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Encounters with uncertainty and complexity: Reflecting on infection prevention and control nursing in Aotearoa during the COVID-19 pandemic

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Abstract

The disruptiveness of the COVID-19 pandemic created the need for rapid responses in health systems already under pressure and challenged nursing in Aotearoa New Zealand with levels of uncertainty and complexity not previously encountered. For the small number of specialists in the field of infection prevention and control (IPC) nursing nationally, this meant having to adapt to new ways of working and collaborating in situations where the pace of change was extraordinary. This short commentary describes the author's experiences working as an infection prevention and control nurse leader and is underpinned by complex adaptive systems thinking and the concept of collective competence as theoretical frameworks through which to conceptualise and account for the COVID-19 response in the Canterbury region.

Keywords: COVID-19; infection prevention and control; nursing

Introduction

The COVID-19 (SARS-CoV-2 virus) pandemic has required rapid adaptation across health systems. Traditional health sector solutions to changes in the external environment are often driven top-down, though when faced with uncertainty and unpredictable situations, collaboration and shared responsibility may be more effective (Figueria et al., 2019; Hammond, 2000). An approach such as complex adaptive systems thinking, which has risen out of the study of biological and social systems in the field of complexity science (Senge, 2006; Waldrop, 1992), offers organisational leaders in health care a useful model to understand complex health systems, including how groups self-organise, learn, adapt and evolve in dynamically changing environments such as the COVID-19 pandemic response (Ratnapalan & Lang, 2020; Rusoja et al., 2018). Furthermore, the cognitive and collaborative complexity of decision-making that must be negotiated by healthcare teams operating in the COVID-19 response has been complicated by the number and diversity of actors involved and by the potentially diverging values and objectives of these actors. This means even the process of agreeing on the exact nature of problems to be tackled is made more difficult, let alone finding agreement on broadly acceptable long-term solutions (Brown et al., 2010). Boreham (2004) defined three key characteristics of teams that effectively navigate these types of challenges: (a) collective sense-making of events; (b) making use of the knowledge base of the collective as a whole; and (c) a sense of interdependency. Boreham termed this collective competence. These two frameworks have supported and informed the author's understanding of the COVID-19 response in the Canterbury region.

Infection and prevention control response

As news of an emerging respiratory virus pandemic hit the headlines in early 2020 (McNeil, 2020), there was a noticeable increase in phone and email enquiries as anxious clinical staff sought infection and prevention control (IPC) advice. An interdisciplinary team from a range of health professions, joined forces to collectively support the IPC response to the pandemic. The integrated health system model in the Canterbury region has been previously described (Timmins & Ham, 2013) and

this model enabled the power of these existing networks to be promptly harnessed. At first, this coming together was unstructured and informal. Available colleagues met together first thing each morning and worked through questions of the day flooding in from clinicians via different pathways as best we could. Later this evolved into a formal Technical Advisory Group.

There was significant depth of experience and knowledge available from subject matter experts across the Canterbury Health System (including Canterbury Health Laboratories, Community and Public Health, Canterbury Primary Response Group, Department of Infectious Diseases, IPC Service) that provided strategic and operational input on infection prevention and control to health providers and other agencies across the region (Table 1). Strategic objectives focused on: a) monitoring overseas developments and advising on implications for the Canterbury region; b) ensuring IPC policy and practice remained fit for purpose and responsive to changes in epidemiology; and c) providing balanced, timely and evidence-based decisions on complex, far-reaching, technical matters. However, achieving these objectives was no easy task. Interdisciplinary synergies and specialist knowledge were central to progress but as with other district health boards, we were dealing with a new threat and limited knowledge on how to best mitigate risks created by the SARS-CoV-2 virus.

The key challenge to be navigated was the difficulty posed by decision-making under uncertainty and dealing with the characteristic messiness arising from intrinsic cognitive and collaborative complexities in the situation (Berger et al., 2019; Lingard, 2012; Kahneman et al., 1982). For example, progress towards decisions was non-linear because as we collectively sought to make sense of the rapidly evolving international pandemic crisis and provide sound advice, we encountered obstacles such as conflicting opinions, knowledge deficits, physical and cognitive fatigue, and the general burden of responsibility. This led to back-tracking, redirecting and reframing of problems (Blumenthal-Barby & Krieger, 2015; Ghosh, 2004). On the other hand, group performance benefited from the sense of interdependency and being in this together. We relied on each other's expertise and understood that decisions made by consensus were stronger and safer. Being able to tap into the shared knowledge base of the team as a whole, enabled problems to be conceptualised in novel ways and open interactions including positive and negative feedback prompted necessary modifications in thinking to ultimately enable satisfactory collaborative decisions (Boreham, 2004; Curşeu & Schruijer, 2012; Lamb et al., 2011).

Looking back over the COVID-19 response to date, the most significant occurrence from an IPC nursing perspective has been a paradigm shift in relation to respiratory virus transmission. In the traditional IPC view, the mode of droplet transmission is where infectious droplets greater than 5μm in diameter fall rapidly to the ground under gravity, and therefore are transmitted only over a limited distance (≤1m). Another mode of airborne transmission is where infectious droplet nuclei, defined as 5μm or smaller in size, are carried on air currents particularly indoors (Centers for Disease Control and Prevention, 2016). Early in the pandemic, published evidence and expert guidance indicated that transmission of SARS-CoV-2 virus was predominantly via the droplet route and that airborne transmission had not been reported (Ong et al., 2020; World Health Organisation, 2020). However, transmission investigations undertaken locally ultimately led to a rethinking of respiratory virus transmission, at least as far as it related to SARS-CoV-2 (Eichler et al., 2021).

A turning point in the thinking about transmission occurred during the investigation of two cases of guest-to-nurse transmission events linked to a large cohort of mariners with COVID-19 in a managed isolation and quarantine facility. At that time, we were working with the droplet transmission model, where the recommended mask was a surgical mask (vaccination was not yet available). This investigation established that there were no breeches of personal protective equipment and evidence drove consideration to other possible explanations (Lancet Respiratory Medicine, 2020). In this instance, transmission was ultimately identified as being due to poor ventilation and virus-laden aerosol particles, carried from rooms into corridors in which the nursing staff were working when doors were opened and closed. This realisation also triggered re-examination of a guest-to-guest transmission event that had occurred earlier in another Canterbury managed isolation and quarantine facility (initially linked to possible fomite transmission through the

Table 1: Canterbury region's COVID-19 Integrated Infection Prevention and Control Response

	Objectives	Examples of IPC contributions to COVID-19 Response
Strategic Input	1. *Monitoring overseas developments and advising on implications for the Canterbury region* 2. *Ensuring IPC policy and practice remains fit for purpose and responsive to changes in epidemiology* 3. *Providing balanced, timely and evidence-based decisions on complex, far-reaching, technical aspects of COVID-19 response*	**Clinical Governance** - COVID-19 Technical Advisory Group membership **Leadership in Policy and Procedure** - Canterbury DHB IPC SOP[1] "Guidance for Isolation and Quarantine Hotels" adopted as foundation for MBIE's national IPC SOP - IPC Specialist input into national MOH ventilation and air cleaning project (and ventilation protocols in MIQF) - CDHB change to N95 mask use for health staff (following staff infection at Sudima MIQF) adopted into MBIE's national IPC SOP
		Critical Incident Investigations - Case investigation Crowne Plaza MIQF guest-to-guest transmission - Case investigation Sudima MIQF guest-to-staff transmission - Sports teams breeches of exemption conditions in MIQF - Breeches of protocols by returnees in MIQF
		Service on National Committees - HQSC Strategic IPC Advisory Group (SIPCAG) - MOH National IPC Expert Group (NIPCEG) - MOH COVID-19 Clinical Governance Meeting - MOH National IPC Leads - MOH National MIQF IPC Leads
Operational Input	1. *Coordinating with the laboratory and Public Health to support surveillance and testing* 2. *Liaising with key stakeholders on trends and control strategies* 3. *Collaborating with regional and national stakeholders on transmission risk management* 4. *Identifying opportunities to improve safety, health and welfare of staff*	**Surveillance** - Monitoring incidence and prevalence of cases in the electronic surveillance system (ICNet)
		Management of Confirmed Cases and Close Contacts - Supporting Public Health as required with transmission investigations and contact tracing - Overseeing IPC protocols for positive case transfers to quarantine
		Canterbury Managed Isolation and Quarantine Facilities - Assessing hotel suitability to function as MIQF - Advising on room configuration for quarantine/isolation in MIQF - Establishing IPC policy and procedure for MIQF - Partnering with Canterbury Regional Isolation and Quarantine (C-RIQ) staff on IPC requirements in MIQF - Conducting observational walk-throughs and assessments of IPC SOPs in MIQF - On-going training for all workforce groups Special Projects - Providing IPC expert input on appropriate protocols for special groups with exemptions i.e. international sports teams - Reviewing pathways and planned renovations at Christchurch Airport (Red pathway for returnees in both domestic & international arrivals as travel bubbles introduced with neighbouring countries)
		Training and Education (across Canterbury Health System and beyond) - Staff training (all workforce groups and across sectors) - N95 mask use/PPE refresher training/nasopharyngeal swabbing technique - Coaching/guidance for staff on IPC SOPs and IPC protocols

[1]Standard operating procedure

use of communal rubbish bins). Closed-circuit television footage was reviewed, and it was noted that during routine day 12 testing only a 50-second window of time elapsed between one door closing and the next door opening for the cases. It was hypothesised that suspended aerosol particles were a more probable mode of transmission (Eichler et al., 2021). Ultimately, SARS-CoV-2 transmission events have helped us understand that virus-laden infectious respiratory particles exist on a continuum from large droplets to droplet nuclei and aerosols (Tang et al., 2021). Practice has consequently changed and includes the use of appropriate respiratory protection (fit-tested N95 masks) and transmission-based precautions for airborne diseases (Lancet Respiratory Medicine, 2020; Tang et al., 2021).

Future Perspectives

The COVID-19 pandemic continues to pose significant challenges to health systems and wider social systems that were already under strain. Yet a continued response to this crisis is required. Understanding the Canterbury response to COVID-19 has been supported by complex adaptive systems thinking and the concept of collective competence. It has highlighted how an effective response to health service challenges is facilitated by leveraging off existing networks, promoting multi-stakeholder engagement and sharing knowledge across disciplines with a collaborative approach.

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