people around the globe must remain vigilant over, however. The reemergence and tenacity of plague in disparate locations around the globe, as well as continuing battles with HIV/AIDS and new strains of influenza, are but three established infectious diseases that stubbornly stalk human populations. Further still, there remains a seemingly relentless nature to illnesses such as tuberculosis, malaria, yellow fever, cholera, syphilis, and gonorrhea. Combined with the steady onslaught of a range of slow-acting chronic diseases, global public health crises of all kinds promise to continually impact and even shape the course of human development as time moves on. Pandemic threats are simply one type among them.

Although not the focus of a piece on natural pandemic threats, due to the technological or human-made intervention that leads to their spread, the ongoing specter of biological warfare or terrorism releasing some uncontrolled deadly pathogen on the planet must at least bear mention in this discussion. In addition industrial accidents also present the human population with an array of outbreak possibilities, both at the time of occurrence as well as during the aftermath of crisis. Recognizing the full breadth of infectious disease threats that can become global is important because innovations from responding to each type can feed into an overarching approach of reinforcing techniques for addressing pandemic emergencies, in general.

To some, historically, we have been poorly prepared to deal with the global impact of many or all of these illnesses. To others, the reality of drug resistant, emerging and re-emerging infectious disease has been a spur to action that has led to the creation of rapid response units and global detection systems. To capture a snapshot of the current picture on these matters, this contribution will address how handling biological natural hazards involving infectious disease pandemic threats are best managed through a dynamic coupling of players across a range of response levels and sectors of action.

Background and Context

Ancient African, Asian, and European pandemics provide examples that catastrophic illness has been with us for as long as we have been recording human societal development. While it is difficult to say whether or not a new pandemic will have the same enormous impact on civilization that many feel the plague of Europe did in the fourteenth century, or the 1918 avian influenza outbreak did in the early twentieth century, it is at least clear that the study of pandemic management offers an opportunity to evaluate and reflect on the current state of public health system administrative progress. Effectively responding to these threats is a complicated process that requires unusual amounts of cooperation and coordination to be successful.

As should be clear from the discussion to follow, pandemic threats require treatment from the international level to the regional, national, local, and individual ones (see chapter on "▶ Emergency Management: International"). From global planning to local implementation, coherent and cohesive action must be closely knit together to accomplish pandemic infectious disease management. In addition, differing sectors of society concerned in this type of process must be involved in coordinated action to gain the most from such preparations. While the health sector is clearly central in such a discussion, it does not exist in a vacuum. Technological advances, as well as the contours of the legal, criminal justice, social, cultural, economic, and political sectors, also hold sway on what can and cannot be done. And, with so many infectious diseases emerging directly

from the natural environment, expertise and leadership from within the ecological sector is also important to leverage when describing and explaining problems, as well as crafting policy responses.

The range of players involved in such a task spans governmental, nongovernmental, and private domains, with representatives from each needing to navigate the web of interaction in order for crisis engagement to be effective. From international policymakers to on-the-ground first responders, these actors can be involved with multiple levels of response and sectors of impact or be isolated within a particular level and sector alone. Collectively organizing their actions smoothly is one core goal of pandemic management.

A defining characteristic of pandemic threats in the twenty-first century is the impact that processes of globalization have had on the ability of pathogens to spread. Advances in the movement of people, animals, and goods have accelerated the disbursement of infectious agents. As such, the context of understanding pandemics needs to be viewed through an arc of time that encompasses improving technological innovation. Today's problems require the reassessment of quarantine strategies, engaging emerging technologies, understanding the differences faced from rural and urban outbreaks, and many more subject areas.

Human-made events, where the goal is political destabilization and change, warrant note here as well because they highlight some important effects sought from deliberately created health calamities. These are valuable concerns to include because the results are not unique to human-made crises of this type. Natural pandemics can also give rise to significant political upheaval and security concerns. The result in both cases can be the weakening of policy and cultural bulwarks, leaving room for unrest and violence to emerge.

Understanding that these issues are often addressed within pandemic threat situations provides us with a broad overarching rationale for continually assessing our collective and ongoing effort to improve the ways that we approach these hazards. Assuring that both cases and death tallies are minimized are not the only values at stake.

Planning for Naturally Occurring Pandemic Threats

Preventing future pandemic public health emergencies, or minimizing their effects during response, requires establishing health regulations and legal rules that provide ways to clearly prepare, assess, and respond to a crisis. Such conventions enable the identification and containment of risk, as well as focused and concerted action in redressing danger. These platforms then allow for sequential planning, performance measurement, and evaluation of programs as essential aspects of managing these types of events. Training, practicing, and the organization of thought and action are essential elements in this process. Applying knowledge through an "all hazards" approach to crises creates economies of scale that allow for broad-based treatment of public health threats. This systematic application of routines makes the most of generalized information while addressing the unique concerns of certain types of outbreaks. Over time, information that is learned from on-the-ground efforts is cycled through a global system of feedback and refinement.

Infectious disease pandemic threat preparations can be examined within such conceptualizations. The ongoing concern about potential flu pandemics lends itself to displaying how accepted approaches to public health pandemic management fan out from global bodies to regional ones and then to states and localities. The cycle of information sharing is not a one-way street, however. As events occur that reinforce or add to the knowledge base, it is hoped all actors in the system will update their plans in accordance with lessons learned from throughout the system.

Illustrating policy diffusion of this nature can be quickly demonstrated through the highlighting of documents offered across different levels of the international system. For example, WHO provides a "checklist" to states, governments, and health authorities readying themselves for a possible influenza pandemic (World Health Organization 2005, 2018b). WHO addresses areas of relevance for pandemic management that spans topics from preparation, to surveillance,

to case treatment, to community engagement, maintaining services, carrying out research, and finally implementation within its list categories. Other levels of response engage in similar activities. Some examples are provided below.

At the regional level, the European Union provides guidance to member states through the European Centre for Disease Prevention and Control's publications on national influenza pandemic plans that is no less thorough than those of WHO (European Centre for Disease Prevention and Control 2018). The United States Department of Health and Human Services presents a national influenza pandemic plan that serves as one model for addressing a flu-based scenario (United States Department of Health and Human Services 2017). All actors operate with a reasonably common vision that is steeped in experience from treating the illness.

Where countries and local communities are concerned, governmental and nongovernmental players are best advised to craft legal, policy, and funding instruments that will facilitate and guide response during a pandemic emergency that make use of accepted global and regional strategies but also take note of their unique settings. A wide range of legal and regulatory scaffolding exists that can be offered as examples for exploring options. All should be coordinated as best as possible with international understandings of pandemic management. Mutual aid agreements that cut across jurisdictions and localities, as well as a variety of public-private partnerships, often are useful means of providing a unified vision for how to react to such situations at the base level of communities and local governments, where the heart of the actual work fighting disease spread will take place (see chapter on "▶ Public-Private Partnerships: Emergency Management"). To the extent these efforts dovetail with the international image for redressing infectious disease spread, so much the better.

As an example of a country-level arrangement, the United States applies a comprehensive planning approach to both human-made and natural hazards that uses a variety of frameworks designed to guide the phases of emergency management at the national level. Built to maximize the logic of the all hazards model in real-world settings, and acting in concert with the National Incident Management System (NIMS), these frameworks focus on aspects of the emergency management cycle while offering perspective to how roles and tasks may dovetail across the process. Local and state American governments are engaged in their own planning activities, as well. Pandemic emergency preparation across all levels falls within this broad conceptualization of mitigation, preparedness, response, and recovery (Lindsay 2012; also, see chapter on "▶ Emergency Management: Concepts and Definitions").

Managing Naturally Occurring Pandemic Threats

As the above documents display, planning only takes preparedness so far. Ensuring effective action in pandemic response requires that the plans be tested and appraised on a regular basis, in order that weaknesses can be identified. It also mandates that lessons can be both learned from, and integrated back into, the planning cycle. Communicating strategies, training first responders, and educating civilian populations about where to find information and resource caches become important aspects of this endeavor. Examining the effectiveness and efficiency of such activities then rests on properly constructing, analyzing, and understanding performance indicators and results in relation to intended strategies, missions, and operational goals. Plans developed and left in vacuums over time risk becoming unhelpful at best or even deadly in worst-case scenarios. Of course, central to achieving these aims is establishing a secure and operational health infrastructure that can be relied upon during an emergency. As noted below, the roles of international governmental organizations, international nongovernmental organizations, and donor states take on special importance where struggling countries are concerned.

One of the most important aspects of minimizing infectious disease pandemic threats involves active surveillance and information gathering to further prevention. This is true at all levels of

identification and response. As many infectious disease pathogens are of zoonotic origin, it is clear that ongoing efforts to monitor the natural environment are imperative to the quick management and response of developing crises and could be the key to preventing a local outbreak from turning into pandemic spread. The hunting of new pathogens, as well as tracking the emergence of known ones, remains critically important in controlling public health upheavals.

While some states are better prepared to carry out these activities than others due to expertise and resource availability, those in less capable positions are equally important to carrying out the overall task at hand. As such, WHO, other relevant members of the United Nations system of international governmental organizations, supporting states, and organizations from global civil society, can be found providing personnel, skills, and guidance in these circumstances when needed.

The Global Outbreak Alert and Response Network (GOARN), in effect since 2000 and supported by the International Health Regulations (IHR) of 2005, created a WHO network of partners with the ability to coordinate and provide the delivery of needed services to locations with health emergencies (Global Outbreak Alert and Response Network 2018). A comprehensive Events Management System is managed by WHO to further serve this purpose, and its Strategic Health Operations Centre monitors a wide range of public health issues on an ongoing basis. Addressing pandemic threat from infectious disease in relevant scenarios effectively starts with gathering the data for review at the local and country levels long before pandemic intensity is reached and then analyzing results within this international structure.

Once a new threat has been identified, response and recovery actions must be quickly engaged. Cases must be treated, and, where necessary, contacts must be traced for the work of managing spread to effectively occur. If vaccines exist, and are available, they need to be dispensed to affected populations. Best practices for controlling the particular disease must be put into effect beyond vaccine protocols as well, often modifying cultural and social norms for the benefit of enhancing safety specific to a given disease's modus operandi.

Establishing the tools to handle emergency pandemic threats needs to be connected to the awareness that rapid deployment of funds and resources may be necessary, often without a great deal of warning. This fact is consistent across sectors, actors, and levels of response. However, the degree of support required from the international system will vary based on need. In the case of WHO, establishing capacity at the global level to support states suffering outbreaks and health crises has been developed through the Contingency Fund for Emergencies (CFE). CFE was started in the wake of the 2014 Ebola outbreak in West Africa and is a part of WHO's broader Health Emergency Program. While not designed for infectious disease engagement alone, the CFE allows for rapid disbursement of financial resources to targeted recipient states that are facing extreme, and often unforeseen, health challenges. This could easily be the case where the threat of pandemic spread is involved. To the extent such financial resources can be made to affected countries and regions rapidly, worst-case pandemic scenarios stand a better chance of being avoided. This new funding structure offers WHO the ability to begin its work in crisis scenarios and settings early, as well as to support state activities as soon as possible. Other fiscal and material supports from the international system of governmental organizations, states, and civil society can take longer to mobilize (World Health Organization 2017a).

Global civil society offers additional support structures to prepare for, and respond to, pandemic threats. The Global Fund, for example, provides ways for donors to directly connect with those affected by specific health crises involving HIV/AIDS, tuberculosis, and malaria (The Global Fund 2018). It expressly recognizes that building strong health systems enables wider protection against a range of infectious diseases that are already, or could turn into, pandemic threats (see chapter on "► Critical Infrastructure: Healthcare and Public Health Sector").

In furtherance of these goals, the organization offers supporters the ability to engage in these activities as one shot or ongoing efforts. Additionally, a variety of direct relief and support services can be found in the wealth of medically focused

INGOs willing to engage health crises on the ground. Groups such as Doctors Without Borders and the International Federation of Red Cross and Red Crescent Societies are among the better known of these organizations and often find themselves in the thick of the pre-pandemic fight.

Formally recognizing the existence of a pandemic threat takes place at the highest tier of the system of response, even while a disease may be progressing on the ground in local, national, and regional settings. The fact that the disease is already active requires that the central actors recognize and categorize said threat for what it is as quickly as possible. Recognition supports the plans that have been designed for response being put into action across levels of the international system. Triggering mechanisms, such as the one described below, enable rapid and efficient coordinated response from the top down rather than sluggish and confused vertical and horizontal engagement.

At the international level, the Public Health Emergency of International Concern (PHEIC) declaration is of critical importance to combating infectious disease spread, serving as an early warning device against possible pandemic emergence. Since the early 2000s, there has been an active effort to empower WHO, through the IHR, in a way that would invigorate response to global health dangers by encouraging concerted efforts of varied players in the political arena. Among the outcomes of this pursuit has been the creation of the PHEIC declaration that the body can pronounce in reaction to significantly threatening circumstances. Driven by WHO's IHR Emergency Committee, a committee that provides advice to the director general of the organization, declarations of this nature can be used to assuage confusion and disagreement by states, intergovernmental organizations, and international nongovernmental organizations as to the extent of a particular problem. Issuance of a PHEIC declaration signifies that the body agrees a public health threat meets the following criteria:

> i: to constitute a public health risk to other states through the international spread of disease; and
>
> ii: to potentially require a coordinated international response. This definition implies a situation that: is serious, unusual or unexpected; carries implications for public health beyond the affected State's national border; and may require immediate international action. (World Health Organization 2017b)

Since 2007, when the IHR on this matter came into effect and formalized the PHEIC declaration as a tool WHO could utilize, it has been used on four occasions. The first involved H1N1 in 2009, the second involved Polio resurgence in 2014, Ebola in 2014, and most recently Zika Virus in 2016. The importance of the PHEIC declaration is in the ability to develop a concerted vision of a crisis that captures competing parties and viewpoints as it welds a common position together. Indeed, the role this body of experts plays in the process speaks to how actors across levels of governance can be brought into the overall process of decision-making in a respectful, and hopefully productive, manner. As such, the process of deliberation, and the declaration itself, represents a mechanism for channeling energy and ideas – creating a critical means of linking stakeholders to each other across domains and levels of response as they craft more unified policy positions. While announcing the existence of a full-fledged pandemic will come later, if required, one value of the PHEIC declaration is in its ability to begin that process as early in the term of an outbreak as possible.

Conclusion

The best prevention, when managing biological hazards that can become pandemics, is to engage the threat as early as possible. If a threat cannot be identified or stopped in the natural environment before it appears in local human communities, then it must be pursued there. If it breaks free from these surroundings to include whole states or beyond, then it must be engaged in that wider venue. Once an infectious disease outbreak is understood to be expanding to other countries, health authorities at all levels of the system must move quickly to minimize its coverage prior to it reaching worldwide levels. The overall process is one of continuous identification and response. However, the purpose of the process does not mean the earliest alerts will be taking place when the first cases of an outbreak

unfold. It does mean, however, that the alerts sounded must be made as soon as possible in the development of pandemic threats. If the earliest efforts to recognize and stop infectious disease emergence fail at the local and country levels, then international dissemination of the pathogen must be flagged for response as rapidly as possible, relying on the wealth of resources and knowledge discussed throughout this contribution.

Cross-References

- Critical Infrastructure: Healthcare and Public Health Sector
- Emergency Management: Concepts and Definitions
- Emergency Management: International
- Public-Private Partnerships: Emergency Management

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Further Reading

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