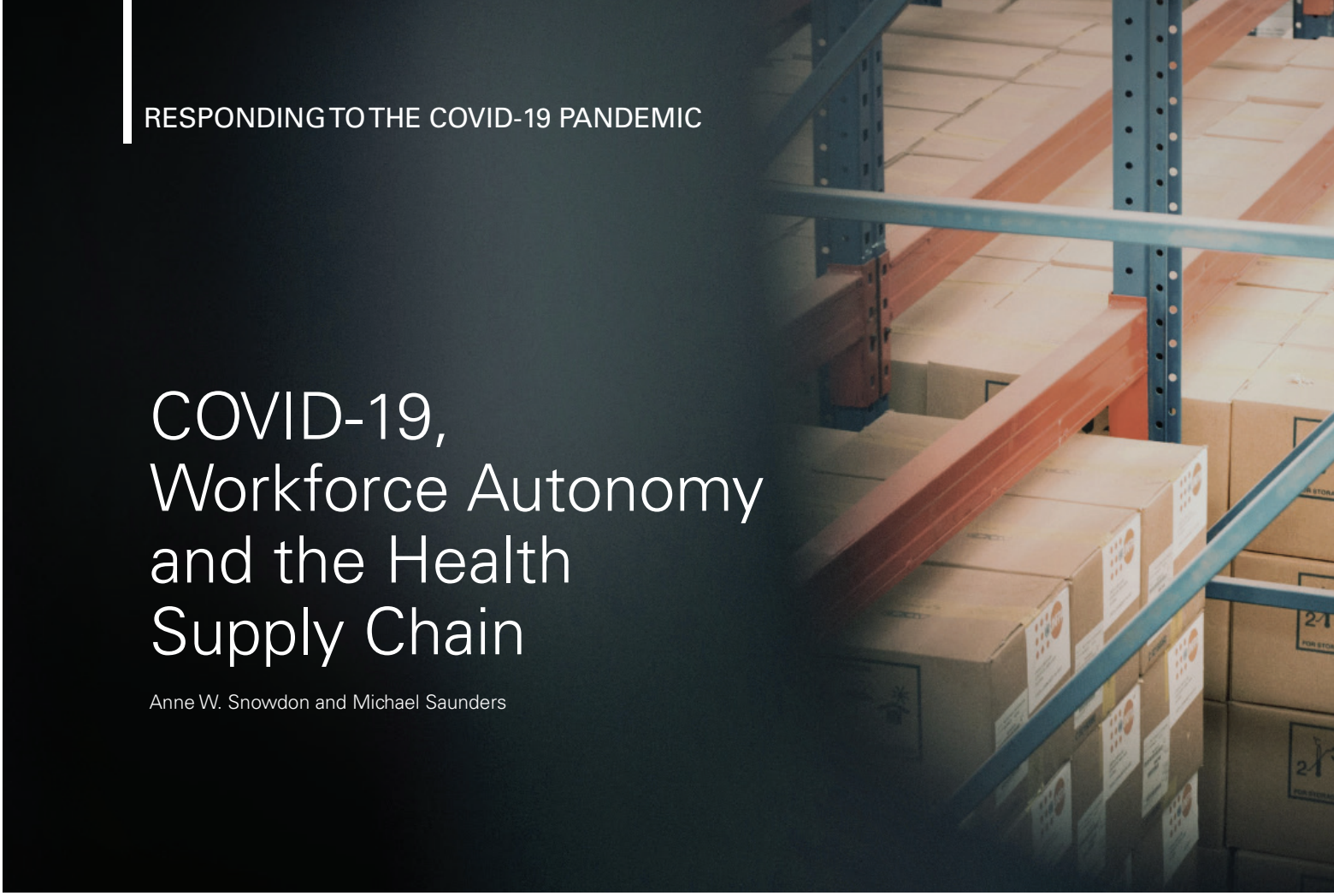

COVID-19, Workforce Autonomy and the Health Supply Chain

Anne W. Snowdon and Michael Saunders

Abstract

During the COVID-19 pandemic, the rapid surge in demand for critical supplies and public health efforts needed to guard against virus transmission have placed enormous pressure on health systems worldwide. These pressures and the uncertainty they have created have impacted the health workforce in a substantial way. This paper examines the relationship between health supply chain capacity and the impact of the COVID-19 pandemic on Canada's health workforce. The findings of this research also highlight the impact of the pandemic on health workers, specifically the relationship between the health supply chain and the autonomy of the health workforce.

Introduction

The COVID-19 pandemic has created a rapid surge in demand for the critical supplies needed for public health efforts to both contain the spread of the virus and care for those who become infected. The relentless demand for supplies has placed tremendous pressure on the global health supply chain, resulting in significant shortages of critical products, such as personal protective equipment (PPE), vaccines and essential equipment, such as beds and ventilators. This destabilization of the global health supply chain continues to reverberate throughout health systems, creating a landscape rife with uncertainty for the health workforce and contributing to a form of mass trauma. This has been called the "COVID-19 effect," which is "a unique and complex form of trauma with potentially devastating consequences in both the short- and long-term for individual nurses" and the care environments they work in (ICN 2021).

In addition, the shortage of critical products (e.g., PPE) has been linked to high rates of infections in front-line healthcare workers (ICN 2021). As of December 31, 2020, 1.6 million healthcare workers were reported to have been infected with the COVID-19 virus globally, and 2,692 nurses had died as a result of infection. In Canada, COVID-19 infections among health workers have tripled since July 2020, with 65,920 reported cases as of January 15, 2021 (CIHI 2021). There have been reports of 43 health worker deaths due to COVID-19, including 12 deaths just in the past six months (CFNU 2021; CIHI 2021). Canadian health workers have stated that access to respirators (e.g., N95 masks) continues to be a challenge, with only 60% reporting that PPE was available when needed (CIHI 2021). The total number of global healthcare worker deaths remains unknown due to the underdeveloped system for tracking infections and deaths among health workers worldwide (ICN 2021). It has been widely reported that healthcare workers are suffering from exhaustion and burnout, with the International Council of Nurses warning of an exodus of nurses, exacerbated by the COVID-19 effect, which could lead to a global shortfall of 10 to 14 million nurses by 2030 (ICN 2021). One in three nurses in Ontario are "considering leaving this critical front-line

healthcare profession" (WeRPN 2021). In Quebec, 4,000 nurses are reported to have left the profession since the onset of the pandemic (Kline and Kovac 2021). The link between health supply chain capacity to supply critical products and health workers' health, safety and confidence is now clearly evident, although long-term outcomes for the health workforce remain to be determined.

The purpose of this paper is to examine the relationship between health supply chain capacity and the impact of the COVID-19 pandemic on Canada's health workforce. Specifically, this paper will examine the impact of the health supply chain's destabilization on the front-line health workforce in Canada, informed by the emerging themes and findings of an ongoing COVID-19 operating grant (CIHR Ref. VR5 172669). This research project has used a mixed-methods case study approach to both document the response of provincial health systems to the COVID-19 pandemic and to examine the relationship between health supply chain capacity and COVID-19 outcomes. Participating provinces include British Columbia, Alberta, Manitoba, Ontario, Quebec, Nova Scotia and Newfoundland and Labrador. This paper reports on the results of emerging findings from a qualitative analysis of more than 140 interviews of key stakeholders across the seven provinces, a secondary analysis of public reports and quantitative analyses of publicly available health system data sets. Primary data sources were the original qualitative interviews, which were conducted to fulfill the purpose of the study. Theoretical sampling was used to identify key participants who represented varied perspectives and expertise in each provincial health system, including health professionals (e.g., medicine, nursing), health organization leaders, representatives from health professional organizations, government leaders and supply chain teams. A snowball sampling approach was used as interviewees identified others who could provide additional insights and experiences to inform study outcomes. Semi-structured interviews documented the study participants' experiences, perspectives and views about how supply chain infrastructure and processes were operationalized during the pandemic; how they contributed to the management of the COVID-19 pandemic; how supply chain processes influenced health system processes and workforce outcomes during the pandemic; and how challenges, solutions and gaps in supply chain capacity have contributed to COVID-19 outcomes in Canada. Participants were invited to take part in the research via e-mail and were provided with study information and a consent form prior to participation. All interviews were conducted over a secure digital platform and were audio-recorded with participant consent, transcribed verbatim and then subjected to analysis using a grounded theory approach to support the accuracy and validity of the study findings.

Findings

Four themes emerged from the qualitative data analysis:

1. anticipatory fear and uncertainty across the health workforce;
2. the destabilization of the health supply chain and supply chain fragility;
3. tensions arising from shortage of critical supplies and health system approaches to conserve supply inventory; and
4. the erosion of professional autonomy in the case of making decisions on the use of PPE.

The four themes are described in the following sections.

Anticipatory fear and uncertainty across the healthcare workforce

The first theme describes the intense fear and uncertainty that the health workforce experienced in the early phases of the pandemic. As the pandemic rapidly unfolded across the globe, countless social media images and news reports illustrated its devastating impact in many global jurisdictions, including China, the UK, Italy, Spain and the US. The constant and sustained fear engendered by the COVID-19 pandemic was described by a senior member of a health professional association:

> [The pandemic was not like] an earthquake where we had to deploy a bunch of people into one place … and then it's over in a day or it's over in five minutes, and then you have to clean up or whatever. But this was like this big dark shadow that could actually kill you sitting out there.

This sense of uncertainty unfolded rapidly: COVID-19, as a novel and unknown virus, was described as a source of high anxiety and uncertainty for front-line health professionals. Uncertainty and anxiety were further aggravated by the deluge of images and news reports of global health systems being rapidly overwhelmed by a surge in COVID-19 cases. In these hard-hit jurisdictions, the exhaustion of critical supplies such as PPE, ventilators and beds gave rise, at times, to ethically fraught situations, particularly surrounding the ethics of triage and the rationing of scarce medical resources. There were far more patients in need of care due to COVID-19 infection than there were hospital beds and critical equipment (e.g., ventilators and PPE) available for the provision of safe care. One physician leader described the impact of these images on the workforce:

> [A]t one point, I think we were told that we should be planning for 1,500 patient admissions a day in [city name], which is just ridiculous. We couldn't handle a quarter of that a day, so I saw a real disconnect. And I'm a numbers person, so I would stare at numbers a lot and just look at what I was hearing. … [T]here wasn't enough back and forth [discussion] for people to challenge the assumptions being made about the numbers. And [that's] where the panic set in. I think everybody was going "Oh my God!" and they quit thinking. So they [health leaders] would give summaries, but they wouldn't give the actual numbers to crunch models and things like that. [They were] so very protective around what the numbers meant, what was coming down the road, which impacted planning, and so the panic … And so we were allowed to go into panic mode, and I think that really deeply affected the psyche of the healthcare system, the healthcare workers and the leaders.

The issue of workplace health and safety and the availability of PPE became a central concern for Canada's healthcare workforce as the pandemic swept across every global jurisdiction. Health workers experienced high stress and concern regarding the availability of and access to PPE, especially N95 respirators. A great deal of this anxiety stemmed from the *relational context* of clinicians caring for patients suffering from COVID-19:

> This relational context suggests that [clinicians'] concerns about PPE may arise not just because of concerns for personal safety but also because of concerns about transmitting COVID-19 to loved ones, especially those who have medical conditions that make them particularly vulnerable, or because they may be the sole support for and carers of children or dependent adult relatives. (Morley et al. 2020a)

The location of front-line health workers and PPE considerations within a relational context was a consistent theme that described the experiences of health professionals in every province. A provincial human resources leader recounted the experience of fielding questions posed by front-line healthcare workers:

> Am I safe? What's the impact here? Is my family safe? Am I bringing anything home to my family? What does this mean for my patient and me safety-wise? What protection do I need now?

Two senior nursing union leaders from two different provinces described how front-line healthcare workers worried about appropriate PPE protection and the risk of exposing their families to COVID-19, a concern that was particularly acute given that so little was known about the COVID-19 virus at the time:

> So a huge concern was around [the] level of PPE required, and all the anxiety that came with that. I mean I guess all the anxiety and fear that came with an unknown virus was huge, beyond huge, and the fear that the workers were going to bring the virus home to their families. I never heard them say, "I'm afraid I'm going to get sick" …; it was always "I'm going to bring it to my family." [There was] huge, unbelievable fear and anxiety around that, and then an extension of that [was] will the PPE keep them safe, and anxiety around that.

> We had hundreds and hundreds of calls from nurses, mostly concerned about PPE. We had a lot of calls from nurses that, maybe, are immunosuppressed, or they were caring for a senior in their home, or they had young children, and so there was a great deal of anxiety and fear in the first, I'd say, two months because of the unknown ...

A physician leader conveyed how anxiety about PPE and its appropriate use extended to physicians. In some cases, physicians would procure their own PPE to feel safe, which caused distress in their fellow healthcare workers, as described by a physician leader:

> Physicians in general are not employees of the healthcare centre. [T]hey would go out and buy whatever stuff they want[ed], and [this was] the only way I could kind of get through to them – I said, you know, if you come to work wearing a spacesuit, that's your prerogative; you can buy this stuff; you're not employed by the health centre. I can't tell you what to do. But if you're in a spacesuit and the poor nurse beside you and the respiratory therapist are wearing a surgical mask ... what does that say to the team?

This sense of concern about PPE's appropriate use was echoed by a senior supply chain and logistics chief:

> Staff were really concerned in all of this; they were concerned about the products that were protecting them.

Some health supply chain and health system leaders suggested that this fear and uncertainty about supply availability led to "hoarding" of critical products by healthcare workers. Multiple provincial health supply chain teams described a sudden and dramatic increase in the utilization of PPE, often prior to the appearance of a confirmed case of COVID-19 in the province. Front-line healthcare workers were concerned about having access to protective equipment and about their safety in the workplace, which fuelled their anticipatory fear and uncertainty. Before the emergence of confirmed COVID-19 cases in Canadian provinces, the effects of the global health supply chain's destabilization were felt deeply by front-line healthcare workers. The lack of knowledge and evidence about the virus was compounded by the lack of transparency about the available supply of protective equipment, which further fuelled the sense of uncertainty and anxiety among health teams.

As the impact of the COVID-19 virus began to unfold, uncertainty was also linked to the constantly changing decisions and directives issued to manage the pandemic. The COVID-19 virus was, and is, a novel virus, and when the pandemic began, decisions were dynamic, and directives changed as new information emerged. A union leader described how the health workforce's anxiety was compounded by these frequent changes in PPE protocol:

> And there [were] so many changes, [such as] we didn't wear masks, then we did wear masks and you had face shields; so there [were] changes almost every other day in what the PPE requirements would be. So that created a lot of angst as well.

The first wave of the pandemic was characterized by fear, uncertainty and panic across Canada's entire health workforce due to the many unknowns about the COVID-19 virus, lack of transparency regarding anticipated numbers of COVID-19 cases that health system leaders were preparing for and the fear of being overwhelmed by high numbers of patients infected with the COVID-19 virus. Shortages of PPE further contributed to health workers' fear for the safety of their own selves, their families and their patients, which resulted in considerable pressure on health leaders to source and procure PPE at both the provincial and federal levels. As health system leaders and their respective supply chain teams urgently worked toward securing PPE to protect the workforce, it became very clear to the workforce that there was a shortage in the supply of critical products needed to protect the safety of both health professionals and their patients.

The destabilization of the health supply chain and supply chain fragility

The destabilization of the global health supply chain during the COVID-19 pandemic made clear many of the characteristics of health supply chain fragility (Snowdon et al. 2021), which had far-reaching and system-wide consequences. Across Canada, health supply chain teams worked to ensure that health systems and front-line healthcare workers had access to critical and life-saving products. However, these teams were often fighting against strong currents of global competition due to unprecedented system-wide disruptions and destabilization. They were also confronted with – and attempting to rapidly address – deep-rooted supply chain fragilities that were exposed and exacerbated by the COVID-19 pandemic. Provincial health systems were dependent on long supply chains, which were often tethered to a single geographic source. Moreover, the manufacturing capacity for many essential health products was, and is, generally offshore for Canada, with very few products sourced from domestic suppliers that manufacture products locally. At the outset of the pandemic, the standard health supply chain channels were severely disrupted because the quarantine of populations in China resulted in shuttered manufacturing and a very sudden decline in product availability.

Almost immediately, provincial health systems faced significant disruptions in the distribution of critical products. This disruption resulted in severe shortages of products, which resulted in suppliers limiting the distribution of critical supplies to the product volumes that had been established in procurement contracts well before the onset of the pandemic. This restriction of product distribution was referred to as an "allocation strategy," or as placing health systems on "allocation." A health supply chain leader described this strategy to restrict allocation of supplies to health organizations in the following way:

> When COVID first started, all vendors put us on pre-COVID allocations, right? So what it really meant was we don't really care whether you're using 10 times more now or 30 times more now. They basically said if you received 100,000 before, you are getting 100,000. I can give you a classic example with masks. So in the case of masks, we [normally] use 30,000 masks a day. That's all you are getting. When our utilization hit[s] 600,000/day, you're not going to make it, right?

Traditional suppliers and distributors were not able to honour requests for increased product volumes due to the profoundly limited supply available from manufacturers, which were primarily located in China. This situation of supply chain destabilization and allocation was described by a provincial health system and supply chain leader:

> Traditional suppliers … were of some value, but little. They couldn't help, they had nothing. Their answer was: You're on allocation, that's it.

A provincial health supply chain leader from another province described a similar situation:

> All these distributors came back to us and said: You know what? We actually can't help you, we have no product. We're putting you on allocation.

The inability to source and procure critical supplies, such as PPE (e.g., gloves, gowns, masks, face shields) and ventilators, forced health systems to compete for new sources of supplies, with very little time for due diligence or product-vetting processes. Provinces attempted to rapidly source and procure products from non-traditional suppliers, which forced health supply chain teams to modify their vetting procedures, resulting in some shipments of substandard (or even fraudulent) products. This situation of supply chain destabilization and uncertainty was aggravated by many health systems lacking well-managed pandemic stockpiles. In many cases, health systems had little or no pandemic stockpile or had failed to manage pandemic stockpiles, resulting in the waste of products that had exceeded their expiry dates and had to be discarded before the onset of the pandemic. The inventory of critical products was profoundly limited, with no line of sight as to when these products could be sourced and distributed to meet the surge in demand across all Canadian provinces. Global health supply chain fragility exerted a downward force on provincial health systems – as described, traditional or contracted suppliers placed health systems on allocation, which led to health system leaders implementing processes to control the access and use of critical supplies. A health system supply chain leader described the impact of traditional supplier allocation on the implementation of their own allocation procedures:

> I don't know how other provinces did it, but for us, if we were still getting pre-COVID allocations [from traditional suppliers], what we had to do was actually sequester that product. And then we allocated it to our sites based on what we were getting, which meant that they would not have enough supplies.

The purpose of these strategies was to "conserve," or ration, the availability of products to clinicians in patient care settings. Conservation strategies and allocation models became a system-wide reaction to health supply chain fragility and destabilization. A conservation mindset contributed to the use of an "allocation framework" that restricted the type of PPE health professionals had access to in most clinical settings. Health professionals were required to limit their use of PPE to the allocated PPE items for each shift. This allocation strategy was designed to strictly control the utilization of the critical supplies in order to manage the limited inventory of PPE available. In order to control access to critical supplies, health leaders and their supply chain teams often removed critical supplies from hospital locations, pulling critical supplies (especially N95 respirators) from shelves and storing them in centralized warehouses. Products that did remain on site in hospitals were locked away and, in some cases, required access via key cards. Access to critical supplies required special requisitioning and approval before clinicians could acquire the products needed for patient care. Access to PPE for clinician teams was determined by an allocation framework, which prescribed the products permitted for use in specific clinical settings and for identified care procedures. For example, N95 masks were only to be used for aerosol-generating procedures, which are procedures most common in critical care settings such as emergency departments and critical care units. The use of a conservation strategy was fundamentally a response among provincial teams to manage the global supply chain destabilization that had resulted in critical shortages of supplies. This "reactive" approach was a central feature of many health system and supply chain responses to the COVID-19 pandemic across Canada. During a surge event, a reactive health supply chain (Snowdon et al. 2021) relies on conservation measures to control the use of critical products by using a decision-making framework that allocates products to specific clinical use situations. Given that, at the onset of the pandemic, most provinces had a limited supply of critical products and a limited capacity to meet the surge in demand for care, these measures were intended to manage the surge in demand for products. These conservation supply measures have had a profoundly negative impact on Canada's workforce.

Tensions arising from shortage of critical supplies and health system approaches to conserve supply inventory

In most provinces, conservation strategies prioritized hospitals over other health organizations. In the early phases of the pandemic, the conservation of PPE was prioritized for hospitals in an effort to ensure that patients acutely ill with COVID-19 could be cared for safely. One physician noted that the motivation to preserve and protect critical supply inventory for hospitals delayed implementing masking protocols in other organizations, such as long-term care (LTC) facilities. The availability of product supply was a key driver of pandemic-management strategies that focused on ensuring that hospitals had prioritized access to critical supplies such as PPE:

> Acute care got prioritized because [the health authority] was the one holding most of the PPE and the best logistics for getting it around and getting it into people's hands, etc., etc. So [the province] had their own supply chain mechanism to get stuff out to them. So there was somewhat of a conscious attempt to not create [something] like the masking protocols, and things in LTC facilities were held off for a bit longer to preserve and protect supply for the hospitals.

One health professional suggested that, in some cases, PPE was removed from LTC facilities to support hospitals:

> Hospitals and regions came [to LTC facilities] and said: We need your PPE for [the] ICU. [The] ICU is more important than you.

Allocation models in some provinces then rationed PPE supplies to LTC facilities, allotting a weekly or biweekly amount to each facility. Other provinces directed LTC facilities and other community organizations to source their own PPE, and if the facility experienced an outbreak, the province would then allocate PPE to support the management of the outbreak. A leader in one community organization described the following:

> We were absolutely on the hook to keep our staff healthy because we [had] had one example in [province] where they got sick with COVID, and they had to close down. They were closed for two months. So we can't afford for that to happen ... I've been through a shortage before ... It was all based on a contingency by hospital[s], and the rest of the sector just gets forgotten in that, and of course what is happening is the hospitals [is] seen as the most critical.

As mentioned, most provinces prioritized hospitals in the early phase of the pandemic and then amended allocation decisions to supply to all health organizations some weeks later. The health workforce in community settings (e.g., LTC) was reported to have severe staff shortages due to high rates of infection with COVID-19, although there remains very little, if any, data to quantify these workforce outcomes in community settings across the seven provinces.

In using conservation strategies to control access to and utilization of critical supplies, health systems adopted a *command-and-control* approach for supply management, whereby leadership committees at regional and provincial levels (e.g., emergency operation centres) created allocation guidelines to inform decisions on which medical units and clinical teams required access to critical supplies, such as N95 respirators. These conservation measures allowed supply chain teams and health system leaders to monitor the utilization of supplies (or approximate "burn rates") as they diligently managed utilization across the province. This conservation mindset also extended to the contingency measures that many health systems considered and, in some cases, implemented, including recycling or reprocessing N95 masks, use of donated and/or non-medical grade products and collection of PPE from health organizations in the community to redistribute to hospitals in order to ensure that products were available to prioritized hospital settings.

Allocation of protective equipment has continued across most provincial jurisdictions. The definition of appropriate use of PPE has been, and continues to be, a source of confusion and dispute, such that front-line healthcare workers are concerned about not only the availability of protective products but also about the appropriateness of the protection they are afforded by the allocation guidelines. The question of the appropriate level of protection has been a source of high uncertainty and fear among health workers, which was described by a leader of a palliative care organization in the following quotation:

> Our biggest worry was frankly our nurses, and they were extremely anxious. Some of them are going home to some compromised people and, you know, [are] really, really very worried all the time. So it's been very, very tough, and we've done many things to recognize them, to bring them meals and food … but the reality is [that] they're the ones [who] go into those rooms … so it's been very, very difficult for them.

As the allocation frameworks were implemented by provinces, significant tension emerged between healthcare unions and health system leadership. Given the novel nature of the COVID-19 virus, health unions asserted that health systems should follow the *precautionary principle* and established infection control principles rather than relying on conservation measures and allocation models informed by inventory supply levels and projected utilization rates. The precautionary principle directs health professionals to use the highest level of protection in clinical care until there is evidence to support the theory that lower levels of protection are suitable to protect staff and patients from transmission of the virus. The level of risk associated with the mode of transmission of the virus (e.g., droplets, contact, airborne) determines the type of PPE that offers the most appropriate protection. There was significant concern among health professional unions that availability of products, rather than established principles and scientific evidence, was informing decisions regarding PPE protocols. A union leader described this concern:

> It is our firm belief that the lack of recognition that COVID is airborne is still being driven by [the] supply of PPE, and even though [the] government is saying there's adequate PPE in this province, I don't think there is – not to have everyone be fully decked out in full respiratory precaution.

The basis of health professional union advocacy for the use of precautionary principles was evidence from prior pandemic events such as severe acute respiratory syndrome (SARS), as described by one leader:

> Justice Campbell's executive summary was my guiding principle through all of SARS. So I've kept the introduction to Justice Campbell's report – the last paragraph in the introduction is what's guided [the organization] through it: "SARS taught us that we must be ready for the unseen, that this is one of the most important lessons of SARS. Although no one did foresee, and perhaps no one could foresee the unique convergence of factors that made SARS a perfect storm, we know now that new microbial threats like SARS have happened and can happen again. However, there is no longer any excuse for governments and hospitals to be caught off guard and no longer any excuse for healthcare workers not to have available the maximum level of protection through appropriate equipment and training." And that has been our guiding principle throughout.

One health supply chain team leader suggested that the decision of their provincial government to not implement a more comprehensive N95 masking protocol stemmed from a combination of both political calculation and supply availability. Specifically, the lack of an appropriate quantity of N95 masks to support the implementation of a comprehensive N95 masking protocol may have informed the decision to implement allocation procedures and restrict access to N95 respirators. Although this supply chain leader noted that allocation was understood to be a politically unpopular stance, they suggested that it may have been viewed by political leadership as better than the risk of failing to operationalize a protocol:

> I do find that our politicians are likely struggling with two different problems. One is do they keep the N95 use restricted to these very specific circumstances and fight the battle around people wanting more than they have and holding that line? That is certainly unpopular and has a certain cost politically and to people's health. Or do they let the doors fly wide open on N95s and let people get what they want, but then simply not have enough?

No evidence has emerged from this study to suggest, however, that any of the provinces attempted to adopt and support the precautionary principle or mobilize and enable their health supply chain and supply chain teams to attempt to implement a comprehensive PPE policy informed by the precautionary principle. Instead, allocation decisions were made based on being ready to manage a potential overwhelming surge in cases requiring hospitalization. Conservation of protective products using allocation frameworks was implemented from the outset of the pandemic to control their utilization by monitoring and controlling access. A conservation mindset informed the implementation of allocation protocols, and supply inventory considerations were key determinants in shaping these conservation strategies by provincial health systems.

The outcome of allocation as a conservation strategy further escalated healthcare workers' anxiety, uncertainty and, in some cases, panic due to fear for their personal safety and the safety of their families. The implementation of allocation models and conservation strategies imposed a compliance approach that health professionals were required to abide by, which eroded health workforce confidence in the safety of their work environments.

The erosion of professional autonomy in the case of making decisions on the use of PPE

The use of conservation measures in seven Canadian provinces created a rationing regime in which access to critical products, particularly N95 respirators, was restricted to specific care processes or situations. A senior union member described this situation of restricted access:

> We would advise our nurses that if you felt safer with an N95, you should ask for them, but they would ask, and they weren't allowed to have them. In some places, the N95s were under lock and key.

Prior to the COVID-19 pandemic, clinicians would routinely make decisions regarding the use of PPE during clinical practice based on precautionary principles guided by the best evidence of infection control and prevention. The use of allocation models by definition pre-empted health professionals from making the decisions on PPE use in care settings. Removing health professionals from decision making diminished the autonomy of clinicians to fulfill their professional practice role whereby clinicians are expected to abide by practice standards that require clinical judgment and knowledge of best practice to inform decisions on the appropriate use of PPE for a particular clinical situation. These allocation strategies eroded the autonomy of health professionals, especially insofar as it concerned their ability to make decisions informed by principles of

infection control. According to health unions, this was not a dispute over the necessity of conserving scarce critical resources, but rather over the ability of front-line healthcare workers to meaningfully engage in the stewardship of these critical resources. Conservation measures precluded health professionals from leveraging their professional judgment and expertise in determining risk and informing decisions and guidelines on the use of PPE in patient care settings. In all provinces, there was evidence of substantive tension between leadership's command-and-control approach and the professional autonomy of the healthcare workforce. Restricting the freedom of clinicians to exercise clinical judgment compromised the *professional ethos* of the front-line healthcare workforce. This kind of tension is described below (substituting conservation measures for metrics):

> When metrics are used by managers as a tool to control professionals, it often creates a tension between the managers who seek to measure and reward performance and the ethos of the professionals (doctors, nurses, policemen, teachers, professors, etc.). The professional ethos is based on mastery of a body of specialized knowledge acquired through an extended process of education and training; autonomy and control over work; an identification with one's professional group and a sense of responsibility toward colleagues; a high valuation of intrinsic rewards; and a commitment to the interests of clients above considerations of cost. (Muller 2019: 8)

In implementing allocation protocols to conserve protective products, health systems devalued and diminished two features of the health professional ethos: mastery of a body of specialized knowledge (clinical expertise) and autonomy and control over professional practice (clinical judgment). A health system logistics expert reflected on how allocation contributed to this erosion of professional autonomy and the health professional ethos in the healthcare workforce:

> [H]ow can you tell a professional, "I'm giving you two [masks] …"; we would never do that normally. I mean, you know, if we wanted to understand something, we would ask professionals because that's what we're paying them for. We wouldn't tell them how to do this or how to protect themselves.

Allocation protocols transformed the traditional relationship between health system leadership and the healthcare workforce: instead of drawing on the clinical expertise of front-line health professionals, health system leaders prescribed specific practices to health professionals regarding the use of specific types of protective equipment (e.g., surgical masks vs. N95 respirators) during care procedures. It was no longer possible for health professionals to make decisions on the safest care delivery based on precautionary principles; instead, compliance with allocation frameworks was required and enforced by health system leaders. In this way, the health supply chain's destabilization, which resulted in critical shortages of PPE, contributed to the devaluation and minimization of health professional clinical judgment and autonomy as well as to the erosion of the professional ethos of health professionals. Moreover, compliance with allocation frameworks was in direct conflict with health professionals' knowledge and expertise of infection control practices, which supported the use of fully protective equipment in situations where little is known about infection transmission.

A nurses' union leader described how, within a relational context, loss of professional autonomy contributed to the stress and anxiety of front-line health workers:

> We would have nurses calling our regional VP or calling our labour relations officers or their bargaining unit presidents, and they would be crying because they couldn't get an N95 mask. They would be crying because they weren't being allowed to change their PPE between patients. They were afraid to go home and expose their kids because they didn't feel like they had protected themselves well enough in the workplace.

Allocation frameworks essentially conflicted with professional practice principles (e.g., the inability to change PPE between patients, limitations in access to PPE), which was a source of *moral distress* for front-line healthcare workers. The triage and allocation of scarce medical resources during COVID-19 have been described as a form of *moral-constraint distress* (Morley et al. 2020b), in which the allocation models and conservation strategies *constrained* the ability of health professionals to exercise their clinical and ethical judgment to determine the most appropriate PPE for different clinical settings. Most importantly, allocation strategies constrained their ability to determine how best to safely care for patients. According to nurses' unions, infection-prevention and control (IPAC) practices were altered in order to conserve the inventory of PPE and to manage the limited capacity of health systems to adequately respond to the demand for critical supplies. This was described by a union leader:

> They changed IPAC for COVID. So we were educated as nurses, and infection control goes a little bit like this, as I recall, and I don't think it's ever changed: I go into a patient room; I don and doff outside the room; I put

> it on in the appropriate order; I put on my gloves, my mask, my whatever, my shield and I go into the room. And I treat that patient; I only treat that patient. People might pass me in things, and I look after that patient, and when I'm ready to come out, I doff. I doff in a certain order. I make sure not to contaminate myself with what I am taking off. I immediately thereafter wash my hands and whatever, and then I leave that area. I don't cross-contaminate myself in a normal course of events by looking after non-COVID patients. But therein lies our problem. In hospitals and in LTC, where they weren't properly cohorting, it wasn't happening; they changed the rules. So they would say if you're looking after two COVID patients, you have to change your gloves between patients, but you don't have to change your gown, mask and shield between patients.

The use of allocation models to conserve protective product supply impinged upon the professional autonomy of front-line healthcare workers; it disempowered their training and expertise and exacerbated their anxiety and uncertainty regarding the safety of the workplace and their ability to deliver safe care. In order to redress this loss of autonomy, health unions attempted – whether through negotiation and the issue of joint statements or through legal injunctions – to enable point-of-care risk assessment (PCRA) as a means of restoring nurses' ability to make decisions regarding use of protective equipment, such as N95 respirators. This prioritization of PCRA in joint statements or legal injunctions was intended to restore healthcare worker autonomy by formalizing their ability to exercise clinical judgment. The endorsement of PCRA was seen by a health union leader (in the following quotation) to be a necessary compromise with health system leaders in order to ensure that professional autonomy was recognized and that, to a limited degree, health professional autonomy and judgment were restored:

> [There was] a joint statement around PPE, which eventually the health minister signed. [It included] language to the effect that [there was] the requirement to do a point-of-care risk assessment, and, based on that assessment, the provider could access the appropriate PPE, and it wouldn't be unreasonably denied. We felt that was a compromise in that it allowed a front-line worker, a professional, to use their professional judgment of circumstances when they felt they needed a fitted respirator, and then [in our discussions with the Minister], the only way it would be denied was because of supply.

However, these attempts to restore healthcare worker autonomy through PCRA often ran aground on issues of interpretation, with employers delimiting what constituted a PCRA. A union leader described this situation:

> We had employers decide what was a point-of-care risk assessment and what it could be. And, basically, we had some hospitals that told nurses what that point-of-care risk assessment should be in three easy questions, which always, always, always – unless it was an aerosol-generating medical procedure – downgraded your PPE to a level 2 mask only.

In a sense, then, allocation principles and methodologies were reasserted through the delimitation of PCRA. Moreover, aerosol-generating medical procedures primarily take place in acute care settings, which resulted in health organizations outside hospitals (e.g., community care, LTC) having little to no access to protective equipment, such as fitted respirator (N95) masks. The prioritization of a "hospitals first" supply allocation strategy conflicted with the unions' efforts to enable all health professionals to exercise PCRA, particularly in community-based health organizations. The same health union leader succinctly expressed the relationship between the attenuation of PCRA and the erosion of clinical judgment:

> [The PCRA criteria] took away any professional judgment you had.

Multiple provincial unions experienced the same conflict over the interpretation of PCRA:

> The [provincial health leadership] is now backing away from the interpretation that we thought we had in our joint statement. They're now going back to, well, ... the evidence says that you only need an N95 with aerosol-generating medical procedures, and that is their IPAC guidelines that they put out. So now we are back to a fight with the department again. So that's going to unfold in the next number of weeks, and we will either find a resolution on that or they'll agree to the interpretation we all thought we agreed on several months ago. Or I suspect that we will have a joint or a very public fight with this government about safety of employees if they are not willing to make the right response to the professional decision making of front-line nurses and the equipment that they need to keep them safe and to keep their families safe and other patients safe.

Retrospectively, one senior health system leader agreed with the union's assessment that the health system had not

always adhered to the joint statement in a satisfactory manner. The health system had subsequently revised its protocols to more closely follow the joint statement, granting all front-line healthcare workers access to an N95 mask following the determination of a PCRA:

> [In] most provinces, we saw an accord or an agreement with our unions around PPE. It took a while. We took a while getting out [of] the gate, but we did get it done, and I don't think we fully lived up to what was in that [joint statement], and so we changed the rules last week to allow an employee to do the risk assessment. And if they want an N95, we're going to give them one.

Reflecting on the first wave of the COVID-19 pandemic, this same provincial health system leader talked about the attenuation of professional autonomy and judgment that resulted from the implementation of allocation strategies:

> It's almost like if a carpenter or electrician was putting in a light, ... and they had to climb the ladder, and the ladder was aluminum, and he said, "I'm not climbing an aluminum ladder with a live wire that can electrocute me." We'd say, "Yeah, you're right." We'd say, "Yeah, good self-risk assessment." In this case, here, you know what I mean ... we sort of took some of the professionalism away from the professional. The conservation measures took their judgment away.

Some provincial leaders suggested that supporting healthcare workers' clinical judgment – maintaining their professional autonomy, or the *professionalism of the professional* – was a central lesson learned following the first wave of the pandemic:

> If I was doing it [leading the pandemic response] again, I would certainly allow an employee self-assessment to be the trigger, the risk assessment, whatever the outcome of that is.

The necessity of prioritizing and supporting healthcare workers' judgment and autonomy – especially through maintenance of, and responsiveness to, their exercise of PCRA – coincided with the assessment of a nurses' union leader:

> We need to trust the point-of-care risk assessment of the professional who's doing their assessment with this patient at this time and this circumstance, and if we trust our judgment, we can never go wrong.

The implementation of allocation measures to conserve critical supply inventory (a consequence of health supply fragility) resulted in an erosion of autonomy of the front-line healthcare workforce, limiting the ability of health professionals to exercise their professional and clinical judgment. The immediate consequence of allocation measures was heightened anxiety and uncertainty regarding the safety of their workplace. This erosion of autonomy also led to a loss of trust and loss of confidence among health professionals in their health system. The erosion of autonomy, and of the professional ethos, resulted in an erosion of trust among the Canadian health workforce. Or, stated differently, a failure of health leaders in trusting the clinical judgment of front-line healthcare workers and in their autonomy to make decisions based on PCRAs contributed to the loss of healthcare workers' trust in health system leadership and their ability to support health professionals in their work. One provincial health system leader suggested that this erosion of trust is a consequence of the COVID-19 pandemic:

> I do think there's going to be fallout in all jurisdictions when all is said and done, in how we [should have] allowed the staff to make decisions on their own welfare.

The erosion of the professional autonomy and the resulting decline in trust have been suggested to be a long-term consequence of this pandemic:

> I think we'll live with that long past the pandemic. It will take a while for those because those feelings [of a loss of confidence] are there, especially from nursing, and that's practical nursing and registered nursing. Those feelings are there. I do think all jurisdictions will take years to overcome some of the feelings from this.

The long-term consequences from this loss of trust have been further conveyed in other studies:

> [Healthcare workers] feel abandoned by their governments, which failed to prepare for an inevitable epidemic, despite recommendations. The knowledge that they are at increased risk of infection due to lack of protection has resulted in anger, frustration, fear and a sense of violation that may have long-lasting implications. (Brophy et al. 2021: 267)

The disruption to the global health supply chain, coupled with Canada's health supply chain's fragility, contributed to severe consequences for Canada's health workforce. Decisions on care procedures were driven by supply shortages and a lack of pandemic preparedness by Canada's health systems, which

often had little supply of critical products and were generally caught off guard during the first wave of the pandemic. Conservation efforts to manage supply shortages prioritized hospitals and restricted the use of protective equipment; allocation frameworks prescribed when, or if, a health professional had access to protective products and equipment. Health professionals in community-based organizations (e.g., LTC, home care) had access to whatever their organization could provide, with few options for access to PPE. Health professionals in hospital settings experienced high anxiety and uncertainty in the early phases of the pandemic, fuelled by images of the devastating impact of the pandemic in countries such as Italy, Spain, the UK and the US. Health professionals could no longer make patient-care decisions informed by evidence and precautionary principles due to the rapid and severe destabilization of Canada's fragile health supply chain. Efforts to control and limit the use of protective equipment replaced clinicians' ability to make decisions based on evidence and best practices with a compliance model in which decisions were made based on the availability of supply inventory. The loss of the professional decision-making role eroded clinicians' professional ethos and autonomy as health professionals, which in turn eroded their trust in the safety of their workplace. The long-term impact of this erosion of trust, and the resultant devaluation of the professional ethos, remains to be determined as the pandemic continues to unfold.

Conclusion

A number of key findings have emerged from this research that describe the critical link between health supply chain capacity in Canadian health systems and the health workforce, which are summarized in the following section.

Health supply chain capacity is a strategic asset that enables and supports safe work environments in health organizations

This research has demonstrated that health supply chain capacity must be seen as an integral and indispensable component of the larger ecosystem of healthcare delivery, which makes possible the delivery of quality care within a safe and supportive workplace for health professionals. The post-pandemic health system must strengthen the *resilience of the health supply chain to withstand unexpected disruptions in supply and a rapid surge in demand for care*, which will be a crucial task for successful post-pandemic recovery.

Resilience to disruptions in the supply of protective products

A *resilient* health supply chain must have the *capacity to ensure that there is sufficient protective equipment during events of global supply chain destabilization in order to adequately support the professional ethos and autonomy of the health workforce*. During a crisis, a resilient health supply chain should have the capacity to provide critical protective products.

Supply chain capacity is a critical enabler of the professional ethos and autonomy of front-line health professionals

High-performing health systems, particularly during times of crisis, rely on health professionals to deliver quality patient care; in these systems, health professionals are supported and enabled by agile supply chain teams, which are themselves supported and enabled to provide protective products in sufficient quantity so that protection is offered based on principles of infection control and workplace safety. It has become exceptionally clear during the COVID-19 pandemic that supply chain capacity is *critical for supporting and sustaining the professional ethos and autonomy of front-line health professionals*. Divorcing considerations of health supply chain preparedness from health system preparedness creates an environment in which the essential material and logistical support of the professional ethos of health professionals is neglected.

A resilient health supply chain is not only an essential component of the physical safety and mental well-being of healthcare workers but is also required for the protection of the health workforce's professional autonomy and clinical judgment. A resilient supply chain would be able to *guard and protect the professionalism of the professional*. The lack of such protection of the health professional ethos erodes the trust and confidence of health professionals in the safety of their workplace and the capacity of health systems to proactively manage risk, which may have long-term consequences for the sustainability of Canada's health workforce.

Role of the health supply chain in the *moral community* of health systems

If health supply chain fragility gives rise to anxiety and moral distress in the front-line healthcare workforce (placing at risk their safety, professional ethos, autonomy and ability to deliver care), then future efforts to strengthen supply chain capacity should be situated within the context of the broader *moral community* of the healthcare system (Hardingham 2004; Morley 2020) – a community that engages in and supports ethical decision making and that works toward a shared "moral horizon" (Rodney et al. 2009). An integrated approach to strengthening supply chain capacity in health systems would locate considerations of supply chain management, function and decision-making processes within the moral community of the health system. For example, the necessity of conservation and triage – whether of PPE or ventilators – is both an ethical and logistical supply issue; the health supply

chain is, therefore, already implicated in the ethical decision making of the moral community. Through this integration, the ethical considerations that intersect with supply chain capacity and management would not only arise in the wake of the breakdown or destabilization of supply chain function, such as during a shortage of critical products, but would be a central feature and concern of supply management and health supply chain strategy.

Framed in this way, health supply chain management and processes would not only address practical problems but also actively engage in – and be engaged by – the moral community of the health system. Strategies for strengthening Canada's health supply chain for the post-pandemic future must take into account both the central role of health supply chain capacity and resilience in supporting safe work environments and for ensuring that the autonomy of healthcare workers to make decisions on the use of protective equipment that are based on best evidence is preserved and protected; *these* person-centred health supply chain strategies *would support the moral community of the health system through their attention to the person – the healthcare worker or patient – at the end of the health supply chain*.

Post-pandemic health supply chain resilience as a critical driver of safe care delivery

The COVID-19 pandemic has made clear that the person at the end of the health supply chain should be the primary and motivating focus of the health supply chain, and this attention to that person should organize post-pandemic strategies for health supply chain resilience. The COVID-19 pandemic has laid bare both the fragility of Canada's health supply chain and its critical role in supporting the capacity of health systems and healthcare workers to deliver care. A legacy of this pandemic is the urgency to foster and preserve a key differentiator of the health supply chain: its bearing on human life, on the lives of both the healthcare worker and the recipient of care. HQ

References

Brophy, J.T., M.M. Keith, M. Hurley and J.E. McArthur. 2021. Sacrificed: Ontario Healthcare Workers in the Time of COVID-19. *New Solutions: A Journal of Environmental and Occupational Health Policy* 30(4): 267–81. doi:10.1177/1048291120974358.

Canadian Federation of Nurses Unions (CFNU). 2021, April 16. In Memoriam: Canada's Health Workers Who Have Died of COVID-19. Retrieved March 11, 2021. <https://nursesunions.ca/covid-memoriam/>.

Canadian Institute for Health Information (CIHI). 2021, February 25. COVID-19 Cases and Deaths in Health Care Workers in Canada. Retrieved March 11, 2021. <https://www.cihi.ca/en/covid-19-cases-and-deaths-in-health-care-workers-in-canada>.

Hardingham, L.B. 2004. Integrity and Moral Residue: Nurses as Participants in a Moral Community. *Nursing Philosophy* 5(2): 127–34. doi:10.1111/j.1466-769X.2004.00160.x.

International Council of Nurses (ICN). 2021, January 13. International Council of Nurses COVID-19 Update. Retrieved February 9, 2021. <https://www.icn.ch/news/covid-19-effect-worlds-nurses-facing-mass-trauma-immediate-danger-profession-and-future-our>.

Kline, A. and A. Kovac. 2021, February 9. Nurses Leaving Quebec Public Healthcare System in Droves during Pandemic: Report. *CTV News*. Retrieved March 22, 2021. <https://montreal.ctvnews.ca/nurses-leaving-quebec-public-healthcare-system-in-droves-during-pandemic-report-1.5301132>.

Morley, G. 2020, March 25. COVID-19 and the Moral Community: A Nursing Ethics Perspective. *Journal of Medical Ethics Blog*. Retrieved March 17, 2021. <https://blogs.bmj.com/medical-ethics/2020/03/25/covid-19-and-the-moral-community-a-nursing-ethics-perspective/>.

Morley, G., C. Grady, J. McCarthy and C.M. Ulrich. 2020a. COVID-19: Ethical Challenges for Nurses. *The Hastings Center Report* 50(3): 35–39. doi:10.1002/hast.1110.

Morley, G., D. Sese, P. Rajendram and C.C. Horsburgh. 2020b. Addressing Caregiver Moral Distress during the COVID-19 Pandemic. *Cleveland Journal of Medicine*. doi:10.3949/ccjm.87a.ccc047.

Muller, J.Z. 2019. *The Tyranny of Metrics*. Princeton University Press.

Registered Practical Nurses Association of Ontario (WeRPN). 2021, January. *Nursing in Ontario during COVID-19: Exploring the Impact of the COVID-19 Pandemic on Nursing*. Retrieved March 17, 2021. <https://www.werpn.com/wp-content/uploads/2021/01/WeRPN_NursingDuringCovid_Report_Jan27_V2.pdf>.

Rodney, P., C. Varcoe, J.L. Storch, G. McPherson, K. Mahoney, H. Brown et al. 2009. Navigating towards a Moral Horizon: A Multisite Qualitative Study of Ethical Practice in Nursing. *Canadian Journal of Nursing Research* 41(1): 292–319.

Snowdon, A.W., M. Saunders and A. Wright. 2021. Key Characteristics of a Fragile Healthcare Supply Chain: Learning from a Pandemic. *Healthcare Quarterly* 24(1): 36–43. doi:10.12927/hcq.2021.26467.

About the Authors

Anne W. Snowdon, BScN, MSc, PhD, is the scientific director and chief executive officer of Supply Chain Advancement Network in Health (SCAN Health), an international knowledge translation platform that engages health system leaders and supply chain experts to advance global capacity to adopt and scale best practices in the healthcare supply chain to offer traceability of products and care processes from bench to bedside to patient outcomes. She is a full professor of Strategy and Entrepreneurship at the Odette School of Business, University of Windsor in Windsor, ON. She can be reached by e-mail at anne.snowdon@uwindsor.ca.

Michael Saunders, PhD, is a postdoctoral fellow in the Supply Chain Advancement Network in Health (SCAN Health) at the University of Windsor in Windsor, ON. He can be reached by e-mail at michael.j.saunders@uwindsor.ca.