ORIGINAL RESEARCH

Perspectives on the use of personal protective equipment by acute care providers caring for patients on COVID-19 medical and critical care units

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ABSTRACT

Background: Studies have provided strong evidence that personal protective equipment (PPE) effectively reduces the risk of transmitting highly infectious emerging diseases among healthcare providers (HCPs). However, literature examining this phenomenon specifically within the context of the COVID-19 pandemic remains limited. This study explored the behaviours and contributing factors influencing HCPs' use of PPE, as well as how they established a sense of safety while caring for patients with COVID-19.
Methods: We conducted 22 semi-structured interviews with HCPs who provided direct care to patients with COVID-19 in the medical and critical care units of a large urban hospital in Vancouver, British Columbia. An interpretive description approach was used to understand staff narratives and identify key themes.
Results: Staff reported high confidence in their PPE practices, citing factors such as emerging evidence and guidance, infection prevention and control (IPAC) protocols, occupational experience, specific PPE workflows, and point-of-care risk assessments. Within the broader context of the COVID-19 pandemic in British Columbia, staff identified several factors that influenced their PPE behaviours: PPE accessibility and availability, staff education, environmental reminders, staffing levels, environmental cleaning, physical space, time constraints, patient acuity and workload, PPE fatigue, the evolution of SARS-CoV-2 variants, vaccination status, occupational culture, and systemic trust.
Conclusions: Overall, our findings highlight the importance of a relational approach in supporting HCPs to keep both patients and colleagues safe during the pandemic. By fostering trust and open communication, infection control practitioners (ICPs) can help HCPs navigate the challenges of misinformation and psychological stress. Identifying the factors that shape PPE behaviour enables ICPs to design targeted interventions that address frontline staff needs and promote effective PPE practices. Ultimately, the development of realistic, context-sensitive guidelines — along with addressing the mental and informational challenges faced by HCPs – is crucial to enhancing safety and adherence to infection control practices in future public health emergencies.

KEYWORDS
COVID-19, personal protective equipment, healthcare providers

INTRODUCTION

Personal protective equipment (PPE) plays a critical role in interrupting the transmission chain of SARS-CoV-2 within acute care facilities. Proper use of PPE reduces the risk of healthcare-acquired infections among healthcare providers (HCPs) when treating highly infectious emerging diseases, including Ebola (Shenoy & Weber, 2021; Suen *et al.*, 2018), Middle East Respiratory Syndrome (MERS), and Severe Acute Respiratory Syndrome (SARS) coronaviruses (Gamage *et al.*, 2005; Occupational Safety and Health Administration, n.d.). Evidence on the effectiveness of PPE in reducing SARS-CoV-2 transmission among HCPs began to emerge during the early stages of the COVID-19 pandemic (Algado-Selles *et al.*, 2020; Griswold *et al.*, 2021). Guided by standards established by the World Health Organization (WHO, 2020) and the Centers for Disease Control and Prevention (CDC, 2024), acute care facilities worldwide implemented PPE protocols to protect HCPs from contracting COVID-19.

Prior to the COVID-19 pandemic, research emphasized the role of individual, organizational, and contextual factors in shaping how HCPs carried out PPE practices (Baloh, 2019; DuBose *et al.*, 2018; Fan *et al.*, 2020; Gurses *et al.*, 2018; Ruskin *et al.*, 2021). During the pandemic, mandatory PPE use imposed significant physical and mental strain on the health and well-being of HCPs. HCPs faced an increased risk of physical adverse effects, including headaches (Galanis *et al.*, 2021; Hajjij *et al.*, 2020), breathing difficulties (Galanis *et al.*, 2021; Battista *et al.*, 2021), skin reactions (Galanis *et al.*, 2021; Battista *et al.*, 2021; Singh *et al.*, 2020), and heat stress, all of which negatively affected their physical and mental performance (Davey *et al.*, 2021; Hajjij *et al.*, 2020). In Canada, 95.0% of HCPs reported psychological impacts, with 86.5% experiencing elevated work-related stress (Statistics Canada, 2022). This level of occupational stress underscored the need for strategic interventions to enhance the sense of safety across all levels of healthcare organizations (Abbas *et al.*, 2021).

In this study, "PPE practices" refers to the specific actions, protocols, and routines followed by HCPs to ensure the proper use, maintenance, and disposal of PPE. "PPE behaviours" describe how HCPs engage with or respond to PPE for its use and adherence. Understanding HCP perspectives is particularly valuable in light of the increasing prevalence of misinformation and disinformation. While some studies have employed survey methodologies to examine PPE behaviours among HCPs, few have explored their experiences through narrative-based approaches. This study had three primary objectives: (i) to understand the narratives of HCPs who worked in COVID-19-specific units during the pandemic and how they established a sense of safety through PPE use; (ii) to explore the individual, organizational, and contextual factors that influenced effective PPE practices, along with recommendations to address identified gaps; and, (iii) to assess how PPE practices contributed to HCPs' sense of safety for themselves, their colleagues, and the patients in their care.

METHODS
Study design
We conducted a qualitative semi-structured interview study.

Setting
The study was conducted in the COVID-19 medical-surgical and critical care in-patient units of the Vancouver General Hospital from January to June 2022.

Participants
A total of 22 HCPs who delivered direct care to patients with COVID-19 were recruited using a convenience sampling strategy, including email invitations, posters, and communication through departmental leadership. This was followed by snowball sampling to expand participation. The sample was comprised of registered nurses, physicians, allied health professionals (physiotherapists and occupational therapists), radiology technicians, respiratory therapists, porters, social workers, and dietitians (Appendix A). Targeted recruitment strategies were later employed to ensure representation across a diverse range of healthcare professions.

Data collection
We developed a semi-structured interview guide based on the research aims (Appendix B). Participants provided informed consent before completing a 1:1 interview. All interviews were audio-recorded via Zoom. Interviews were then auto-transcribed using the speech-to-text function and cleaned up in Microsoft Word. Transcripts were stored in secured private cloud storage only accessible to the investigators. All participant identifying information was anonymized using a participant code. Transcripts were proofread and checked for accuracy before analyzing them using NVivo 12 software.

Data analysis
Interview data was analyzed concurrently with data collection using an interpretive description approach. We analyzed interviews from various health professional groups for narrative triangulation. The first transcripts were randomly selected and thematically coded using Microsoft Word. Preliminary themes and sub-categories were identified to create a draft codebook, which was then refined with subsequent transcripts coded. Once finalized, the remaining transcripts were coded using this guide. After independent coding, the authors held reflexive discussions to verify emerging concepts and theoretical links before coding in NVivo software. Finally, the quotes for each code were summarized to extract narratives before reaching a consensus on these narratives.

Ethics
The University of British Columbia Behavioural Research Ethics Board approved this study (H21-03077). Vancouver Coastal Health gave this study operational approval (V21-03077).

RESULTS
1. Confidence in the use of personal protective equipment in patient care areas and non-patient care areas.
Generally, staff reported that PPE guidelines were more explicit in patient care areas than the non-patient care areas given the greater risk of patient-derived transmission (Figure 1). Because guidelines in these areas were straightforward and familiar, staff's confidence in their PPE practices was consistently rated high. In non-patient care areas, staff admitted to being more relaxed with their PPE practices given the lower risk of patient-derived transmission. However, when more colleagues began falling ill with COVID-19 from spending time in the same common areas, respondents reported being more careful with their PPE practices to avoid transmission amongst themselves.
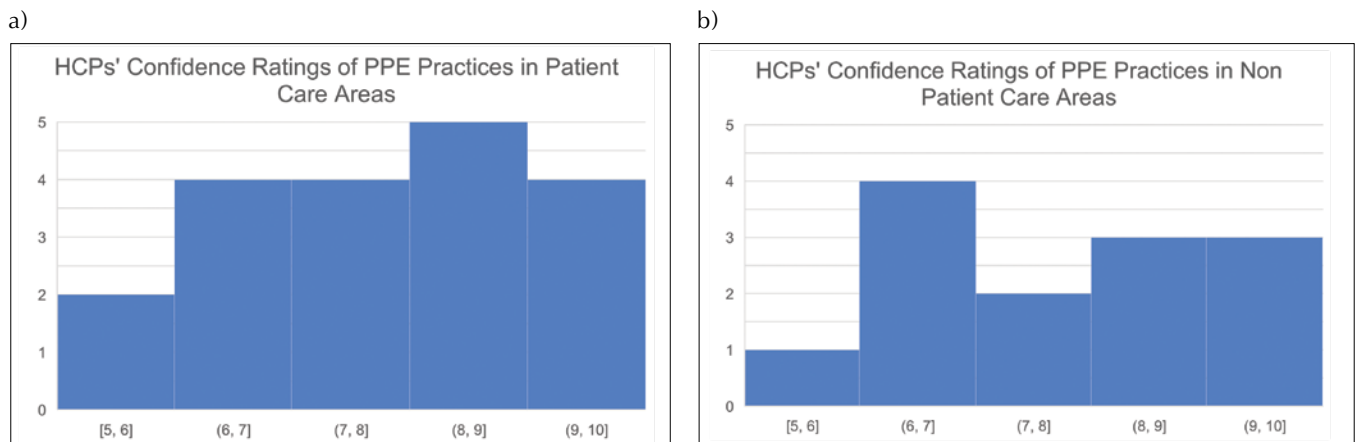
a)   b)

Figure 1: Confidence ratings in PPE practices

Some participants rated their confidence levels in their own PPE practices on a scale from 0 (no confidence in their PPE practices, felt that their practices were inadequate) to 10 (high confidence in their PPE practices, felt that their practices were excellent) in both patient care areas and non-patient care areas.

Confidence level reported by participants for PPE practices in **(a)** Patient-care areas (mean rating = 8.21, n = 19), and **(b)** Non-patient-care areas (mean rating = 8.15, n = 13). X-axis shows the score assigned by participants, and the y-axis shows the number of participants who assigned a given confidence score. *Patient care areas* are defined as areas in acute care facilities where inpatient care takes place e.g., patient rooms. These areas are restricted to direct care providers, the patients, and any patient visitors. *Non-patient care areas* are defined as areas in acute care facilities where direct patient care does not take place (nursing stations, dictation areas, conference rooms, break rooms, change rooms, elevators, stairways, and common hallways and lobbies).

Score assigned by participants

2. Determinants of confidence in personal protective equipment
The factors below affected staff's confidence levels in their PPE practices and the PPE that they utilized. Table 1 provides supporting quotes.

2.1. Current, emerging evidence
Staff's confidence in their PPE practices was shaped by the constant stream of current and newly emerging evidence reported by global, national and provincial public health organizations (e.g., WHO, Public Health Agency of Canada, British Columbia Centre for Disease Control). Participants repeatedly mentioned the mixed messaging presented to them on COVID-19 precautionary guidelines and PPE recommendations for the direct care of COVID-19 patients.

2.2. Point-of-care risk assessment
Staff's confidence in their PPE practices was greatly influenced by their process of performing point-of-care risk assessment (PCRA). PCRA is an assessment conducted by HCPs to guide themselves in selecting appropriate PPE to minimize the risk of exposure to infectious body fluids by taking into consideration the patient, the care task, and the environment (Provincial Infection Control Network of BC, 2023). Participants reported a connection between their PCRAs and individual risk tolerance to contracting SARS-CoV-2. Staff factored in the prevalence of COVID-19 within their community e.g., the prevalence of close coworkers contracting COVID-19 during a specific time period to

determine their level of risk in the workplace. The PCRA promoted their confidence in subsequent PPE choices they made as well as in justifying their PPE behaviours in COVID-19 units. Staff also applied the risk assessment to non-patient care areas such as break rooms.

2.3 Particularity in PPE workflow
In light of conflicting information surrounding COVID-19 transmission and PPE recommendations, staff developed habits in their PPE workflow. What staff wore, how much they wore, when they wore it and what they preferred were all dependent on the situation and individual. At baseline, staff followed the instructions of the isolation precaution signage guidelines on the patient doors. However, there were deviations as participants reported feeling more confident and comfortable when they were able to choose between wearing a surgical mask or an N95 respirator. Developing PPE workflow helped staff maintain consistency in their PPE practices. It established itself as a natural habit which built confidence and a sense of safety among staff.

2.4. Infection prevention and control guidelines
There were contrasting perspectives on how IPAC guidelines within acute care facilities impacted staff's confidence in their PPE practices. Some participants initially felt apprehensive about PPE guidelines but deemed them adequate over time as they followed them. In contrast, others noted much unclarity and confusion across the pandemic's course due to

constant changes in guidelines with the different SARS-CoV-2 variant waves, PPE supply constraints and emerging evidence on the virus. Several participants reported feeling that local PPE guidelines were inadequate in protecting them. Based on the discordance between the IPAC guidance and their PCRAs, staff resorted to doing their own research to guide their practices. Observing variations in colleagues' PPE practices decreased confidence levels in their individual PPE practices.

2.5. Occupational experience

An aspect unique in daily practice during the pandemic was the frequency of donning and doffing PPE for such a large volume of patient encounters. Educational refreshers for staff helped instill and maintain their confidence levels in PPE practices. Participants reported carrying out PPE practices so often that "*it felt like second nature.*" When they provided care for acutely ill patients and did not contract the virus, they were reassured that their PPE practices were accurate and effective in preventing transmission.

Table 1: Sample quotes supporting determinants of staff's confidence in PPE	
Determinants	**Quotes**
Current, emerging evidence	"*Policies just kept changing. And we had no idea which policy was the most recent. That and a lot of exceptions were made from time to time [for PPE guidelines] and we weren't privy to that information right away.*"
Point-of-care risk assessment (PCRA)	"*Some patients come from the Emergency Unit and they're physically coughing and have a fever but, on their chart, there is no isolation so you kind of have to make your own judgement. Like I should wear something in case.*" "*If [a patient] was close to coming off isolation, I would be less careful – maybe wouldn't wear the N95 for example.*"
Particularity in personal protective equipment (PPE) workflow	"*It was just the matter of the gown. Sometimes I would wear it, sometimes I wouldn't. Just depended on what I was doing, to be honest. Quick drop off [of things], I wouldn't wear it.*" "*I would be in the [patient] room but I wouldn't have touched the person. I would just drop something off... thinking, I could just take everything off without washing my hands in between [every step]. Can I just take my gloves off? And not wash my hands? And then take off my gown... there were some steps that I wasn't too sure if I really needed to do and if I could get away with doing.*"
Infection Prevention and Control guidelines	"*I worked on the COVID-19 unit for three months and I didn't get COVID-19... I told myself in the beginning, 'I'm going to do my job', what is expected of me. And the people making the vaccines and people in charge of infection control, they're doing their jobs properly. I don't know anything about the disease... about how infectious it is and whatever... I just have to trust who's in charge of that stuff [and] that they're doing it properly. I trust it for the most part.*" "*The hardest part of the pandemic was getting different information and recommendations about PPE.*"
Occupational experience	"*The thing that made me most confident [in my PPE practices] was working there all the time.*" "*I don and doff PPE like a hundred times a shift... I've been working with all COVID-19 patients for this long and haven't gotten it so my PPE practice must be working and I must be doing it right. You gain confidence that way.*"

3: Characterizing personal protective equipment use errors

When speaking about observed and self-reported PPE behaviours, study participants reported what they considered to be PPE errors as practice that deviated from the recommended IPAC guidelines (British Columbia Centre for Disease Control, 2023a, b). Table 2 highlights some of the perceived PPE errors.

The table reveals errors that were performed by other colleagues (Other) and by the participants themselves (Self), and the number of times they were reported by individual participants.

Category	Error	Point of confusion	Recommended practice	Others	Self
Table 2: List of PPE errors reported by participants and the associated points of confusion					
Donning and doffing sequence	Staff coming out of the patient room while wearing full PPE.	Staff are unclear where they are supposed to doff PPE: in the antechamber or inside the room?	Doff all PPE prior to leaving the anteroom or patient room.	1	0
	Staff doffed their gown over their head without untying the tie.	Staff could be unaware that doffing the gown over their head can lead to self-contamination.	Gown is doffed by untying the ties on the top and bottom part of the gown.	2	1
	Staff are in the patient room with an untied gown, or only tying one tie instead of two.	Staff assuming that they will not be exposed to infectious body fluids from the back of their gown.	Gowns must be tied completely on the top and bottom part of the back.	3	5
	Staff are not removing booties after leaving the patient room.	Staff could be unaware that by not removing booties after leaving the patient room, they could transfer infectious contaminates into the common non-patient care areas.	Booties are doffed after leaving a patient room.	1	0
	Staff are not changing their PPE when transporting patients out of the ward to another location.	Staff could be unaware that they are contaminating other areas in the hospital and potentially other patients indirectly.	All PPE is to be doffed when a patient encounter is finished. New PPE is to be donned prior to a new patient encounter.	3	2
	Staff are snapping off their face masks.	Staff could be unaware of the risk of self-contamination if facial protection is not removed properly.	Facial protection is doffed by touching the least contaminated sections (the straps) and leaning forward to remove to avoid self-contamination.	3	0
	Staff are doffing their PPE in an incorrect order.	Staff could be unaware of the risk of self-contamination if PPE is doffed in the incorrect order.	After leaving a patient room, PPE should be doffed in order of gloves, gown, eye protection, mask or N95 respirator with hand hygiene in between each step.	1	0
	Staff are not doing hand hygiene in between PPE doffing steps.	Staff could be unaware that not performing hand hygiene in between doffing steps can result in self-contamination.	After leaving a patient room, PPE should be doffed in order of gloves, gown, eye protection, mask or N95 respirator with hand hygiene in between each step.	3	3
	Staff are not washing their hands for >20 seconds.	Staff reported that dry, cracked skins led them not to wash their hands for >20 seconds. Staff could be unaware that not washing hands for >20 seconds may result in ineffective hand hygiene.	It is recommended to wash your hands for >20 seconds to achieve effective hand hygiene.	0	1
	Staff are not donning PPE when going into patient rooms to quickly empty out hampers or garbage bins.	Although they are not providing direct patient care, staff might be unaware that they can still breathe in potentially infectious droplets/aerosols within the patient room or touch contaminated surfaces.	Prior to going into a patient room, all recommended PPE should be donned.	1	0
	Staff are only wearing N95 respirators when entering an airborne contact isolation room when doing quick tasks such as turning off the IV pump. Staff are not wearing gloves or gowns.	Staff could be unaware of the possibility of contaminating themselves without wearing a gown or gloves in the patient room. Staff are being selective to what PPE they need to wear in the room based on the time needed for the task to be performed.	Prior to going into a patient room, all recommended PPE should be donned.	1	1

Category	Error	Point of confusion	Recommended practice	Others	Self
	Staff are double gloving when donning PPE.	Staff are unclear whether wearing multiple layers of gloves will help protect them more.	One pair of gloves should be donned.	0	1
	Staff are rolling up their gown in a ball when doffing PPE.	Staff could be unaware that they can potentially self-contaminate themselves by disposing off the gown improperly.	Doff the gown by touching the contaminated surface of the gown as least as possible.	0	1
	Staff are not properly seal checking their gown at their wrists when donning PPE.	Staff could be unaware that their PPE can be breached from the gap in the gown at the wrists.	Make sure gloves are put over the wrists of the gown to avoid gaps in PPE.	0	1
	Staff are not following routine practices (frequent hand hygiene, respiratory etiquette, cleaning and disinfection principles) and extra ecommended isolation precautions.	There is a misconception that if there are no extra recommended isolation precautions needed, there is no need to take any precautions or follow common infection control principles. Staff are unclear whether they can wear less PPE than recommended by the isolation precaution sign according to their PCRA.	Routine practices are followed consistently in any healthcare setting. When determining what PPE to wear, the recommended PPE as per the extra isolation precautions is the minimum PPE to be worn.	0	3
Contamination tracking	Staff are leaving the patient room without doffing PPE, touching items outside the room and coming back into the patient room.	Staff are unclear whether they need to doff all their PPE if they are only touching certain items, and no other surfaces before going back into the patient room.	All PPE should be doffed when exiting a patient room. Fresh PPE should be donned when going back into the room. Staff can also get a colleague to pass items to them without fully exiting the room.	1	0
	Staff are touching their face and mask without sanitizing their hands before or after.	Staff could be unaware that they are potentially self-contaminating themselves when they touch their face and mask.	Hand hygiene is performed prior and after touching the mask or face if need be.	1	1
	Staff are not frequently cleaning and disinfecting direct user items such as communal department pagers and phones.	Staff could be unaware of the bioburden harboured on direct user items that are not frequently cleaned and disinfected.	Frequently used items are recommended to be cleaned and disinfected after every use by the direct user.	0	1
Masks	Staff are not changing their masks or N95 respirators frequently enough: wearing the same masks for extended periods of time in both patient care and non-patient care areas.	Given the resource constraints on PPE supply and the introduction of the extended mask policy, staff were likely unsure whether it was okay or unacceptable to change their masks after every patient encounter or after the mask is soiled.	During mask shortages, it was recommended to change the mask when it has become soiled in order to preserve mask stock. However, optimally, it is mandatory to change the mask between every patient encounter.	7	1
	Staff are removing their masks while at the nursing station to eat and drink.	Given the space constraints, staff did not have many options for places to eat and drink during their breaks. Especially during night shift, staff thought it was safer to unmask due to less activity during this time. Staff could be unaware of the risk of contracting an infection when unmasking in the COVID-19-unit care areas.	It is recommended to eat in designated break rooms away from the patient care area.	3	0
	Staff are not wearing appropriate PPE while performing aerosol generating medical procedures (AGMPs).	Generally, staff wear a surgical mask and eye protection for COVID-19 positive patients but could not always be able to anticipate when an aerosol generating medical procedure is performed while in the room.	When anticipating a need for an AGMP to be performed on a patient, consider donning PPE for airborne precautions. The best practice is to wear N95 respirator during AGMPs.	1	1

Category	Error	Point of confusion	Recommended practice	Others	Self
	Staff are double masking: • Surgical mask on top of N95 respirator • Surgical mask on top of another surgical mask • Face shield masks on top of surgical mask or N95 respirator.	Staff could be unaware that double masking could result in breaking their mask seal and create opportunities for infectious aerosols to come through. Double masking does not increase protection.	A single mask is sufficient for facial protection. It is recommended to use: • Surgical mask with eye protection goggles • Face shield mask (already includes eye protection) • N95 with eye protection goggles	6	1
	Staff are only wearing surgical masks when going into patient rooms on airborne contact precautions for quick tasks.	Staff could be unaware of the potential risk of infectious aerosols coming through their surgical masks during the short task time.	Prior to going into a patient room on airborne contact precautions, all recommended PPE should be donned. This includes an N95 respirator.	1	0
	Staff are not always seal checking their N95 respirators or securing their mask properly prior to entering a patient room.	Staff could be unaware that the N95 respirator will not work effectively if the seal is not checked and properly fitted on the face.	Prior to going into a patient room, N95 respirator seal check can be done.	1	3
Eye protection	Staff are not wearing appropriate eye protection in patient care areas.	Personal eyeglasses are not considered appropriate eye protection from infectious body fluids. Staff could be unaware that infectious body fluids can enter the eye mucosa as an alternative route of transmission.	It is recommended to wear proper eye protections e.g., goggles or face shields during patient encounters.	1	3
	Staff are not properly cleaning their reusable face shields after patient encounters.	Staff could be unaware of the potential risk of self-contamination while wearing a contaminated face shield.	After every patient encounter, it is recommended to clean and disinfect reusable face shield.	0	1

4: Factors affecting personal protective equipment use behaviours

Eleven distinct factors were found to affect the HCPs' PPE behaviours, and three of which had a greater impact are highlighted in this section. Appendix C provides a description of the remaining factors.

4.1. Vaccination

Participants acknowledged the need for a multipronged approach to protect themselves from COVID-19. Some viewed vaccination as key, while others felt natural infection provided similar protection. Over time, vaccination increased staff comfort and reduced stress when working with high-acuity patients. With time, becoming vaccinated promoted a sense of safety among HCPs and increased their comfort level in viewing COVID-19 like any other viral respiratory illness. One participant expressed concern about "false confidence" from vaccination, though they felt safer in the hospital due to high vaccination rates among HCPs. Several participants noted an increased number of PPE breaches among peers, which they attributed to the protection conferred by the vaccine, especially in decreasing the risk for severe illness.

4.2. SARS-CoV-2 variant evolution

The unpredictability of variant trends facilitated adherence to PPE protocols due to uncertainty about vaccine protection against emerging variants. Vaccination mandates were introduced in response to more transmissible variants, creating a temporary sense of safety among staff. This sense faded, however, when the Omicron variant became dominant in British Columbia. Staff initially became more vigilant, but as the link between Omicron and mild illness was established, participants reported being relaxed in their PPE practices. However, not all participants reported changes in their PPE practices in response to this variant evolution.

4.3. Systemic trust

With the fear of COVID-19 taking root early in the pandemic timeline, a hesitation to count on the system for protection, i.e., systemic trust, was undermined as staff drew comparisons of the varying guidelines from the United States, China and Europe. Staff wondered whether local guidelines were up to date. This was further complicated by the "*flip-flopping*" of constantly changing PPE recommendations and IPAC guidelines that staff were expected to follow. Staff perceived a disconnect between the actual risk and the guidelines, further fuelling systemic mistrust. One participant shared their thoughts about this: "*I think [it] was frustrating to [be] in some meetings and presentations where I felt, in some ways, that we were being lied to… There was so much confidence that… wearing masks and droplet [contact] precautions [were] totally adequate for COVID-19… I think the data that they were looking at was our risk of infection… And I feel like it wasn't openly admitted to us.*"

Systemic mistrust amassed among some staff when they started feeling like "*experimental subjects*" or "*sacrificial lambs*" working in the COVID-19 units, and they felt that the IPAC guidelines did not implement the highest level of precautionary measures. As a way of disseminating pandemic-related updates to staff, regular town halls were conducted by organizational leadership. Participants raised the need for these to be transparent and open, characterized by consistent follow-up on questions brought forth by staff. To staff, communications sounded like "*political-speak*" with organizational leadership "*sweep[ing] things under the rug.*" They voiced that they wanted communications to be concerned with individual actions staff could take instead of being primarily led by organizational leadership.

DISCUSSION
During the COVID-19 pandemic, mandated PPE use placed physical and mental strain on the health and well-being of HCPs. The ever changing and sometimes conflicting guidelines on PPE requirements exacerbated the situation and this significantly influenced PPE practices.

Through HCPs' narratives, we set out to understand the determinants of their confidence in PPE and how they established a sense of safety using PPE when working in COVID-19 medical and critical care units, for themselves and, by extension, the patients they cared for. We identified eleven factors influencing HCPs' PPE practices that emerged from commonly reported PPE errors from the participants. These factors and associated practice gaps could be viewed at the individual (virus evolution and PPE fatigue), organizational (staffing and organizational culture), and contextual (vaccination and systemic trust) levels. Other factors include education, PPE availability and accessibility, time, patient acuity/workload, environmental clues and the presence of PPE spotters.

The findings of the current study addressing PPE behaviours explain why PPE guidelines may fall short; going beyond artificial simulations and mannequin-based research (Kang *et al*., 2017, Baloh *et al*., 2019). The results of the current study can help guide the development of interventions to support PPE practices among HCPs through the following strategies:

Using a relational approach to support systemic trust
Amid uncertainties during a public health emergency, ICPs must offer a steady, empathetic presence to HCPs and foster open communication. One effective way of doing this is holding regular and timely debriefings after major outbreaks so ICPs and leadership can gain real-time insight into HCPs' experiences while creating a safe space for transparent reflection. Open discussion can generate valuable perspectives and opinions that can bring forward quality improvement ideas for implementation. The data of the current study revealed varying levels of information literacy and critical appraisal skills among HCPs, highlighting the ICPs' role in debunking false narratives and building strong, trusting relationships among HCPs and leadership.

A bottom-up relational approach allows ICPs to meet staff where they are and work together to develop realistic guidelines and effective interventions to keep staff and patients safe. Especially when there are changes to guidelines or policies, reviewing them with HCPs promotes engagement, adherence and shared understanding. Reciprocity and respect of expertise within these relationships enhance adherence to infection control practices (including appropriate PPE practices), promote shared decision-making, and ensure that concerns and challenges are addressed promptly.

Considering the informational ecosystem
To effectively empower HCPs during public health emergencies, ICPs must recognize the interplay between the public, pandemics and accompanying infodemics. The WHO (2024) defines the term 'infodemic' as an overload of information, including misinformation and disinformation that commonly brings attention to underlying dynamics between information, communication and technology. Altogether, this is known as the informational ecosystem. Unlike past pandemics (e.g., SARS of 2003, H1N1 swine flu of 2009), the COVID-19 era saw a more rapid, uncontrollable spread of misinformation primarily due to increased usage of the internet and social media (Caceres *et al*., 2022). There were too many information outlets available leaving HCPs feeling overwhelmed and unclear with the guidance they should follow in their practice. In our study, this informational pressure had profound implications on HCPs' PPE behaviours and their confidence in PPE practices to keep themselves safe.

Ensuring a sense of safety
HCPs' sense of safety, encompassing both physical and mental aspects, was influenced by the afore-described factors. HCPs reported experiencing moral distress when balancing their sense of safety, including their PPE behaviours, with their sense of duty to prioritize patient care (Alonso-Prieto *et al*., 2022). For instance, nurses often prioritized their sense of duty to their patients and profession over their sense of safety, leading to decisions involving personal sacrifice and risk during pandemic situations (Fernandez *et al*., 2020). Caring for patients under the constraints and stress of the pandemic meant that HCPs' risk tolerance was especially labile, accounting for the dynamicity of HCPs' PPE behaviours. This aligns with the Risk Homeostasis Theory (Wilde, 1982), which suggests that an individual, in any given circumstance, has a tolerable level of risk, and upon comparing this with the perceived risk, they adjust their behaviour to minimize the discrepancy between the two.

The use of tools like the PCRA helped guide decision-making in these situations, being shaped by how HCPs intuitively understood the risk they assumed in a given circumstance and how this compared to the actual risk present. While the PCRA has been primarily conceptualized for ensuring safety in patient-care areas, the attempt to apply the tool outside of patient care contexts may have contributed to reduced confidence as reported in this study. PPE errors further

complicate this dynamic and the observed PPE errors in the current study may be linked to risk homeostasis, while others may stem from HCPs simply being unaware of the increased risk posed by suboptimal PPE behaviours.

Limitations

While this study was meticulously conducted, it is important to acknowledge the following limitations. The study sample was drawn from a single urban hospital in Vancouver, the province of British Columbia's largest COVID-19 care centre. Most study participants worked exclusively in COVID-19 units. Some participants joined the study to voice concerns and provide feedback to the IPAC team using the interviews as debriefs. As participation was voluntary, the study likely attracted HCPs with stronger opinions on PPE and IPAC guidelines. Social desirability bias may have influenced participants' responses, with some answering to align with IPAC best practices. Conversely, participants who were familiar with the authors personally, may have felt more comfortable sharing genuine experiences. To address this reflexivity, another researcher acted as a second analyst for coding and data interpretation.

Despite the small sample size, the perspectives shared by participants were often consistent and, therefore, attained data saturation.

CONCLUSION

The three strategies outlined above can guide future research and quality improvement efforts, focusing on the interplay between the determinants of confidence in PPE, common PPE errors to enhance PPE utilization, and factors influencing PPE practice, not just for future pandemics but also to guide daily practice. ICPs, as they are positioned uniquely within the healthcare system, can empower frontline HCPs against infodemics by fostering resilience against misinformation. By actively addressing barriers to trust, ICPs can create space for open conversations during public health emergencies. Further research is needed to explore the role of risk homeostasis and HCP risk awareness in common PPE errors, which can support ICPs in these efforts. These identified key themes for ICPs can guide the focus of quality improvement initiatives in collaboration with frontline HCPs.

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