"Flying Blind": Canada's Supply Chain Infrastructure and the COVID-19 Pandemic

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Abstract

Canada's COVID-19 response has been described as slow, with reactive decision making that has left the most vulnerable populations at risk of infection and death from the virus. Yet, within and across the provincial health systems, the supply chain processes and data infrastructure needed to generate the relevant data for and evidence of the spread of COVID-19 and the health system's capacity to respond to the pandemic are non-existent in Canada. Emerging evidence from a national research study highlights the significance of supply chain data infrastructure and processes that offer transparent, real-time data to inform decisions that support a coordinated, evidence-informed pandemic strategy that is proactive and capable of protecting the health of every Canadian.

Introduction

Canada's response to the COVID-19 pandemic has been profiled as "slow to act," with limited international surveillance and delays in implementing protective measures such as physical distancing, border closure and the generalized use of personal protective equipment (PPE) to contain the spread of the virus (Doolittle et al. 2020). This widely held view suggests that Canadian decision makers had the opportunity to respond more quickly but did not. Yet, health leaders have had little or no relevant information, limited data and even fewer analytics tools to inform decisions and actions to manage this pandemic proactively and decisively. The legacy of this pandemic should not be the slowness in taking action – which, from an international perspective, is debatable – but the complete absence of robust, transparent data infrastructure with digital platforms and tools to inform leadership decisions to enable an effective pandemic response.

Evidence of the Impact of Supply Chain Infrastructure and Pandemic Management

When supply chain processes are interrupted, there are severe consequences that can place patients and clinicians at great risk. A flood in 2012 at a Sanofi Pasteur plant in Toronto, the supplier of a bladder cancer drug called ImmuCyst, resulted in a significant worldwide shortage (Mostafid et al. 2015) and lengthy delays in treatment for patients. When Hurricane Maria knocked out the electrical grid in Puerto Rico in 2017, Baxter's plant – one of the United States' only manufacturers of intravenous (IV) bags – experienced a severe stock shortage (Wong 2018). Canadian and US hospitals were left without the needed supply of IV bags, limiting their ability to deliver IV medications for a number of weeks. Supply chain interruptions during public health crises are also well documented.

A key lesson learned from the severe acute respiratory syndrome (SARS) epidemic was the importance of protective equipment for health workers. Three of the 44 Canadians who died of SARS were healthcare workers (Low 2004: 63–83) as transmission of the virus was poorly understood, resulting in 400 persons who became ill with SARS and 25,000 people placed in quarantine (Varia et al. 2003). Although public health practices and infection-control procedures improved following the SARS epidemic, supply chain practices did not change.

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There is a remarkable dearth of research on the health system supply chain in Canada and in global health systems. Supply chain infrastructure and processes in Canadian health systems are highly varied in structure (e.g., centralized in some provinces, decentralized in others), with little or no access to data (e.g., product and inventory data, utilization data, lab capacity), which impedes coordination of pandemic responses across jurisdictions (Beaulieu et al. 2018) and results in little or no transparency of health system outcomes (Snowdon and Alessi 2018). This pandemic has laid bare the critical need for data infrastructure and supply chain capacity to acquire and move products, equipment and supplies in an effective manner to enable health teams to deliver essential care services safely. As the COVID-19 pandemic continues, health systems must strengthen data infrastructure and supply chain processes informed by empirical evidence of best practices and supply chain resilience (Ivanov and Dolgui 2020).

This paper reports on early findings emerging from a study funded by a COVID-19 operating grant (Canadian Institutes of Health Research Ref. VR5 172669). The study used qualitative methods to examine health leader perspectives on supply chain processes and data infrastructure and associated pandemic management strategy within and across seven provincial health systems. This evidence informs health system strategy, policy and collaborative approaches across federal and provincial governments to support effective, agile and responsive COVID-19 management.

The Role of Supply Chain Data Infrastructure in COVID-19 Outcomes

Lack of data infrastructure to inform decisions

When one physician leader was asked by our team to describe his experience in managing the COVID-19 pandemic, his response was "We are flying blind." "Flying blind" was a term first used in World War II when pilots had no ability to see the horizon and relied on instruments to navigate the aircraft. What has quickly emerged as a key theme across the seven provinces is that there are no instruments to guide and inform leaders or provider teams as they navigate and respond to this pandemic. Current data systems are, for the most part, non-existent in most provinces and inadequate in others. Health system leaders, supply chain teams and clinicians described the lack of data platforms that precluded proactive surveillance of COVID-19 outcomes across populations; the underdeveloped and untested contact-tracing infrastructure used to inform public health decisions; and the limitations of manually counting and reporting critical supplies, such as PPE, and manually aggregating fatality reports. Another key finding evident across all seven provinces was the absence of data systems or platforms that traverse federal, provincial and territorial jurisdictions to offer the digital connectivity needed to better coordinate efforts and enable learning across provincial health systems. Thus, health system leaders and clinician teams had no other option but to make decisions without data or evidence. Examples include the absence of data that help identify the communities with the highest-risk population segments (e.g., seniors living in long-term care, chronic illness populations) in need of early prevention efforts so as to reduce the risk of contracting the virus as well as the absence of data identifying inventory volumes and locations where PPE was most needed to support public health directives to prevent virus transmission. There is an absence of instruments in the public tool box that analyze population health data to identify citizens at highest risk so that proactive measures can be implemented to protect them.

PPE shortage

An early outcome evident in the first wave of COVID-19 was the lack of supply data infrastructure across Canada to identify risks based on access to PPE; this emerged as a key factor contributing to the capacity of our health workforce to deliver care and services safely. In many organizations, such as long-term care and homecare facilities and community agencies, there is no supply chain capacity (e.g., no supply chain expertise, no supply chain teams and no data infrastructure to identify products on hand) to source and procure critical products such as PPE to prevent transmission of the virus to both patients and health workers. In hospitals, supply chain teams source and procure the critical products (e.g., PPE, medications, ventilators, beds) that health teams need to safely care for patients, particularly patients with COVID-19. Hospitals varied widely in their supply chain infrastructure to ensure that PPE products were available when and where needed. None of the seven provinces have achieved a digitally enabled supply chain infrastructure to track available supply inventory, location of supplies and utilization rates of critical products or equipment in real time, to inform health leaders of actual or

potential product shortages or to identify communities and health workers at greatest risk due to critical capacity challenges such as COVID-19 testing capacity. Data infrastructure able to track the utilization of and demand for critical medical supplies across jurisdictions, including PPE, or the rate of health worker exposure to COVID-19 across health organizations simply do not exist. Many participants in this research have noted that the key lessons learned from the SARS epidemic were never implemented. The availability of PPE had been identified as a significant challenge during the SARS epidemic, but approaches to PPE supply remain unchanged due to a pervasive lack of understanding of the strategic importance of supply chain capacity and infrastructure (Low 2004: 63–83; Naylor et al. 2003; Varia et al. 2003). One supply chain leader said,

> Supply chain teams are at the bottom of the birdcage in health systems; we were not even included in the "pandemic pay" allocations offered to essential workers.

By comparison, global health systems that have prioritized supply data infrastructure as a strategic asset reported greater supply chain resilience, such as a lower incidence of workforce transmission of COVID-19 and transparent digital platforms able to track the availability of PPE for every employee (B.J. Rocchio, personal communication, June 2020), during the early phases of COVID-19.

Impact on Canada's health workforce

The most consistent theme emerging from participants in all seven provinces is the significant challenge that all health workers and clinician teams experienced during the early phases of the COVID-19 pandemic. The lack of supply chain data infrastructure and the visibility and insights that these data offer have had a profound impact on Canada's health workforce, which has experienced intense uncertainty, anxiety and, in some cases, panic as workers were desperate to access PPE to protect themselves and their families. Clinician leaders (e.g., chiefs of medical staff, chief nursing officers) described the anxiety and panic among clinicians as they all watched reports of health systems being overwhelmed in Italy, Spain and China, with media reports of widespread COVID-19 infections and deaths among health workers in these jurisdictions. Every province has resorted to conservation efforts, which restrict health workers' access to PPE and are perceived as further fuelling panic, anxiety and uncertainty among health teams. In hospitals, PPE were kept in locked storage areas, and clinicians were allocated a small number of PPE items (e.g., masks, gowns, gloves) to be used for their entire shift. In long-term care, PPE was often unavailable, and workers resorted to wearing garbage bags and homemade masks to protect themselves. Although these measures were intended to conserve PPE supply to avoid shortages, this strategy had a profound impact on the confidence of health workers in the safety of their workplace. In some community organizations, leaders reported rates of absenteeism as high as 30% due to workers fearing for their personal safety and the safety of their families. Workforce confidence in the safety of the workplace was further eroded by provincial directives that required health organizations to manually count and report PPE supplies. Staff counted masks, gloves, gowns and face shields on hand and reported their counts each day, further fuelling their uncertainty about whether their workplace could continue to supply the necessary products to protect workers providing patient care. Over 21,842 health workers have been infected with the virus and 12 have died, accounting for 19.4% of the COVID-19 cases across Canada (CIHI 2020a).

Impact of supply chain data infrastructure on COVID-19 rates among seniors

A key finding from the first phase of the pandemic is the high rate of COVID-19 deaths among seniors in long-term care facilities, accounting for 81% of deaths in Canada, compared to an average of 42% in other Organisation for Economic Co-operation and Development countries (CIHI 2020b). The two provinces with the highest rates, Quebec and Ontario, have no provincial data infrastructure capable of tracking COVID-19 outcomes among key populations (e.g., seniors, vulnerable populations), tracking workforce prevalence of COVID-19 or identifying the availability or location of PPE supplies across the health system. In both provinces, long-term care settings had little or no access to PPE and no supply chain capacity to source and procure PPE, both of which contributed to high rates of worker absenteeism resulting from fear for their personal safety and high prevalence of COVID-19 cases among care providers. In both provinces, the two groups of Canadians who paid the highest price for the lack of access to PPE and absence of digital infrastructure that would help inform decisions on PPE distribution were our seniors and health workforce. Leaders in these provinces had no access to data to support evidence-informed decisions: there were no data to identify populations at greatest risk, no data to inform leaders on how best to scale the capacity of lab testing and a complete absence of information to inform decisions on PPE distribution to ensure that our most vulnerable citizens (e.g., seniors in long-term care) and the care teams that provide care for them had the protective equipment they needed to protect themselves from COVID-19.

Lack of connectivity and collaboration across jurisdictions

Findings reveal high variation among federal agencies and Canadian provinces in terms of data infrastructure and the

advances in supply chain data and capacity this infrastructure offers. For example, Alberta Health System has highly digitized supply chain infrastructure capable of tracking every product, its location and its utilization rates across the entire province, which enabled leaders to source PPE in December 2019, well in advance of nearly every other global jurisdiction (Drinkwater 2020). In stark contrast, Ontario and Quebec have no such digital infrastructure or supply chain capacity, resulting in leaders having to make decisions based on limited and fragmented data from the manual counts of PPE supply reported daily. Most notably, the COVID-19 infection rates among health workers in these two most populated provinces were 16.7% and 24.1%, respectively, compared to 8.1% in Alberta (CIHI 2020a). In addition, infection and death rates among seniors were much higher in both Ontario and Quebec compared to those in Alberta, British Columbia and the eastern provinces. Although there are a number of factors that likely contributed to these outcomes, health system leaders and supply chain experts across all seven provinces perceived these outcomes to be linked directly to the inadequate capacity of data infrastructure and supply chains to anticipate, and respond to, the COVID-19 pandemic as it swept across Canada in March through June of 2020. The current research program is applying quantitative data analyses to investigate the factors that could predict these critical pandemic outcomes for Canadian provinces.

Conclusion

It is long overdue for Canada to create a comprehensive digital strategy that ensures data (e.g., population data, supply data and workforce health data) are available in real time, within and across jurisdictions, to inform leadership decisions that are proactive and able to anticipate risks and implement preventive measures to ensure that every Canadian and every health worker has the protection needed to sustain health, wellness and quality of life. A proactive and preventive pandemic strategy is only possible with a robust data infrastructure to proactively inform decisions and track outcomes in every jurisdiction. These emerging findings support the urgency for Canada to prioritize supply chain data infrastructure capable of connecting provincial, territorial and federal health systems to create the transparency that leaders need to overcome the slow, reactive approach to pandemic management that is evident today. As Canada plans for the future, the capacity to mitigate the risks of COVID-19, and future pandemic events or disasters, will stand or fall on the availability of robust data infrastructure to ensure that every health organization has the essential supplies, equipment and capacity to respond proactively, to support preventive public health efforts to contain the spread of the virus and to offer the care needed for those who become infected. HQ

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