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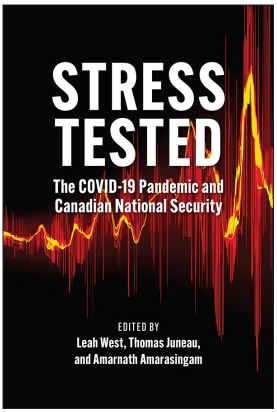

STRESS TESTED: THE COVID-19 PANDEMIC AND CANADIAN NATIONAL SECURITY

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Reviving the Role of GPHIN in Global Epidemic Intelligence

Kelley Lee and Julianne Piper

Introduction

Effective surveillance, monitoring, and reporting are essential pillars in any global system of disease prevention, control, and response. Identifying public health events of concern quickly and accurately, to provide early warning of outbreaks and new pathogens, is particularly critical. Epidemic intelligence prompts timely action to prevent such events from becoming more severe and potentially spreading internationally (Murray and Cohen 2017).

The World Health Organization (WHO) is mandated with the responsibility for global epidemic intelligence gathering under the remit of the International Health Regulations (IHR), an internationally binding legal instrument that governs how national governments and the WHO respond to international health emergencies. Historically, this UN specialized agency relied on paper-based reports from official government sources. When developed and launched by Canadian public health officials in the late-1990s, the Global Public Health Intelligence Network (GPHIN) proved to be a ground-breaking initiative for expanding capacities to rapidly gather and disseminate epidemic intelligence. Within a decade, however, GPHIN's role would become less prominent, and was indeed downgraded by the Canadian government. Technological advances,

new data platforms, and a shift in the political climate away from multilateralism led to the sidelining of GPHIN. This decline in support mirrored WHO's struggle with chronic underfunding at a time of increasing risks from emerging pathogens and outbreaks, notably from zoonotic diseases (Smith et al. 2014).

This chapter begins by briefly tracing the creation and integration of GPHIN, as a technically and politically innovative tool for strengthening outbreak intelligence capacities nationally and globally. We then explain the factors leading to the decline of support for GPHIN and its neglect during a period of withdrawal from global engagement and co-operation under the Stephen Harper government (2006–15). We consider the implications for the replacement of GPHIN with alternative arrangements for national and global health security, notably in relation to the emergence of SARS-CoV-2 and the COVID-19 pandemic. We conclude with lessons learned for GPHIN and the future role of early warning systems amid anticipation of new revisions to the IHR (2005) and reform of WHO and potentially of global health governance more broadly.

Background: Creation and Expansion of GPHIN

Several critical trends at the turn of the twentieth century led to the creation and refinement of GPHIN, which offered a cutting-edge contribution to international disease surveillance. First, the rapid transformation and growth of communication technologies significantly changed how information could be collected and shared. Second, in response to accelerating globalization, the security sector's traditional focus on issues of national economic or military importance expanded to encompass a wider range of social and political issues. The emerging framework of "human security" in the 1990s sought to shift focus from the security of the state to that of individuals and communities, reframing basic human needs such as access to education and health care as security concerns (UNDP 1994). Amid the HIV/AIDS pandemic, the reframing of health by WHO and other global health actors became increasingly common, contributing to the popularization of the concept of "global health security." Third, as a prominent voice in the global health landscape, Canada was a respected champion for both multilateralism and a broadly defined global

health agenda. It was against this backdrop and at the nexus of security, global public health, and information technology that the first iteration of GPHIN (GPHIN I) was established in 1997.

GPHIN I was created by Canadian public health officials with financial support from the Nuclear Threat Initiative based in Washington, DC. Initially a prototype, GPHIN was a leader in the yet-to-be-explored field of Internet-based disease surveillance (Mykhalovskiy and Weir 2006). It served as a national early warning and situational awareness network designed to detect potential public health threats worldwide through real-time, events-based monitoring of media reports from around the world (Mawudeku et al. 2016). In 2000, GPHIN was then integrated by WHO as one of the centrepieces of its Global Outbreak Alert and Response Network (GOARN). GOARN was a global "network of networks," serving as a repository of global epidemic intelligence and a reserve of experts that could be deployed by WHO in response to identified public health events. Supplementing traditional reporting and co-operation with member states, GOARN enhanced WHO's ability to detect potential international public health threats. The historically novel reporting relationship between GPHIN and WHO prompted comparisons with Canada's formative contribution to international peace and security through its championing of UN peacekeeping (Wenham 2016).

The post-9/11 world saw a broader framing of security issues to include biological, bioterrorist, and chemical threats, all of which contributed to the growing prominence of the global health security paradigm. Amid renewed efforts to further strengthen early warning and rapid response to outbreaks following the severe acute respiratory syndrome (SARS) outbreak in 2002–03, GPHIN II was launched in November 2004. The Minister of Health at the time, Ujjal Dosanjh, exemplified the tone of Canada's approach, noting that "such incidents as SARS and avian influenza have demonstrated the importance of a strengthened network of international cooperation and communications. GPHIN is an example of the benefit of this increased collaboration" (Government of Canada 2004). The launch of GPHIN II was among several significant investments made by the Canadian government in its health emergency preparedness and response capacities during this period, including the creation of the Public Health Agency of Canada (PHAC) in 2005. These developments

coincided with the revision of the International Health Regulations (IHR) by WHO member states as the international legal framework for preventing and controlling the international spread of disease. The embedding of non-government information sources in the IHR's functions, as provided by GPHIN II and similar systems, was especially seen as a substantial strengthening of national and global epidemic intelligence in an increasingly interconnected world.

The prototype of enhancements for GPHIN II was developed in collaboration with Nstein Technologies, in recognition of the "need to make the most of the tools of modern communication . . . for the earliest threat detection possible" (Ted Turner quoted in Government of Canada 2004). This second iteration of GPHIN brought a new level of sophistication, marked by an expansion to operations in seven languages, the adoption of an all-hazards approach, and a greatly increased data-processing capacity. Maintained by PHAC as a hub of surveillance and response, GPHIN II performed secure web-based system searches of news wires with more than twenty thousand daily news reports and websites, on a wide range of topics including disease outbreaks, bioterrorism, chemical exposures, product and drug safety, and natural disasters. Information was then filtered for relevance and made available via electronic international alerts to GPHIN users, including WHO, government authorities worldwide, and NGOs, as well as daily reports for use within Canada. If the automated filtering by the system's algorithms determined an event met a certain threshold of significance, an alert would be sent to GPHIN users automatically. Events at a lower threshold of significance, or deemed irrelevant by the automated process, would be examined by GPHIN analysts from a wide range of disciplinary backgrounds (e.g., journalism, public health, medicine, social sciences) to check their accuracy. Any potential alerts erroneously dismissed would be actioned appropriately.

The incorporation of GPHIN into global health surveillance systems was a critical contribution to WHO's capacity to identify disease events, sometimes even before states reached a comprehensive understanding (Davies 2015). In the mid-2000s, GPHIN was providing approximately 40 per cent of WHO's early warning information on disease outbreaks. Perhaps even more significantly, the creation and success of GPHIN helped revitalize and transform the global impetus for international monitoring

of disease outbreaks and other health threats (Mykhalovskiy and Weir 2006).

Overall, initially envisioned as an early warning system to strengthen Canadian responses to potential public health threats, GPHIN became recognized as "one of the most imaginative and creative additions to global disease detection . . . [and] a key tool for the detection of significant new epidemics, wherever in the world they may occur" (Government of Canada 2004). Yet while GPHIN's contributions were celebrated at the global level, its role remained to inform Canada's responses to global health crises including SARS (2002–03), H1N1 (2009) and MERS (2012) (Dion, Abdelmalik, and Mawudeku 2015). Indeed, in a world of increasingly permeable borders and mobile populations, distinctions between "global" versus "national" public health risks became somewhat blurred.

The Displacement of GPHIN

The accolades given to GPHIN for its early contributions to addressing issues of data scarcity and access to enhance global public health surveillance systems through the increased use of open-source and unofficial data sources have been well earned. The early detection of SARS by GPHIN in 2002, in particular, put it at the forefront of a new era with the coming into force of the revised IHR (2005). However, two developments since this period led to the decline of GPHIN. The first concerned dynamics at the global level. On the heels of GPHIN's success came the advent of other platforms, such as ProMED and HealthMap. Launched in 2006, HealthMap is an automated system based on algorithms for data collection, filtration, and assessment. The HealthMap system expanded open-source disease surveillance by integrating "disparate data sources, including online news aggregators, eyewitness reports, expert-curated discussions and validated official reports, to achieve a unified and comprehensive view of the current global state of infectious diseases and their effects on human and animal health" (cited in Roberts 2020). The importance of HealthMap was demonstrated in March 2014 when it issued a health alert regarding a hemorrhagic fever in Guinea, which was reported to WHO by the government nine days later as a rapidly evolving Ebola virus outbreak.

In principle, these additional platforms should have strengthened WHO's GOARN, expanding available intelligence sources. In practice, GOARN shifted over this period from its original mandate of global coordination of early warning public health intelligence to a stronger focus on response. One reason for this shift was the increased workload of reviewing and analyzing incoming intelligence from a growing number of traditional and digital sources. This increase in demands on staff coincided with funding pressures on WHO caused by decades of zero real and absolute growth in the assessed contributions of member states, policies upheld amid the global financial crisis (Lee and Piper 2020). The decision by GOARN to shift focus to response activities led surveillance platforms to work more directly with governments and each other. As part of their commitments under the 2005 IHR, many States Parties also invested in strengthening core capacities during this period, including disease surveillance. Many countries began to develop direct relationships with other countries, often circumventing WHO. Instead of a globally coordinated network of networks, therefore, epidemic intelligence became increasingly fragmented. GPHIN maintained its close working relationship with GOARN but found itself operating amid multiple, even competitive, systems of epidemic intelligence (Roberts 2020).

The second factor leading to the decline of GPHIN stemmed from domestic policy decisions. The emergence of a more fragmented global epidemic intelligence environment coincided with rapid technological change and expanding "big data" sources (e.g., social media), which required platforms to continually invest in updates. However, amid increased austerity measures under the Harper government (2006–15), the necessary financing for updates was not forthcoming and GPHIN failed to keep pace (Carter, Stojanovic, and de Bruijn 2018).

In 2013, an evaluation of epidemic intelligence systems revealed that the GPHIN "system design did not allow the extraction or collection of data in a format compatible" with the needs of the Global Health Security Initiative, a prominent Ottawa-based international partnership formed in 2001 to strengthen global public health preparedness (Barboza et al. 2013). The impacts of insufficient investment in GPHIN were compounded by changes in PHAC management. Efforts to align bureaucratic processes with other federal departments, and to reduce spending, ultimately

resulted in an undervaluation of and subsequent departure of relevant public health expertise from PHAC's senior management. While these developments originated under the Harper government, the Trudeau government (2015–) has not reversed this trend. This has contributed to institutionalized misunderstandings of how to effectively leverage GPHIN's capacity. In a renewal process undertaken from 2015 to 2019, driven in part by efforts to bring GPHIN into compliance with government IT policies, PHAC and the National Research Council replaced GPHIN with a "modular platform that incorporates modern natural language processing techniques to support more ambitious situational awareness goals" (Carter, Stojanovic, and de Bruijn 2018). As noted in the interim report by the independent review of GPHIN launched by the Government of Canada in 2020, "while the [renewal] led to some enhancements, some potential opportunities might not have been realized and not all were satisfied with the amount of improvement that resulted" (External Review Panel 2021).

However, this description suggests a continued lack of understanding of the important role played by a system like GPHIN. The renewal resulted in a significant curtailing of certain GPHIN functions, prompting internal dissent and resignations. In practice, this meant that GPHIN alerts have not been issued for public health events in Canada since 2014, and changes to reporting procedures meant that GPHIN analysts could no longer issue alerts about detected public health threats without senior management's approval (External Review Panel 2021). This requirement undermined GPHIN capacity to provide rapid early warning. As described in a *Globe and Mail* investigation, "as a result of this edict, the alert system went silent, which had a cascading effect inside the department. Soon after, international surveillance and intelligence-gathering activities were also cut back. Analysts were told to focus on domestic issues that were deemed more valuable to the department" (Robertson 2020a).

Overall, at both the global and domestic levels, governments have failed to invest sufficiently in up-to-date and coordinated epidemic intelligence systems since SARS-1. GPHIN suffered as part of this broader pattern of neglect. From a flagship platform celebrated internationally, lack of investment by successive federal governments over time saw it struggle to keep pace with technological change (PHAC 2018). Most importantly, at a time when risks of major public health events evolved and grew amid

intensified globalization, Canada's epidemic intelligence system became increasingly neglected.

The Role of GPHIN in Early Warning on COVID-19

The scale of global devastation resulting from COVID-19 is testament to a collective failure to act on lessons learned from previous global health emergencies, both in terms of repeated calls from experts to strengthen the authority of WHO in its global coordination role, and the need to enhance preparedness and response capacities at the national level. Unfortunately, GPHIN's trajectory and the degree to which it was leveraged to support national and global responses to the COVID-19 pandemic are no exception.

Canada's Chief Public Health Officer, Theresa Tam, confirmed that GPHIN was the body responsible for informing her of a cluster of coronavirus cases in Wuhan in late December 2019 (Gilmore 2020). Government records confirm that data on the outbreak was first shared by GPHIN on 31 December 2019 (PHAC 2020). When questioned on the role of GPHIN in Canada's COVID-19 response, Health Minister Patty Hajdu underscored that Canadian officials were aware of the risks to human health and "watching it very carefully" in late 2019 and early 2020. However, she also acknowledged that greater intelligence provided by GPHIN would have likely contributed to a better and earlier understanding of the situation (Gilmore 2020). Indeed, the critical value added of a tool like GPHIN is that its reliance on unofficial sources like local news outlets and social media means that it should, in theory, outpace the data-collection and information-sharing processes of official government sources.

Analyses of the beginning of the COVID-19 pandemic contend that GPHIN was not leveraged to its full potential in the earliest days and weeks of the outbreak, nor in the period from early January to mid-March 2020, during which Health Canada's assessment of the risk of COVID-19 to Canadians was persistently maintained as "low" (Wark 2020). At least three early warning platforms—BlueDot, HealthMap, and ProMED—have been credited for alerts on 30 December 2019 regarding a cluster of "unidentified pneumonia cases" in Wuhan, several days ahead of WHO's first public notification of the outbreak via Twitter on 4 January 2020

(WHO 2020). Key questions surrounding the role of GPHIN in responses to COVID-19 extend beyond whether or not the threat could have been identified a few days or weeks earlier. That GPHIN was not issuing global alerts throughout 2019 and 2020 and, equally importantly, that it was not being drawn upon for situational awareness as the COVID-19 pandemic unfolded suggest that critical opportunities were missed. For example, if GPHIN had been operating at optimal capacity, it is difficult to imagine that the intelligence network would not have picked up on red flags around the global spread of SARS-CoV-2 and its impacts, which were being signalled at escalating rates by late January and throughout February (Wark 2020). Similar questions could be asked about what intelligence informed Canada's preparedness and response to the new COVID-19 variants that subsequently emerged during the pandemic.

There was widespread disappointment with GPHIN's failure to provide timely Canadian intelligence or global early warning alerts. Simply put, "the Global Public Health Intelligence Network was meant to perform a critical warning task with regard to the COVID-19 outbreak. This was its job" (Wesley Wark quoted in Brewster 2020). Considerations of the role of GPHIN and epidemiological intelligence gathering in national and global responses to COVID-19 must extend beyond questions of what information was collected and how, to how this information was made use of once available. Notwithstanding the potential benefits that earlier intelligence could have had, why did the early warning signs not trigger a sufficiently robust national public health response to prevent (or mitigate) the pandemic? The failure in Canada to prevent the devastating impacts of COVID-19 suggests deeper structural and institutional challenges, including an inadequate incident-management system. For future events, how can Canada better leverage its intelligence gathering capacity to support timely and evidence-informed decisions? What investments will be required from Canada and others to sustainably advance global health security? The next and final section expands on these dimensions, presenting some of the lessons learned so far with respect to the role of GPHIN.

Lessons Learned

According to the 2018 *Joint External Evaluation of Canada Self-Assessment Report*, which assessed the country's core capacities to carry out its commitments under the IHR (2005), "Canada has strong public health surveillance systems in place to detect and monitor existing and emerging disease and events of significance to human health, animal health and health security. These systems are able to act upon, communicate and share information across authorities, jurisdictions and sectors" (PHAC 2018). However, against the backdrop of the COVID-19 pandemic, many have raised questions about the effectiveness of existing epidemic intelligence to provide early warning from major public health events (Robertson 2020b). The focus has understandably been on the weakened role of GPHIN, which "should have been at the heart of a Canadian and indeed a global early warning system" (Wesley Wark quoted in Brewster 2020). Its neglect and decline over many years points to important lessons for preparing more effectively for future public health events that pose major risks to the country's health and well-being.

First, the exponential increase in data sources, variety, and volume since GPHIN's launch in the 1990s has proven both a blessing and a curse. Improvements to data access and scarcity, through open and unofficial sources, have undoubtedly strengthened early warning systems. The SARS, MERS (or Middle East respiratory syndrome), Ebola, and other outbreaks have been detected using similar sources prior to official government confirmation of such events. However, the explosion of "big data" poses new challenges. The capacity to gather ever more data and identify significant events amid more "noise" is increasingly difficult. If investments to update and support epidemic intelligence systems are not forthcoming, more data can slow down, rather than speed up, required action.

Second, this points to the need to recognize that epidemic intelligence goes far beyond ever-expanding data gathering. GPHIN and other digital platforms have continued to increase their data sources. However, it is how data are processed, analyzed, and shared that determines how useful these systems are for informing timely responses. These latter functions are invariably labour intensive and cannot be replaced entirely by automation. Some filtering of data is possible, using machine learning and other forms

of artificial intelligence, but turning data into usable intelligence to guide action depends on skilled analysts and efficient reporting mechanisms. These functions must be supported, in turn, by appropriate resources and systems that include clear protocols for risk assessment. Systems for rapid reporting of identified risks to appropriate authorities are also essential. Thus, any failure to act quickly during the earliest stages of the COVID-19 pandemic are unlikely due to a few days' delay in early intelligence gathering. Rather, analyses of this data and the reporting of the assessed risk to appropriate decision-makers, along with clear procedures within government to act quickly and decisively on this intelligence, is where the delays are likely to have occurred.

Third, clear structural challenges have hindered the role of GPHIN. This points to the clear need to prioritize investments in an epidemic intelligence system that ensures access to the most up-to-date data sources, support for data analysts, and upgrading on a regular basis. The cost of such a system is not insubstantial but it is far less than that incurred from the failure to act in a timely manner to emerging events. The system for Canada may draw upon the many platforms now available for gathering data and need not replicate them. Investment may be focused instead on analysis of data for Canadian needs. Moreover, public health intelligence systems cannot be stand-alone operations; rather, they must be integrated with other parts of the Canadian health system. The decentralized nature of the health system in Canada, however, poses some structural problems. For example, variation in data collection and barriers to data sharing across provinces/territories (e.g., genomic sequencing) appear to be a hindrance to rapid action (Flood and Philpott 2020). Epidemic intelligence must also be better integrated with other parts of government, including the national security and intelligence community. In its early years, GPHIN analysts recognized this need and often collaborated, at the working level, with relevant units in the RCMP and CSIS, for example. These types of interdepartmental working relationships need revisiting as part of Canada's post-COVID-19 reflections. This suggests the need to consider what type of intelligence is needed for early warning for epidemic intelligence. For example, conflict, displacement of populations, terrorist threats, and environmental factors can be predictive of potential public health risks. Thus, a whole-of-government approach based on an

"all-hazards" framework may be warranted to "connect the dots" across different risks to Canadian interests, including national security.

Finally, the effectiveness of any national-level system of epidemic intelligence is dependent on the quality of global health governance. Major public health events, by definition, go beyond individual countries in terms of both cause and effect. The chronic underfunding of WHO and, by extension, the weakening of GOARN's early warning function also need urgent attention in the wake of the COVID-19 pandemic (Gostin, Moon, and Meier 2020; Lee 2020). Any effort to strengthen national-level systems must thus support, and not undermine, global systems for gathering and sharing epidemic intelligence.

Conclusion

Early warning systems and epidemic intelligence capacities need to be reviewed as part of Canada's post-COVID-19 lesson-learning process. Any approach to strengthening health emergency preparedness and response capacities, both nationally and globally, should sensibly leverage existing knowledge and experience. However, future Canadian contributions to global public health intelligence gathering, and considerations of how to integrate these functions across different government agencies, must recognize the unique and often hidden attributes of GPHIN. First, GPHIN's historical successes were a result of the work of highly trained, multidisciplinary analysts with prior knowledge, specialized expertise, and judgment skills specific to identifying public health events of potential concern. The broadening of skill sets and professional backgrounds among PHAC management, to align it with other parts of government, came at the cost of critically needed specialist public health expertise. A renewal of these capacities is required, although where such expertise should best be located remains unclear. Second, GPHIN was as beneficial to Canada as it was to the rest of the world. A health intelligence system that artificially delineates between national and global risks fails to recognize the interconnected nature of such risks and the critical need for coordinated action within and across countries. Finally, GPHIN initially operated in an organizational environment that was conducive to the agility, collaboration, and technological innovation required to remain responsive in

a dynamic landscape. National security, encompassing health security within Canada and globally, will benefit from renewed public health intelligence gathering that is independent of partisan politics, sustainably resourced, and linked to appropriate incident-management systems at the national and global levels.

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