**CHAPTER 6. Triggering Action: Participatory Surveillance and Event Detection in Public Health Emergency Management**

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***Abstract***

Contemporary developments in public health monitoring and crisis management—particularly those that are meant to leverage big data and social-media infrastructures for participatory surveillance—have less to do with monitoring and making up populations, and more to do with monitoring and making up events. These developments are important not just for the way they configure public health problems, but also for the kinds of governance they imagine and call into being.

In this chapter, we provide a background discussion of global health security and the millennial preoccupation—in the global north—with emerging infectious disease. We also offer a preliminary consideration of emergent modes of public health monitoring and event detection. We use an analytic framework developed in French and Mykhalovskiy (2013) to present an overview of select touchstones for research into event-oriented public health monitoring and crisis management. We focus on the event as a key, active concept, and consider the forms of knowledge, diverse informants, and organizational initiatives that this discursive configuration of public health crises presupposes. We conclude with a discussion of the wider implications of the rise of event detection in public health monitoring, and suggest that big data-enabled modes of participatory public health event detection are a key site for future surveillance studies scholarship.

## 1. Introduction: From Population to Event

> But what does this 'naturalness' of the population signify? What is it that means that the population will henceforth be seen, not from the standpoint of the juridical-political notion of subject, but as a sort of technical-political object of management and government (Foucault 1977/2007: 70)?

Reflecting on the emergence of *population* as both "a notion" and "a reality" (Ibid. 10) in the writings of the 18th century mercantilists, Michel Foucault emphasizes the connection between knowledge production and the constitution of the objects of knowledge. With respect to population, knowledge of numbers of subjects, their age, their capacity to labour, and various other indicators, helped to condense this phenomenon into a specific reality. Indeed, the mercantilists' writings, Foucault argues, were instrumental in producing an understanding of population as a complex, natural phenomenon that exceeded the sovereign-subject dyad.

In the sovereign-subject dyad, the sovereign was depicted as s/he who gave orders (laws); the subject was viewed as someone who either obeyed or revolted. With the emergence of the mercantilist understanding of population, however, this simplistic vision of command and control was displaced. Population was not a phenomenon that could be easily controlled "by decree" (Foucault 1977/2007: 71). Instead, intervening to shape the population required acting "on a range of factors and elements that seem far removed from the population itself" (Foucault 1977/2007: 72), such as currency flows, exports and imports, as well as the individuated desire to

live and profit, embodied by the supposed utility-maximizing actor. This understanding of the population seemed to call forth, in other words, a specific style of rule.

Inspired by Foucault's critical analyses of the linkages between knowledge-production about populations, and the apparatuses of governance, a number of researchers have written about how population monitoring helps to make populations up and govern them (e.g. Cakici 2013; Holt 2013). Armstrong's account of the "rise of surveillance medicine," for example, argues that, once the medical gaze was trained upon so-called "normal populations," illness began to inhabit a novel, extracorporeal space" (1995: 395). For Armstrong, surveillance medicine calls into being a "multifaceted population space" that "encompasses the physical gap between bodies that needs constant monitoring to guard against transmission of contagious diseases" (1995: 401). In rendering as problematic both the mass of bodies that makes up the so-called normal population, a*nd* the extracorporeal space in between these bodies, surveillance medicine helped to configure bodies and their relations as risky. It therefore constituted the population as a phenomenon that posed a certain kind of risk to itself. It also helped to legitimate an anticipatory, interventionist style of governance characterized by intensive monitoring of bodies and the spaces between them.

Our chapter is informed by work that theorizes the relationship between knowledge of populations and modes of governance. However, we want to suggest that contemporary developments in public health monitoring and crisis management—particularly those that are meant to leverage big data and social-media infrastructures for *participatory surveillance*—have less to do with monitoring and making up *populations*, and more to do with monitoring and

making up *events* (cf. Lakoff 2006; 2010; Wraith and Stephenson 2009).[1] This is not to say that populations have been displaced by events per se, nor that population is no longer important to public health. Neither is it to say that Foucault's analytic insights cease to be relevant in the contemporary era, for Foucault's later work certainly engages a range of regulatory techniques trained not solely on bodies and populations, but also on the broader environment in which these phenomena are nested (Massumi 2009). Nevertheless, we wish to emphasize an emergent, discursive configuration of the *problem* of public health *events*. This particular configuration of the problem seems to call for novel kinds of governance brokered by big data and social media infrastructures, which are different from those called into being by surveillance trained upon populations.

Our chapter unfolds as follows. We first provide a brief background discussion of global health security and the millennial preoccupation—in the global north—with emerging infectious disease. Next, deploying the analytic framework developed in French and Mykhalovskiy (2013), we consider several touchstones for research into event-oriented public health monitoring and crisis management. We focus on the event as a key, active concept, and consider the forms of knowledge, diverse informants, and organizational initiatives that discourse organized by this concept presupposes. We conclude with a discussion of some of the wider implications of this emergent kind of governance.

## 2. Global Health Security and Emerging Infectious Disease

Policy literature on health system response to disaster, and on health system preparedness, has grown in recent years. This policy discourse may be situated within what Weir and

Mykhalovskiy have described as the apparatus of "global health security" (2010: 150). Global health security "names a governance apparatus" that "conjoins human actors, objects, statements, and technical devices in networks formed through authorized expertise" (Weir 2014: 18). Although the concept of global health security only entered into mainstream usage in the 21st century, it had begun to catalyze in relation to work and advocacy led by the United States in the early 1990s.[2]

According to Weir and Mykhalovskiy (2010), a 1992 Institute of Medicine (IoM) report on microbial threats, entitled *Emerging Infections*, marked an important period in the formation of contemporary ideas about global health security. This report advanced the concept of emerging (and re-emerging) infectious disease (EID). As Weir and Mykhalovskiy note, the "EID concept amounted to a rebranding of infectious diseases, heightening their political and economic profile after decades of neglect and indifference in the global North" (2010: 30). EID shifted the understanding of infectious disease, they argue, in at least two key ways:

> First, EID brought into discourse a new order of threat to human health: previously unknown infectious diseases or known diseases whose incidence is increasing. […] Second, EID formulated such infectious diseases geopolitically as a phenomenon that threatened U.S. national security. EID thus powerfully called into question existing national and international infectious disease control arrangements. Disconnecting the USA from international microbial threats would require a far faster knowledge of local outbreaks by international public health authorities, necessitating the speeding up of

> surveillance data, the subordination of local historical time to synchronized world time, and the opening of local place to continuous global spatial relations (ibid. 30).

The EID concept may thus be understood as part of a broader movement, led by the United States, to pressure the WHO to strengthen global public health surveillance. Weir and Mykhalovskiy's (2010) detailed account of this movement illustrates the WHO's response to EID through the establishment, in 1995, of the Division of *Emerging and Other Communicable Diseases Surveillance and Control*.

Additionally, in that same year, the World Health Assembly—the decision-making body of the WHO populated by Member State delegates—passed resolution WHA48.7, which called for the revision and updating of the 1969 *International Health Regulations* (IHR). The 1969 IHR were, up until 2005 when the revised IHR came into force, "the only international legal rules on infectious disease control binding on WHO member states" (Fidler 2004: 19). They were narrowly conceived in the sense that they only focused on select, listed infectious diseases, such as cholera. With the updating of the IHR in 2005, the international legal regime governing infectious disease surveillance and control measures was expanded to capture a wider range of communicable diseases, as well as "noncommunicable disease events, whether naturally occurring, accidentally caused, or intentionally created" (Baker and Fidler 2006: 1059).

Importantly, for our analysis, the 2005 IHR expanded the scope of international public health surveillance. Prior to their revision, international communicable disease surveillance relied largely on official reporting channels. Although this approach gave sovereign states some control

over information about communicable disease outbreaks in their territories, when viewed through the prism of the EID concept it appeared woefully inadequate for a world in which microbial threats could so easily cross borders (French and Mykhalovskiy 2013: 180). A key innovation of the revised 2005 IHR, therefore, was to shift surveillance beyond the classic approach of relying on official reports, and to incorporate unofficial sources, such as news reports of outbreaks (Weir and Mykhalovskiy 2010: 80). In addition to this, the 2005 IHR directed the focus of surveillance towards a much broader range of phenomena than the communicable diseases that had been the focus of the 1969 IHR. This expansion of scope, furthermore, seemed to require new ways—especially automated and algorithmically-directed ways—of practicing surveillance.

Accordingly, what we see by surveying the evolution of the global health security apparatus over roughly the past three decades are conceptual, organizational, legal, and practice-level transformations. Invoking military idioms, these transformations can be read as an attempt to simultaneously broaden, intensify, globalize, and molecularize the monitoring of apparent threats to population health (French 2009). On this reading, we can understand the shift to event monitoring as kind of filtering out of the unruliness and complexity inherent in the type of population monitoring that Armstrong called surveillance medicine. Before developing this theoretical observation further, let us turn back to some empirical considerations. In the next section we outline some touchstones for empirical research into big data technologies that are being developed and enrolled into the work of public health event-detection and crisis management.

## 3. Big Data Technologies, Public Health Event-Detection, and Crisis Management

In their analysis of public health intelligence and the global effort to detect pandemic events, French and Mykhalovskiy (2013) propose several touchstones that can guide empirical research. Below we develop these touchstones with reference to big data technologies, public health event-detection, and crisis management. This relates to 1) active concepts; 2) forms of knowledge; 3) diverse informants; and 4) organizational initiatives.

### *3.1 Active Concepts: The Event*

Active concepts are concepts that provoke legal, political and technical transformations (Weir and Mykhalovskiy 2010). Several active concepts are currently shaping discourse on public health monitoring. Below, we want to consider WHO discourse on emergency and crisis management, for this is one discursive domain that accords a central place to the concept of *the event*.

With reference to the principles of the *Sustainable Development Goals* (WHO 2015) "and their objective to leave no one behind by 2030" (WHO 2016a), the WHO has assembled a wide range of materials designed to provide "technical information for crisis and crises management" (WHO 2016b). This work is motivated—according to Dr. Richard Brennan, Director of the WHO's Emergency Risk Management & Humanitarian Response Department—by an understanding that protracted "crises are not going away" (WHO 2016a). Speaking to the ethos of a normalized "state of exception" (Agamben 2005), the WHO discourse on emergency and crisis management calls for enhanced capacity to detect—and master information about—*events* and not necessarily populations. What is interesting, for our perspective in this chapter, is the way this discourse

describes the need for, and utility of, novel forms of digital event detection. To illustrate, we briefly consider one of the WHO's "key policy documents" for emergency risk management and humanitarian response (WHO 2016c), the *Emergency Response Framework* (ERF). We are particularly interested in the way this document describes the WHO's role in event monitoring and event verification.

The ERF opens with a recognition of the WHO's role in supporting State Parties in the work of preparing for, responding to, and recovering from emergencies. It sets out the WHO's "core commitments in emergency response which are those actions that WHO is committed to delivering in emergencies with public health consequences to minimize mortality and life-threatening morbidity by leading a coordinated and effective health sector response" (2013: 7). It also outlines the WHO's "four critical functions during emergency response: leadership, information, technical expertise and core services" (ibid. 8). The purpose of the ERF is thus to clarify the role of the WHO in emergency response.

The ERF observes that, between 2001-2010, "an average of more than 700 natural and technological emergencies occurred globally every year, affecting approximately 270 million people and causing over 130 000 deaths annually" (ibid. 9 –note omitted).[3] In the case of roughly a quarter of these emergencies, furthermore, countries that were afflicted were "less developed […] with limited capacities to prepare for and respond effectively to emergencies" (ibid. 9).

Crucial to the framing of the ERF is the notion that local emergencies have the capacity to escape containment and become global problems. As the ERF states:

> …risks to public health have increased due to globalization, and international travel and trade. Such risks might be transmitted by people (e.g. SARS, influenza, polio, Ebola), goods, food, animals (e.g. zoonotic diseases), vectors (e.g. dengue, plague, yellow fever), or the environment (e.g. radio-nuclear releases, chemical spills or other contamination).

In the context of emergencies that are perceived to be potentially global in scale, the ERF describes the WHO's increased responsibilities, under the 2005 IHR, for "coordinating global surveillance and assessment of significant public health risks and disseminating public health information to" Member States (WHO 2013: 10).

What is under surveillance here? A key task of the WHO in emergency contexts, according to the ERF, is "monitoring events":

> WHO continually monitors events happening worldwide to determine their potential impact on public health and whether an emergency response is required. Such events happen suddenly or develop progressively over time. Sudden-onset events include earthquakes, tsunamis and chemical spills. Slow-onset events include deteriorating situations where the public health risk may increase over time, such as prolonged armed conflict, progressive disease outbreak, drought or food insecurity (WHO 2013: 15).

A persistent problem of event monitoring is the determination of whether or not any given event that is detected merits further investigation, and then treatment as an emergency with public

health implications (Weir and Mykhalovskiy 2010). The ERF deals with this problem by distinguishing between sudden-onset and slow-onset events.

Based on this contrast in the temporal unfolding of events, the ERF specifies two types of triggers for event verification and event risk assessment:

> For sudden-onset events, the reporting or detection of the event serves as the trigger for event verification and risk assessment. For slow-onset events, the trigger to conduct an event risk assessment may not always be obvious. In such cases, triggers to initiate or repeat a risk assessment include the following: a. new information available, e.g. through trend analysis of key health indicators in high-risk countries, and from inter-agency work on early warning; b. new developments, e.g. escalation of scale, urgency or complexity, and political, social or economic changes; c. new perceptions, e.g. headline news, government concern, UN agency or nongovernmental organization (NGO) statements, decisions by other agencies… (WHO 2013: 15)

Here, recognizing the onset of events is crucial. Sudden-onset events contain in their abrupt manifestation the trigger for verification and assessment. More difficult, however, are events that take shape slowly, which in their apparent slow accretion may elude notice. Event monitoring would thus seem to require constant vigilance to capture both obvious and non-obvious events.

Once events are detected, the ERF indicates that the WHO will evaluate them based on their scale and urgency. For scale, this involves considering the

> …number and health status of people affected (with attention to vulnerable and marginalized groups), proportion of population affected or displaced, size of geographical area affected, level of destruction of health structures, post-event national health capacities, number of countries affected, extent of international disease spread, interference with international trade and travel, degree of deviation from the norm in the case of annual predictable events (e.g. seasonal outbreaks, annual floods or drought (WHO 2013: 15-16).

For urgency, it involves considering the

> …threat of or actual increase and degree of increase in mortality, morbidity, or global acute malnutrition, degree of transmissibility of pathogen, speed of international spread, case fatality ratio, degree of environmental or food contamination (chemical, radiological, toxic), speed of population displacement and potential for further displacement, intensity of armed conflict or natural disaster, potential for further communal or intrastate conflict, or for prolonged effects of a natural disaster (e.g. on-going rains causing prolonged flooding) (WHO 2013: 16).

As is apparent, event monitoring is a rather different undertaking than population monitoring. Of course, prevalence, incidence, mortality, morbidity and other epidemiological metrics are still important. However, now the WHO must also consider the size of the area affected, the functionality of health structures, the number of borders that have been transgressed ("extent of

international disease spread") as well as interference of trade and travel.[4] It must consider degree of environmental contamination and population displacement.

### *3.2 Forms of Knowledge: Sorting Signals from Noise*

The orientation of public health monitoring towards events implies a transformation in the forms of knowledge that public health organizations and professionals need. Indeed, event monitoring calls for a wider, algorithmically automated capacity, and a different set of competencies than is found within what we might think of as 'shoe-leather' epidemiology (Koo and Thacker 2010). When larger and more diverse data sources are introduced together with the expectation that the analyses should be performed more rapidly, the focus of epidemiology, understanding population health, also changes. Epidemiologists, who used to work with time series for particular diseases and metrics such as incidence and prevalence, are now tasked with understanding what the population is talking about on social media, or how their over-the-counter drug purchases signal the beginnings of an outbreak or other public health emergency. These new data sources rely on a more complex information infrastructure, and the expertise required to develop and maintain such systems does not exist within the traditional confines of public health.

To illustrate, we can draw from Boulos and colleagues (2011), who provide a useful description of crowdsourcing and citizen sensing technologies, which have been designed with public health surveillance and crisis management in mind. Their review sheds light on the assumptions and forms of knowledge embedded into technologically-mediated efforts to harness the wisdom of crowds in order to accelerate and expand event detection. They argue that "[r]eal-time mining of indirectly […] self-reported and sousveillance information harvested from aggregates of Twitter

and other social network feeds can offer useful data and insights about unfolding trends and emerging crowd behaviours at times of crises" (Boulos et al. 2011: 2). Yet a difficulty with this approach to understanding events is that

> …(raw) data obtained from Social Web feeds often contain variable amounts of 'noise', misinformation and bias (which can get further 'amplified' through the viral nature of social media) and will usually require some advanced forms of filtering and verification by both machine-based algorithms and human experts before becoming reliable enough to use in decision-making tasks (ibid. 2).

As Boulos and colleagues note, leveraging crowdsourced and ambient environmental sensing technologies for event detection and emergency response is a non-trivial exercise. Sorting signals from noise is no easy task, and effective "information collection and sharing has long been recognised as a challenge in emergency management" (ibid. 21).

Boulos and colleagues argue that emergency management personnel "often have difficulties obtaining the information they need for an effective response" and that there are frequently organizational silos that prevent information from being shared "across organizations" (ibid. 21). Addressing this challenge requires, they assert, mechanisms that enable emergency management personnel to "have awareness of, and trust in, the information" they receive (ibid. 21). The kinds of mechanisms the authors have in mind are futuristic situation rooms—organizational crucibles for emergency management—a subject to which we will return momentarily. For now, however, let us simply note that event detection and emergency management using crowdsourced and

ambient environmental sensing technologies calls for new forms of expertise, new forms of knowledge, and new forms of organization.

These new forms introduce potential tensions into public health practice (Cakici and Sanches 2014). Although the effort to analyze in real-time data about emergent events is often framed as a purely complimentary activity, there is a sense in which this work operates in tension with other modes of public health emergency management (Füller, this volume). Consider, for instance, that the expertise necessary for the construction and maintenance of large-scale information processing technologies, algorithmic filtering systems, and so on, is significantly different than that necessary for classic, shoe-leather epidemiology, which implies going out into communities, interacting with people who may be warry of public health and other state officials, and gathering information about exposures and contacts. This is a tension that extends beyond the level of knowledge and everyday practice, and that manifests as divergent cultures of public health and emergency management (e.g. Botoseneanu et al. 2011).

### *3.3 Diverse Informants: Participatory Surveillance*

An effect of the push towards real-time event detection and 'nowcasting' of health emergencies has been to increase the breadth of informants who are providing information to decision-makers. We might conceive of this development as the rise of participatory surveillance in public health contexts. Participatory surveillance aims to enrol citizen sensors who can use "mobile devices to form interactive, participatory sensor networks that enable public and professional users to gather, analyze and share local knowledge" (Burke et al. 2006: 1).

Efforts to detect events of influenza-like illness (ILI) represent one area of significant development in the domain of participatory surveillance. A key motivation driving these efforts is the perceived limitation of extant surveillance systems, which are seen as failing to detect ILI with appropriate rapidity and sensitivity. As Paolotti and colleagues note, for instance:

> Although existing disease surveillance systems (predominantly general practitioner (GP)-based but also involving laboratory-based reporting, mandatory notifications, etc.) have a fundamental role in monitoring and understanding the spread of communicable diseases, they also have several important limitations. One of the major issues is that, for diseases such as [ILI], only an unknown proportion of all infected individuals see a doctor. In addition, consultations frequently occur with a considerable delay, taking place only when a complication has occurred or a doctor's certificate is required […] Other issues of concern: the time delay in data reporting and aggregation; the lack of information on the patterns of household transmission; the lack of uniform standards for clinical definitions, which may vary considerably between countries and even between reporters […]. Furthermore, age-stratified rates of physician consultation may vary widely with different healthcare and health insurance systems (Paolotti et al. 2014: 18).

To overcome these perceived limitations, a range of initiatives have been proposed to track ILI via social media and the internet.

Mobile phone applications that are designed to leverage both the geo-locational capacities of smart-phones, and the sensory perceptions of users, are an interesting case in point. One such

application is *Sickweather* a "Sickness Forecasting & Mapping" application. According to the application description:

> Everyday thousands of people around the globe update social media sites like Facebook and Twitter when they (or someone close to them) get sick. Just as Doppler radar scans the skies for indicators of bad weather, Sickweather scans social networks for indicators of illness, allowing you to check for the chance of sickness as easily as you can check for the chance of rain (Sickweather 2016a).

Using a "patent-pending algorithm," the application crawls social media sites searching for posts "like 'I'm sick,' 'the doc says I have bronchitis' and 'My son has chickenpox'" (Sickweather 2016b). In addition the application also accepts direct user reports via mobile devices and, when "several reports appear nearby each other at approximately the same time they are grouped as potential storm activity represented by […] heat mapping" (Sickweather 2016b).

Reflecting on this technology of participatory surveillance, Caduff argues that it contributes "to the expansion of 'epidemic intelligence' as both a concrete practice and a compelling fantasy" (2014). Participatory surveillance has, Caduff argues, "epistemological effects" in the sense that it enables "the possibility of epidemic events to become shared objects of knowledge" (ibid. 36). By making epidemic events into shared objects of knowledge, they become—by virtue of the continual and partial nature of information about them—partial and non-verified objects. Caduff argues that this partiality and non-verifiability "prevents the normalization and stabilization of the event" (2014: 40), while also creating, we would add, an insatiable demand for information

about the event (French and Mykhalovskiy 2013). According to Caduff, an epistemological effect of the partial and non-verifiable information generated about epidemic events by participatory surveillance is "eventalization" (2014: 41). Here Caduff means "a systematic blocking of the event from becoming a proper object-event," an interruption that "interferes systematically with the attempt to normalize and stabilize" an event (ibid. 41). The concept of eventalization draws attention to the way that participatory surveillance (re)produces events, effectively militating against the logic of using participatory modes of surveillance to improve the timeliness and accuracy of what *Sickweather* calls "indicators of illnesss".

Another well-known participatory flu tracker is the *Flu Near You* website, flunearyou.org. This website invites users to "Help track the flu. Save lives." Users can help "fight the flu in under 1 minute per week" and reap the added benefit of protecting themselves, their families, and their communities. As with *Sickweather*, the *Flu Near You* website presents the population-level experience of flu as a singular event, the reality of which can be revealed, and intervened upon, through participatory surveillance.

With these examples in view, we want to briefly consider the kind of subject imagined by participatory surveillance. If we return to Boulos and colleagues, we see an interesting ontological portrait of the subject, imagined through the prism of crowdsourcing and participatory surveillance.

> Humans continuously subconsciously and consciously sense, process, and induce inferences from events around them in real-time. Sense in this context is defined as one

> of the methods for a living being to gather data about the world: sight, smell[,] hearing, touch, and taste. Humans also leverage past experience, background knowledge, and reasoning to extract meaning from often confusing or new experiences. […] This pre-processing/processing of sensory data from experience/background is what differentiates our sensing capabilities from hardware sensors. Sensing can be defined as an operation of a sensor, the detection of a physical presence and the conversion of that data into a signal that can be read by an observer or an instrument. In citizen sensing, a sensor is not necessarily a hardware sensor but can be a virtual sensor or a human interpreting sensory data (Boulos et al. 2011: 6).

Thus, akin to thinking *the eventalization of events*, we should also attempt to think *the sensorization of citizens* and, equally, *the citizenization of (nonhuman) sensors*. These are ontological effects of participatory surveillance and they link up with its epistemological effects (cf. Gabrys 2014).

Diverse informants are enrolled via participatory surveillance to make up knowledge about epidemic events and other forms of health emergency. They yield not only a fragmented picture of those emergent events, but also a network that (re)produces a relational redefinition: nodes in the network are redefined through their relation, not only to the event, but also to the other sensors in the network. For our purposes in this chapter, what is noteworthy about this emergent ontology of the sensor-network assumed by participatory surveillance is its orientation towards exposure.

Foucault's discussion of the emergence of population identifies a biopolitical rationality, associated with demographic practices, wherein the exposure of some individuals to life-threatening risk (e.g. starvation) is recognized as a tolerable, even natural, reality. This rationality holds that "population is pertinent as the objective, and individuals, the series of individuals, are no longer pertinent as the objective, but simply as the instrument, relay, or condition for obtaining something at the level of the population" (Foucault 1977/2007: 42). What we have with the contemporary public health focus on event detection via networks is, perhaps, a similar rationality. In the contemporary era, the wellbeing of each sensor—whether human or non-human—is enrolled into the service of maintaining the wellbeing of the broader sensor network. The preventative orientation is not to stop exposure per se, but to make nodes in the network prepared for exposure, to identify it early, and to intervene in order to contain its spread (cf. Lakoff 2010).

**4. Organizational Initiatives**

A final touchstone for research that we would like to outline concerns the organizational initiatives that are paired with participatory surveillance. French and Mykhalovskiy (2013) describe how public health organizations have been experimenting with ways of becoming more informatically competent. They observe a range of practices and structures—several of which have been imported into public health contexts from the post-9/11 intelligence community, including, for instance, the establishment of data fusion centres—which have as their goal the derivation of intelligence from diverse data sources.

Some organizational initiatives, which are interesting for our present discussion, are Health Alert Networks (HANs). The United States Centers for Disease Control and Prevention (CDC) maintains a nation-wide HAN, which it describes as the "primary method of sharing cleared information about urgent public health incidents with public information officers; federal, state, territorial, and local health practitioners; clinicians; and public health laboratories" (US CDC 2016). The CDC's HAN issues health alerts to registered network participants. For example, on September 11, 2001 at 13:25 PM EDT, the CDC HAN issued the following message to state and local public health agencies:

> ALERT: Terrorist Activity Response
>
> Due to current events, CDC is on heightened alert status to monitor for any possible unusual disease patterns associated with today's events, including chemical and biological agents. CDC recommends that you initiate heightened surveillance for any unusual disease occurrence or increased numbers of illness that might be associated with today's events (US CDC 2001).

This push message, vetted by a human reviewer, is an example of the kinds of communiqué that are sent out over the HAN.

In Massachusetts, the state Department of Public Health has created a communications platform, based on the CDC HAN, called the Homeland and Health Alert Network (HHAN). The Massachusetts HHAN has been described as an "Internet-based application" that "serves as a portal for communication and collaboration and alerts predefined groups of users involved in

emergency response" (Daniel et al. 2005: 147). Interestingly, the HHAN includes a degree of automation. As Daniel and colleagues note:

> Syndromic surveillance partners' systems report to HHAN by using Public Health Information Network Messaging System events that meet thresholds selected by MDPH [Massachusetts Department of Public Health]. Cluster summaries are automatically posted into a document library (2005: 147).

The automated alert function became operational in July 2004. It is difficult to gauge from publicly available documents the extent to which HHAN notifications are today automated.

However, following the attacks on the Boston Marathon, Cassa and colleagues (2013) undertook a study to demonstrate how data-mining of content posted on *Twitter* could have led to advanced notification of the attacks for first responders. The study was hypothetical, acknowledging that

> …the Boston Athletic Association provides a medical tent near the finish line of the Boston Marathon as well as a strong security and media presence. Hence, first responders, law enforcement and reporters were already present near the explosions, and were able to respond to the injuries, activate the emergency response system, and begin the investigation (Cassa et al. 2013: 6).

Nevertheless, the authors argue, crowdsourced "information may uniquely provide extremely timely initial recognition of an event and specific clues as to what events may be unfolding—e.g.

‘area of 671 Boylston St.’, ‘hundreds hurt…bloody’—that could be used to tailor and refine the response” (ibid. 6).

The example of the HHAN, along with the research of Daniel et al. and Cassa et al. among others, suggests the potentiality of the synergistic linkages between emergent organizational initiatives and novel communications technologies that can be leveraged to enable participatory surveillance for event detection and emergency management. Yet these emergent articulations of organizational form and communication infrastructure may also have unintended consequences. For example, Cassa and colleagues note that “[c]aution in the use of social media reports is warranted” because, while they “can provide timely insight into events as they unfold, they may also produce false positive reports with negative effects” (2013: 6). False positives and other forms of “misinformation” can be “difficult to correct and expunge” once they have been posted and circulated on social media (ibid. 6). Accordingly, Cassa and colleagues recommend the development of techniques, such as content filtering, that could help reduce the impact of false positive reports.

In addition to the development of new techniques necessary to refine and mitigate potential negative consequences of participatory surveillance, we see linked considerations of how to reconfigure extant organizational structures. These considerations are made with a view to adapting organizations so that they can best take advantage of technological advances. One such exemplary consideration is Boulos and colleagues’ discussion of futuristic “situation rooms” (2011: 1). As these authors note, situation rooms are designed “for the emergency management community” to “enable high-volume data feeds, including social media, to be processed and

analysed such that participants in a response activity receive tailored data relevant just to their needs and roles" (Boulos et al. 2011: 21). Borrowing from command and control imagery, the authors describe how, in these spaces, experts collect incoming data, process it, and communicate the best possible course of action to decision makers. The underlying assumption, here, is that events exist before observations of them. With sufficient information a decision can be reached about how to respond, and accurate and timely information leads to more effective decisions. A serious question for researchers to consider, however, concerns how this particular configuration of organizational form, communications infrastructure, and participatory surveillance articulate together to make up events. For, as we have suggested in the introduction to our chapter, the way that events are made up is intimately connected to the way that they are governed.

## 5. Discussion: Wider Implications of Participatory Surveillance for Event Detection

Empirical research into the 1) active concepts, 2) forms of knowledge, 3) diverse informants, and 4) organizational initiatives underpinning contemporary discourse on public health event detection and crisis management will enable the theorization of important transformations in public health governance. In this chapter, we have provided a conceptual framework for future research. We would like now to offer some preliminary thoughts about the wider implications of the rise of event detection in public health monitoring.

### *5.1 Active Concepts*

What can be said about the wider implications of *the event* as an emergent, active concept that provokes legal, political and technical transformations in the context of public health emergency

response and crisis management discourse? As we have noted, event detection is somewhat different from population health monitoring. Although we cannot say that event detection is replacing population monitoring, it is nonetheless worthwhile to observe that it implies a different modality of surveillance and governance, and an emergent kind of politics. Gabrys, in her analysis of participatory modes of environmental management, describes this emergent politics as "biopolitics 2.0" (2014: 36). This term is advanced to refer to the "versioning" characteristic of digital programmes, so that we might think of the differences embodied in a newer version of an older form of biopolitics in the same sense as we think of differences in newer versions of older computer operating systems. It also points to the "distinct types of power arrangements" that might be enabled by each new version of digitally mediated biopolitics (Gabrys 2014: 37). From this perspective, we should ask about the power arrangements implied by the rise of the event in public health monitoring and crisis management, as well as how these arrangements are technically (re)organized with each new version of governance.

The rise of the event can be read as a shift in the focus and means of public health monitoring and crisis management. Whereas once the population constituted the key object of observation, it may, within regimes of participatory surveillance, be comprehended as a key instrument for recognizing sudden- and slow-onset events. This implies logics and techniques that, to borrow from Lakoff, are "oriented to crisis situations and to localized sites of disorder" (2006: 272). They thus depart from population-health based tasks, "such as public health provision and poverty relief" (ibid. 272). They furthermore assume a population—constituted by human- and non-human sensors alike—that are resilient and stalwart reporters in the face of exposure to danger.

### *5.2 Forms of Knowledge*

With respect to forms of knowledge, a decentring of the long-standing expertise of the shoe-leather epidemiologist is well underway. Here one would want to understand, in addition to how participatory surveillance may complement already existing surveillance systems, the tensions and torsions that that it introduces. As Botoseneanu and colleagues (2011) note, public health professions typically have different kinds of skill sets and expertise than crisis management professions. These differences in training and competencies may carry over into conflicts at the level of knowledge, everyday practice, and, more generally, culture.

From this perspective, the rise of the event seems bound up with a transformation of public health knowledge. Indeed, to the extent that those working in public health are expected to have competencies in programming for algorithmically processing big data from social networks, there may be less emphasis placed on the importance of understanding historical patterns of disease incidence and prevalence in different populations and, for example, social histories of marginalization that make people susceptible to disease and illness. In other words, public health professionals may have to become more computationally competent. But, in doing so, what elements of their traditional disciplinary knowledge might they have to relinquish?

### *5.3 Diverse Informants*

Where the diverse informants of participatory surveillance are concerned, we can understand them as fundamentally necessary to the project of event detection. According to the 2005 revision of the *International Health Regulations*, the focus on events represents a broadening of

the scope of surveillance. Insofar as the project of public health monitoring has expanded, it makes sense that the network of actors capable of detecting events must also be broadened. A wider implication of this broadening, however, may be the decentering of (certain) human populations. Additionally, drawing again from Gabrys, we might note that not only do humans stand to be decentered, but so, also, do our understandings of individuality and subjectivity. Gabrys, drawing from Deleuze's (1995) theorization of the emergence of "dividuals" in the age of computational modulation, observes that regimes of participatory sensing "might generate ambividuals: ambient and malleable" operators that are "variously contingent and responsive to fluctuating events, which are managed through informational practices" (Gabrys 2014: 42-43). From this perspective, we should ask about the types of actors and subjects that are imagined in relation to event-oriented public health monitoring and crisis management, as well as whether this imaginary is reflected in reality.

### *5.4 Organizational Initiatives*

Finally, what can be said about the various organizational initiatives underpinning contemporary discourse on public health event detection and crisis management? Here we would like to point to Vayena and colleagues's (2015) argument that, as public health organizations transform to take better advantage of digital event detection, questions of organizational legitimacy may arise. Vayena and colleagues argue that participatory approaches to disease surveillance confront a range of ethical challenges. For instance, with the advent of participatory surveillance, individuals

> …report on disease symptoms on online platforms, (e.g., flunearyou.org) which enables them to contribute to the common good of disease surveillance and often to receive feedback about disease prevalence in their area. This active participation potentially empowers individuals and democratizes the process of scientific discovery. However, data (personally identifiable information, geolocation, etc.) that are collected for DDD [digital disease detection] purposes need to be governed in ways that minimize the risk of harm to participants. For example, if individuals take personal risks in order to report events of public health importance (i.e., a farmer reporting avian flu at risk of losing his flock), those risks should be mitigated by appropriate policies (e.g., compensation) that acknowledge the societal contribution and the local/personal costs (Vayena et al. 2015: 5).

Accordingly, researchers should consider how new organizational initiatives may create novel risks for participants in event detection and crisis management. They should also consider whether, or how, public health organizations seek to govern these novel risks and strive to create and maintain organizational legitimacy.

## 6. Conclusion

We have provided, in this chapter, a consideration of emergent modes of public health monitoring and event detection. We first situated these emergent modes in relation to global health security and the millennial preoccupation—in the global north—with emerging infectious disease. Next, deploying the analytic framework developed in French and Mykhalovskiy (2013), we presented an overview of select touchstones for research into event-oriented public health

monitoring and crisis management. We focused on *the event* as a key, active concept, and considered the forms of knowledge, diverse informants, and organizational initiatives that this discursive configuration of public health crises presupposes. We then offered a preliminary discussion of some of the wider implications of the rise of the event detection in public health monitoring.

Following Foucault, we can say that these developments are important not just for the way they configure public health problems, but also for the kinds of governance they imagine and call into being. At the same time, an important update to the Foucaultian line of analysis is that the object of public health monitoring has broadened beyond populations—beyond even the *population space* that Armstrong discussed in his writings on surveillance medicine—to include events. To the extent that events are viewed as triggers for action, a generalized inaction on the social determinants of health in the absence of detected events could be normalized. We have provided a preliminary discussion of some of the wider implications of this shift. Going forward, many questions remain to be addressed, making big data-enabled modes of participatory public health event detection a key site for future surveillance studies scholarship.

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Endnotes

[1] We draw inspiration for this argument from critical analyses of "biosecuritization" (Fisher and Monahan 2011; see also, among others, Collier et al. 2004; Ingram 2010; Sanford et al. 2016), and studies that interrogate the development of "preparedness" techniques in public health contexts. As Lakoff argues, "techniques of preparedness" are designed to bring diverse risks and threats together into a coherent space of knowledge and intervention (2006: 265). Preparedness can thus be conceptualized as a strategic logic that may be contrasted against the logic of population security. Whereas population security works, Lakoff writes, "through ongoing attention to the health and well-being of members of the population, preparedness focuses on temporally limited interventions to preserve governmental and economic order" (2006: 265).

[2] Stefan Elbe links the 1992 discourse on microbial threats to the US National Intelligence Council's widely cited report, published in 2000, entitled *The Global Infectious Disease Threat and its Implications for the United States*. Elbe notes that as early

as 1987 the CIA had applied for resources to study the security impact of HIV/AIDS. Although this application was initially turned down, it did receive funding in 1990. As Elbe argues, while the uptake of this analysis was not immediate, it was harnessed during the late 1990s and, in "a historically unprecedented gesture, the threat of HIV/AIDS to international peace and security [became] the subject of six separate United Nations Security Council meetings held since January 2000" (2010: 165).

[3] These figures, the ERF notes, do not include "the high levels of mortality and morbidity associated with conflict-related emergencies" (WHO 2013: 9).

[4] This focus on trade disruption has been a perennial concern of the IHR; what is perhaps new here, however, is the degree to which the 2005 IHRs seek to balance or calibrate health interests with trade interests (e.g. Fidler and Gostin 2006).

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