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Citation: WARREN, A., BELL, M. and BUDD, L., 2013. Pandemic governance: using event-based surveillance to manage emerging infectious diseases. IN: Ball, K. and Snider, L. (eds.) The Surveillance-Industrial Complex: A Political Economy of Surveillance. London: Routledge, Chapter 3, pp. 44-60.

Additional Information:

- This is a chapter from the book, 'The Surveillance-Industrial Complex: A Political Economy of Surveillance' [Routledge (Taylor & Francis) © selection and editorial material Kirstie Ball and Laureen Snider; individual chapters, the contributors].

Metadata Record: https://dspace.lboro.ac.uk/2134/12611

Version: Accepted for publication

Publisher: Routledge (Taylor & Francis) © selection and editorial material Kirstie Ball and Laureen Snider; individual chapters, the contributors

Please cite the published version.

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New Transparency ('NewT') and 'Living in Surveillance Societies' EU COST Action

'Surveillance Industrial Complex'

Pandemic Governance: using event-based surveillance to manage emerging infectious diseases

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Introduction

In May 2011, the final report of the Review Committee into the World Health Organization's (WHO's) response to the 2009-2010 H1N1 pandemic highlighted the significance of 'initial event information' in enabling it to improve global public health governance (WHO, 2011: 71). In particular, 'information sources in the public domain, such as new media websites' were cited as an 'important source [..] for the WHO' (WHO, 2011: 71). Consequently, the Committee recommended that the WHO enhance its central repository on epidemic information to include 'more events' in addition to 'expanding information on each event' (WHO, 2011: 13). Meeting this recommendation requires further event-based surveillance.

At a time of rapid disease spread, facilitated in great part by widespread aeromobility, the international community increasingly uses, and relies on, event-based information systems such as the Global Public Health Intelligence Network (GPHIN) and HealthMap. Event-based surveillance differs from traditional indicator-based surveillance in that - rather than reporting *cases* of disease - it aims rapidly to detect, report and assess public health *events*, including clusters of disease and rumours of unexplained deaths. Notably, event-based systems assess disease risk by examining often unverified media sources. As such, this activity arguably adds a new dimension to the 'Surveillance Industrial Complex', a term hitherto used to describe the conjunction of national government security agencies and high tech industries in 'mass information gathering, tracking and routine surveillance' (ACLU, 2007: 11). Scholarly work on this powerful complex has generally focused on counterterrorism activities at both local and national scales (Amoore and de Goede, 2008; Sugden, 2012). There has been little research from within the social sciences that explores this form of surveillance for the purpose of safeguarding public health - at the *global* scale - against emerging infectious diseases. Within an expanding literature on biosecurity and preparedness (for example, Collier and Lakoff, 2008; Ingram, 2010), moreover, scant consideration has been given to the techniques deployed by event-based surveillance systems, including the 'informal' data on which they are based, and their impact on practices of global public health governance. Specifically, there has been a dearth of analysis into the ways in which the WHO and its member states utilise the 'informal' information supplied by these systems in order to make judgements concerning the spread and severity of global disease outbreaks.

In this chapter, therefore, we focus on the operation of event-based surveillance systems in relation to the 2009-2010 H1N1 pandemic, identifying in the process their implications for the wider political economy. Utilising Margaret Chan's call for 'new' international health diplomacy, we consider how disease risk is represented in the international community and we seek to uncover the locations captured by complex information networks, mediating in the space between preparedness and response. Specifically, we investigate: the spatialities of public health surveillance; the complex nature of pandemic preparedness and response; and the diverse biosecurity practices that underpin global public health governance. Through a case example, we draw attention to three ways in which the use of event-based surveillance systems advance understandings of global public health governance.

Firstly, global public health surveillance systems play an important role in locating isolated incidents identified and described by 'informal' information sources and in converting them, and the information on which they are based, into patterns then used to issue global alerts. However, the implications for global governance are messy. Whilst the technologies deployed in this task are largely based in countries of the global north - Canada for GPHIN, the US for HealthMap - their success is dependent on the reporting of events in localities across the global north and south. Secondly, the authority assumed by the WHO in issuing global public health alerts and in securing member state cooperation over pandemic preparedness is subject to challenge. Bingham et al (2008) contend that globalised biosecurity practices are often promoted by countries of the global north, where the 'expertise' is deemed to be located, in the interests of the north (see also Collier and Lakoff, 2008; Ingram, 2010). Yet, we maintain that the WHO's authority is constrained by a number of factors, including: access to the surveillance networks; attitudes of member states to verification and alerting; and capacity of the WHO to respond to the alerts it receives.

Thirdly, in spite of global pandemic preparedness guidance being issued by the WHO, the reality of the H1N1 pandemic was marked by individual member states enacting disparate biosecurity measures. Hinchliffe and Bingham note the various practices (or 'orderings') involved in the performance of biosecurity (2008: 1536-1537). Examples outlined within national pandemic plans include ensuring the availability of hospital beds, the distribution of vaccines, and the imposition of restrictions on internal travel and public gatherings (Cabinet Office and DH, 2007). Other, more contentious, practices - enacted by certain countries during the 2009-2010 H1N1 pandemic - included the imposition of trade embargos against specific nations, the declaration of unilateral travel advisories by sovereign states and, in a few cases, state implementation of quarantine for travellers from affected areas.

We use these three strands – spatialities of public health surveillance, nature of pandemic preparedness and diversity of biosecurity practices – to frame the remainder of this chapter. In doing so, we draw attention to the importance of localities, often situated in countries of the global south, in providing the source materials to initiate pandemic preparedness procedures.

Methods

Our analysis is informed by a number of data sources. Policy documents, working papers and pandemic preparedness plans produced by the WHO and individual countries were consulted, and reference was made to current epidemiological literature. Empirical data on GPHIN was obtained via telephone conversation and email correspondence with GPHIN officials. This included information on volume of articles retrieved, classification of risk, issuing of alerts and further enhancements to the system. Finally data on the H1N1 pandemic was obtained from HealthMap, an open-access event-based system, and from dispatches published by national regulatory bodies such as the Centres for Disease Control and Prevention (CDC) and international news organisations, for example, *BBC News*. The data collection from these sources facilitated analysis of the operation of global surveillance networks and the nature of 'diplomatic' openness.

Biosecurity and preparedness

In recent years, biosecurity - described by Braun as 'political responses' to the unpredictability of global disease (2007: 19) - has become a prominent subject of enquiry as scholars have sought to understand various types of expertise and practices through which disease threats are articulated and managed (Collier and Lakoff, 2008; Bingham et al, 2008; Ingram, 2010). Biosecurity processes are performed within what Bingham et al describe as a 'complex geography' where 'states and locales are increasingly asked to conform to what is regarded (in the metropolitan core) as a safe world' (2008: 1529). According to this viewpoint, it is 'centralised expertise', often located in the countries of the global north, that triggers 'globalising biosecurity practices' (Bingham et al, 2008: 1529), which seek 'maximal cooperation from all countries' (Ingram, 2009: 2).

Fundamental to this approach are the aspirations of transnational organisations such as the UN Food and Agriculture Organization (FAO) and the WHO to see a 'harmonization and integration' of approaches to biosecurity (FAO, 2007 in Bingham et al, 2008: 1532). These transnational bodies, and others such as the World Bank and the World Organisation for Animal Health (OIE), are located in cities of the north and have been perceived as enacting measures that, arguably unduly, focus on 'problems' in the global south (Keil and Ali, 2006; Calain, 2007). This drive for cooperation raises geopolitical, as well as biopolitical, questions. In relation to H5N1 'avian' influenza, for example, it was reported in early 2007 that Indonesia – the country with by far the highest rate of reported deaths from the disease - had stopped sharing virus samples with the WHO and instead had entered into an agreement with Baxter Healthcare, a private US corporation (Ingram, 2008: 82). Under this arrangement, Baxter Healthcare were to develop and manufacture a vaccine, with Indonesia economically benefitting through 'technical support' and being able to produce the vaccine under licence and export it in the future (Shimbo et al, 2008: 645).

The vulnerability of such international systems of biosecurity has, in recent years, been critiqued in relation to travel networks. Sociologists, political scientists and geographers have given increasing prominence to the implications of global mobility of various kinds for the spread of infectious diseases (Keil and Ali, 2007; Budd et al., 2011). Population movement, in particular, has been facilitated by a far-reaching global airline network, which, in an era of transport industry liberalisation, permits direct travel from regional airports to global cities (Budd et al, 2011). During the last influenza pandemic, in 1968, 261 million passengers worldwide travelled by air (ICAO, 1968). In 2011, the world's airlines carried approximately 2.5 billion passengers (ICAO, 2011). This increased mobility highlights the 'epidemiological vulnerability of a closely inter-connected and highly aeromobile twenty-first century world' (Budd et al, 2009: 427). It is a vulnerability that was illustrated during the 2003 outbreak of Severe Acute Respiratory Syndrome (SARS), which spread rapidly along major airline routes to infect over 25 countries (Bowen and Laroe, 2006). One outcome of the SARS epidemic was the increased development of global surveillance networks such as GPHIN, to enable the early identification, and alerting, of disease threats (Blench, 2008a).

According to Ingram, biosecurity in the context of concerns about global mobility and, increasingly, security is characterised by *anticipation* of threats 'which do not yet exist or have not been fully formed' and *preparedness*, the outcome of the former (2010: 296). Rather than tackling specific dangers, preparedness is more concerned with 'generic capacities that will enable responses to a broad spectrum of contingencies' (Ingram, 2010: 296). It aims to 'address vulnerabilities in health infrastructure' by, for example, stockpiling drugs, strengthening hospital surge capacity and exercising response protocols (Collier and Lakoff, 2008: 14). The concept of preparedness has been the focus of growing attention from scholars, the WHO and its member states (Collier and Lakoff, 2008). Collier and Lakoff (2008) demonstrate that the interventions comprise work across a number of scales, resulting in the assemblage of experts and organisations in new initiatives that link health and security.

Preparedness is arguably the enactment of multiple biopolitical realities by many sovereign states (Hinchliffe and Bingham, 2008). Examples outlined in national pandemic preparedness plans – often adapted from the WHO guidance – include ensuring availability of hospital beds and distribution of vaccines, and the imposition of restrictions on internal travel and public gatherings (Cabinet Office and DH, 2007). In the context of pandemics, therefore, the scale of the implications for global public health has been highlighted and guidance provided on a wide range of interventions within national boundaries. In determining the timings of these interventions, global surveillance networks have come to play an important role.

Technological openness: from 'informal' information to the issuing of alerts

A number of scholars have discussed event-based surveillance networks in relation to wider geopolitical debates concerning the expansion of sovereign power (Braun, 2007), the defence and military requirements of an 'oligarchic' global north (Weir and Mykhalovskiy, 2006: 257) and the search for greater global health equity (Ingram, 2008). However, there has been little investigation into the actual *operation* of the surveillance networks and the extent to which their use informs debates surrounding international cooperation in pandemic preparedness interventions. Public health authorities have increasingly come to rely on unstructured 'informal' information – such as internet news and online discussion sites – to safeguard against potential disease outbreaks. Indeed, the role of networks such as GPHIN in the detection of rare but high-impact outbreaks (such as SARS and H5N1 ('Avian') influenza) has been well documented (Keil and Ali, 2006; Weir and Mykhalovskiy, 2006). Moreover, Keller et al (2009) reported that, in the last decade, almost all major disease epidemics investigated by the WHO were first identified through these sources. According to the WHO, these networks proved to be particularly effective in detecting outbreaks among populations that 'do not access health care through formal channels' (WHO, 2008a: 4). Consequently, biosecurity practices, notably alerts, have become ever more embedded in the work of global surveillance systems.

The work of these networks rose to international prominence during the 2003 SARS epidemic. Reports gathered by systems such as GPHIN, coupled with China's role in concealing information during the early spread of the disease, provided the impetus for agreement on the WHO's revised International Health Regulations (IHR) in 2005. The regulations - which came into effect in June 2007 - gave the WHO a legal basis for greater intervention in the affairs of member states to enable, as it perceived it, more effective global public health governance (WHO, 2008b). Therefore, 'informal' information on isolated disease outbreaks occurring in various localities was granted a new authority. By identifying patterns amongst the information gathered, global surveillance systems such as GPHIN could issue 'real time' alerts that would be taken seriously by the WHO.

Although the assembly of news articles does not necessarily require international collaboration, we argue that subsequent global public health interventions do. In a speech delivered in February 2007, WHO Director-General, Margaret Chan argued that the global organisation needed to go further in its preparations for, and governance of, public health emergencies of international concern. According to Chan, this requirement had been demonstrated by the outcome of 'recent events' when collaboration had broken down. They included not only China's concealment of SARS, but also Indonesia's withholding of H5N1 virus samples from the WHO as part of a dispute over proprietary rights to vaccines developed from 'its' virus strains (Fidler, 2008). In both instances, the consequences resulting from lack of cooperation were seen to be harmful to global public health. Chan, therefore, argued that lessons needed to be learnt from these events and applied to a 'new' international health diplomacy. Firstly, this required the WHO to appeal to 'national self-interest', with international cooperation in containing SARS having much to do with 'fear of the economic and social consequences' of failure (WHO, 2007). Secondly, in order to be meaningful, multi-national cooperation required clear rules for good and poor performance on the international stage: for example, a state must not conceal an outbreak. Finally, there was a need for accountability:

> 'If we want to enforce the ground rules, we need to find ways of using the power of public and political opinion to exert pressure.' (WHO, 2007)

Thus, within the context of heightened global uncertainty over emerging infections, according to Chan, operative international preparedness required member state consensus that there be greater openness in the sharing and harmonisation of practices. There needed to be a combination of technological openness, inspired by the contemporary 'revolution in communications and information technologies' (WHO, 2010b), and diplomatic openness in the promotion of a 'new' international health diplomacy.

GPHIN, perhaps the most established global event-based surveillance system, underlines the WHO's desire for greater 'technological openness'. For over a decade, GPHIN has played a major role in alerting 'official' organisations to major disease outbreaks. A subscription-based network, its membership includes the WHO, the FAO, the European Commission, and the CDC. It is a multilingual internet-based system, established in

1997 to provide ‘relevant unverified information on disease outbreaks and other public health events’ (Blench, 2008b). In claiming to detect and monitor events across the globe, it gathers information from local, national and transnational media outlets in nine languages. Sources of information included websites, news wires and local and national newspapers. Notwithstanding the informal nature of this information, GPHIN follows a protocol by which this source material is verified and given some credibility. Retrieved articles are categorised according to a GPHIN taxonomy and assigned a relevancy score (Blench, 2008a: 301). Duplicates are eliminated. Keller et al note that approximately 4000 articles are handled by the system each day (2009: 690).

GPHIN categorises articles according to risk, using a combination of automated and human processes. Each article retrieved is given a ‘relevancy score’, derived from an algorithm utilising keywords and terms within the taxonomy or taxonomies to which it had been assigned (Blench, 2008b: 301). According to Blench, by this process of elimination, approximately 15% are ‘published’, 20% trashed and the remaining 65% are put forward for human analysis (2008b). The degree of risk posed by an event is therefore indicated by the assignation of an alert. Keller et al explain that alerts are judged necessary for events that may have 'serious public health consequences’ and they are sent ‘immediately’ to GPHIN users (Keller et al, 2009: 691). In all, approximately 7-10 alerts are issued daily (Hitchcock et al, 2007). It is this built-in human scrutiny that differentiates GPHIN from counterpart surveillance systems such as HealthMap (Keller et al, 2009).

Notwithstanding the apparent rigour of this approach, it nevertheless poses risks. In particular, alerts rely on often uncorroborated information, for example, commentary on: estimation of an incident’s magnitude; control and prevention measures that have been considered (in addition to those actually implemented); concerns of the general public; and political implications (Hitchcock et al, 2007). These practices of identifying and grading risk are subject to continual revision. For instance, ‘enhancements’ to GPHIN, implemented from spring 2010, include: clarification as to why a risk has been classified as ‘low’, ‘medium’ or ‘high’; and marking up specific texts in reports that GPHIN publish as alerts, in order to illustrate why the information has been categorised as such (GPHIN, personal communication, 13/01/10). The human involvement in the alerting procedures demonstrates the significance of GPHIN’s role in the preparedness process and may also – due to its reliance on the remote assessment of unverified information - be an indication of the precariousness of the pandemic preparedness process. Nevertheless, according to a GPHIN official, the work of analysts in classifying risk is conducted in accordance with official guidance, such as that provided within the WHO IHR (2005) (GPHIN, personal communication, 13/01/10).

For the WHO to issue an alert, additional verifications are necessary, ostensibly involving the detailed event management process illustrated below (WHO, 2008c).

Insert Figure 1

Nevertheless, the role of unofficial data – not least from the news media – in facilitating the WHO's global health governance remains significant. By its own estimation, more than 60% of WHO initial outbreak reports came from 'unofficial informal sources' (WHO, 2010c). Moreover, Weir and Mykhalovskiy contend that approximately 40% of the news reports on disease outbreaks that were verified by the WHO originated from GPHIN (cited in Hitchcock et al, 2007: 210).

Thus, although regulatory developments have undoubtedly conferred new power on the WHO, the evidence suggests that it is a power dependent on access to supranational networks (such as GPHIN) and their repository of 'informal' information grounded in individual countries and localities. Within these settings, there will be silences, as well as records of some kind.

Case Example: event-based surveillance and the H1N1 influenza pandemic 2009-2010

Pandemic preparedness is complex, involving global and national interventions informed by irregular, sometimes unstructured, information, and motivated by competing strategic and political priorities (Gostin, 2009). The 2009-2010 H1N1 influenza pandemic – the first influenza pandemic since 1968 - was particularly significant as it represented a 'test case' for the WHO's new pandemic alerting structure. From its initial reporting in parts of Mexico in early April to Margaret Chan's announcement on 10 August 2010 that 'the new H1N1 virus has largely run its course' (WHO, 2010d), the infectious disease outbreak caused the WHO to regularly review its level of alert pandemic influenza alert. Pandemic 'phases' – used to 'provide a framework to aid countries in pandemic preparedness and response planning' (WHO, 2009a) – have been a characteristic of WHO influenza guidance since the publication of its first guidance in 1999. Although subject to some change over the course of the last decade, the phase structure has consistently included a description of significant attributes – the existence of which, we argue, is frequently based on 'informal' information provided by surveillance systems such as GPHIN - and a list of measures to be enacted by the WHO. The designation of a pandemic phase is made by the WHO Director-General, consistent with the provisions of the IHR (2005) 'in consultation with other organizations, institutions and affected Member States' (WHO, 2009a: 20). The timing and sequence of alerts in relation to the 2009-2010 H1N1 pandemic influenza outbreak is given in Table 1, below.

Pandemic Phase	Declaration by WHO	Probability of Pandemic	Description	Key recommended actions
1-3	Period until 27/04/09	Uncertain	Sporadic clusters / small cases of disease	Producing, implementing and exercising national pandemic preparedness and response plans
4	27/04/09	Medium to high	Verified community-level outbreaks	Rapid containment
5	29/04/09	High to certain	Sustained community-level outbreaks in at least two countries in one WHO region	Pandemic response: each country to implement actions detailed in their national plans
6	11/06/09	Pandemic in progress	Sustained community-level outbreaks in at least one other country in another WHO region	
Post-pandemic	10/08/10		Activity returned to seasonal influenza level in most countries	Evaluation of response, revision of plans, recovery

Table 1: Level of WHO pandemic influenza alert in relation to 2009-10 H1N1 outbreak. Adapted from WHO (2009a: 27).

Analysis of the chronology of the pandemic and the spatialities involved demonstrate that, whilst the networks of surveillance were profoundly important in shaping the WHO's alerting process, this technological sophistication involved a complex set of interactions between member states, in which diplomatic openness competed with national interests. In particular, there were significant moments when WHO pandemic alerting, and advice on collaboration, were undermined by member state actions. In this section, we identify three such moments.

Period I: until 29 April 2009 (initial alerting)

Reports of an outbreak from a range of locations were purportedly being processed from as early as 30 March 2009 (Veratect, 2009). On 1 April 2009, HealthMap identified a local media report, published in the Mexican newspaper *La Jornada*, stating that a respiratory illness had 'sickened up to 60% of residents' in the village of La Gloria, Veracruz (Brownstein et al, 2009). This account, and further media broadcasts within Mexico over subsequent days, reported that residents suspected the epidemic to be linked to the existence of manure 'lagoons' sited at the Granjas Carroll pig farm, also located in Veracruz, and that Mexican health officials had been sent to the area to investigate a report that 400 people were ill, and two had died, as a result of the outbreak (HealthMap, WWW).

According to Brownstein et al (2009), it was GPHIN's alert to the WHO concerning an outbreak of acute respiratory illness in the Mexican state of Veracruz on 10 April 2009 that prompted communication of the

illness to international institutions such as the WHO's Global Outbreak Alert and Response Network. Reporting within Mexico, therefore, informed the WHO's decision to issue its initial disease outbreak notice on 24 April 2009 (*Daily Telegraph*, 2009). The next day, the WHO classified the event a 'public health emergency of international concern' (WHO, 2009b). On 27 April 2009, it increased the level of alert to pandemic Phase 4 'medium to high'. Two days later, the alert was raised to Phase 5 'high to certain'.

It was during this early, complex, period that the WHO began to directly issue guidance to member states on public health interventions. It advised that 'all countries intensify surveillance for unusual outbreaks of influenza-like illness' (WHO, 2009b) and affirmed that it was 'not recommending any travel or trade restrictions' (WHO, 2009c). Yet, the actions of certain countries extended beyond this, counteracting any sense of global cooperation (Gostin, 2009). China, for instance, mandated incoming passengers to report flu-like symptoms at ports of entry when disembarking from H1N1-affected areas (*BBC News*, 2009). Singapore was one of several countries which deployed thermal scanners to screen air passengers on arrival (Cowling et al, 2010), whilst Japan intensified the use of pre-existing scanners at Narita Airport (*Reuters*, 2009a). Moreover, in clear contravention of WHO advice, measures were introduced aimed at restricting travel, with Cuba, for example, becoming the first country to suspend flights to Mexico on 28 April (Lister and Henderson, 2009). These actions caused some academics to conclude that Mexico was being 'singled out' for 'all the wrong reasons' (Condon and Sinha, 2009: 21).

Period II. 29 April – 10 June 2009 (WHO alert at Phase 5)

The period from late April to early May 2009 represented the height of global and, perhaps, national media coverage of the H1N1 outbreak (Warren et al, 2010). At this time, GPHIN was retrieving a total 30,000 articles a day (GPHIN, personal communication, 13/01/10) (Figure 2, below).

Insert Figure 2

The WHO repeated its advice against the imposition of travel and trade restrictions. On 2 May 2009, in an indication of the importance it attached to its task, the WHO combined with other global institutions - the FAO, the OIE and the World Trade Organization (WTO) - to release a joint statement on the H1N1 virus, proclaiming that the consumption of pork posed no sanitary risks (WTO, 2009). This was in response to various decisions taken by individual states during this period that went beyond WHO advice. According to Gostin, 20 countries prohibited meat imports from Mexico, the US and Canada (2009). The main instigators included China and Russia, two of the world's biggest pork importers, and the South East Asian nations of Thailand, Indonesia and the Philippines (Gostin, 2009). In addition, unilateral travel advisories continued to be sanctioned by sovereign states. For example, Hong Kong residents were advised not to travel to Mexico, whilst, on 2 May 2009, mainland China suspended flights from the country altogether (*China View*, 2009).

At the same time, both China and Hong Kong implemented quarantines for travellers from affected areas, whilst Singapore placed recent visitors to Mexico under home quarantine (Gostin, 2009).

The efficacy of these member state measures has been questioned. For example, whilst China deemed its virus-control efforts to have been 'an amazing success' (Yanzhong, 2010), WHO recommendations advised against entry and exit screenings as it did not believe these measures would mitigate the spread of the disease (Katz, 2009). Moreover, Cowling et al (2010) reported that, in countries where entry screening measures were used, 'the majority of cases were identified through the local health care system after arrival' (Cowling et al, 2010: 7).

Period III. 11 June 2009 – 09 August 2010 (Phase 6)

The third, and final, moment commenced with the WHO's official declaration of pandemic Phase 6 on 11 June 2009. In her announcement of the decision, Margaret Chan stated that the virus in circulation was 'entirely new' (WHO, 2009e). She gave general advice to member states, requesting that those with little or no cases 'remain vigilant', whilst countries experiencing widespread disease spread concentrate on 'appropriate management of patients' (WHO, 2009e). Chan also restated the organisation's longstanding position against travel restrictions and border closures (WHO, 2009e). Yet, despite this advice, certain member states continued to undermine the WHO's global pandemic guidance. Pork import bans remained, in some cases, for a number of months. In addition, China continued quarantining travellers throughout summer 2009 in spite of international censure (Metzl, 2009). By the end of October 2009, 2,046 American citizens had been quarantined, with 215 testing positive for H1N1 (Yanzhong, 2010). As late as March 2010, the UK Foreign and Commonwealth Office website warned that anyone arriving in China with flu-type symptoms might be quarantined for up to seven days.

Discussion and conclusion

The 2009-2010 H1N1 outbreak represented the first significant global test of event-based surveillance networks such as GPHIN, redeveloped following the 2003 SARS outbreak, and of the WHO's new disease reporting and verification framework, established under the revised IHR (2005). It is in the context of a new global focus on anticipation and preparedness, and with reference to the notion of a 'Surveillance Industrial Complex', that we return to the three arguments we advanced in our Introduction.

i. Spatialities of public health surveillance

Global public health surveillance systems track information across a range of locations in order to anticipate threats which, to use Ingram's phrase, 'do not yet exist' (2010: 296). Historically, they can be seen to represent the dominance of the global north, where technologies were developed and deployed to promote a particular approach to global health surveillance. Yet, in order for this 'centralised expertise' to operate, decisions made to issue alerts often depend on uncovering largely 'informal' information, including 'rumors' or 'unusual' activities – such as sudden increases in acute respiratory illness - broadcast through local press

reports, news wires and online sources across the global north and south (Brownstein et al, 2008). Through a process of 'verification', this information becomes 'formalised' and provides a basis for issuing global alerts. In the main, it is work based on information in the public domain, on what is said rather than what is left unsaid. There will be selectivity and silences in the reporting process. As a result, and in spite of access to a vast security apparatus, the global north's authority is constrained.

ii. Complexities of pandemic preparedness and response

In our case example, it was clear that the WHO had access to information from a number of surveillance networks and that the Mexican government demonstrated 'responsibility and transparency' in reporting the H1N1 outbreak to the relevant WHO regional office and in sharing its virus samples (CDC, 2009). This implies that there was cooperation between the WHO and its member states in seeking *verification* of this public health emergency, with the Mexican government being lauded for sharing information and being compliant with surveillance.

However, the cooperation was complex. There is evidence that the WHO were initially slow to respond to information received from event-based networks. Brown (2009) has drawn attention to the 14 day gap between the transnational organisation receiving a GPHIN alert concerning an outbreak of acute respiratory illness in Mexico (10 April 1009) and issuing a disease outbreak notice to the global health community (24 April 2009). Moreover, as the pandemic proved less severe than initially feared, allegations were made against the WHO. Specifically, it was accused of 'overstating' the dangers of the outbreak and, according to a draft report commissioned by the Council of Europe, of 'lacking transparency' (Bosely, 2010). Questions were raised about conflicts among members of WHO advisory groups and expert committees, with many understood to have received funding from pharmaceutical companies that manufacture antivirals and influenza vaccines (Bosley, 2010). Indeed, as the case of Indonesia and the sharing of H5N1 avian influenza virus samples demonstrate, the WHO's interactions with the private sector are complicated and subject to controversy. Although the WHO-commissioned Review Committee found 'no evidence of malfeasance' (WHO, 2011:14), the accusations are a reminder of the growth of 'Surveillance Industrial Complex' in public health, encompassing academia, technology companies and vaccine manufacturers.

iii. Diverse biosecurity practices

The WHO pandemic preparedness guidance accorded member states' rights to develop their own national plans. However, our example has highlighted instances where, in pursuing this flexibility, countries acted *against* transnational guidance in an attempt to secure their borders. For example, legally contentious pork embargos were imposed by 20 countries including Russia, China, Philippines and Indonesia (Gostin, 2009). Condon and Sinha (2009) argue that these measures, disproportionately applied to Mexico, could discourage reporting of future disease outbreaks. Moreover, travel restrictions were enacted by certain states - including China, Hong Kong, Argentina and Cuba (Gostin, 2009) – in spite of consistent WHO advice against the 'restriction of regular travel' (WHO, 2009f).

At the same time, we identified a number of member state practices which, whilst not in defiance of WHO guidance, did extend beyond WHO advice. For example, many countries not only imposed trade embargos, passenger health checks prior to disembarkation and thermal image scanning at major airports, but also implemented varying degrees of quarantine (China, Hong Kong and Singapore). These practices have, in the main, proved to be of limited epidemiological benefit. Moreover, the variations in intervention among member states have led to certain countries' practices being criticised for their perceived intrusiveness. For example, the UK media used the experience of UK travellers, particularly those subjected to quarantine measures, to highlight the extent of overseas pandemic interventions, through headlines such as 'UK tourists hit by 'overzealous' checks' (*The Sunday Times*, 26 July 2009) and 'My hell locked up in Egyptian swine flu ward' (*Manchester Evening News*, 30 July 2009). Whilst it is not unexpected that the UK news media would broadcast contentious interventions in such a way (Warren et al, 2010), concern was also expressed within more 'official', or 'expert', discourses. For example, in June 2009, the US Department of State broadcast its disapproval of Chinese quarantine procedures, stating that 'the random nature of the selection process increases the uncertainty surrounding travel to China' (Kralev, 2009).

The use of event-based surveillance systems has, therefore, raised new questions about the relationship between technological deployment and global public health governance. New political economies have been created, particularly with respect to the expansion of the surveillance 'industry' in global public health. These have been examined, and problematised, through our case example of the 2009-2010 H1N1 pandemic influenza outbreak. The informal openness afforded by event-based surveillance systems has acted as a powerful prompt for transnational organisations, such as the WHO, to drive international cooperation in pandemic preparedness planning. Yet, the H1N1 pandemic also highlighted varied practices of preparedness in existence between countries across the global north and south, which undermined the WHO's appeal to a 'new' international health diplomacy. Granted, member states have not subverted the WHO's advice as in the manner adopted by Indonesia in relation to the use of H5N1 avian influenza virus samples. Nevertheless, the WHO's attempts to win support for greater international cooperation, observed in connection with the *alerting and verification* of the current H1N1 outbreak, were, at the same time, weakened by the varied *interventions* of individual member states early in its transmission. These messy realities of global public health governance complicate existing notions of biosecurity as a set of responses promoted by countries of the global north.

Words: 5635 (article) + 1346 (biblio) = **6981** (total)