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Case Study

Simulation for Systems Integration to Support Frontline Healthcare Workers during a Global Pandemic: A Provincial Case Study in Continuing Care

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Abstract

Introduction: The arrival of the Coronavirus Disease (COVID-19) pandemic demanded prompt attention to infection prevention and control strategies in continuing care facilities. Care sites across the province of Alberta, Canada struggled with implementing a reproducible, adaptable and shareable educational simulation package for healthcare providers. The purpose of this simulation initiative was to develop, design, and implement a COVID-19 Continuing Care Simulation Resource Kit to be used by Infection Prevention and Control leaders and educators.

Methods: The case study describes the development of this novel just- in time simulation for systems integration approach and resource kit designed specifically for continuing care organizations with the goal to provide strategies on how to prioritize and assess new processes, workflows, and safety risks to better support staff confidence in managing quality patient care.

Results: Between November 2020-March 2021, qualitative narratives and themes with continuing care educators validated the strong applicability, adaptability, and ease of use of the COVID-19 Continuing Care Simulation Resource Kit for other quality improvement initiatives within a continuing care setting. Over n= 80 educators, infection control practitioners, and leaders participated in the initial presentations for dissemination to individual teams, scaling its impact across Canada's largest provincial healthcare system.

Conclusions: It is anticipated that this novel education resource kit can be easily adapted for future use by local, national, and international healthcare organizations in the event of other infectious disease outbreaks.

Keywords: Simulation, Systems integration simulation, Continuing care, Healthcare workers, Nursing, Patient care

Introduction

The arrival of the Coronavirus Disease (COVID-19) pandemic demanded prompt attention to infection prevention and control strategies in continuing care facilities. Continuing care patients are at higher risk for severe COVID-19 infection due to their advanced age and/or underlying medical conditions [1]. Continuing care patients are described as patients living in a supportive living or long-term care settings and defined by their need for care and not by their age, diagnosis, or length of time they require healthcare needs [1]. Patients in continuing care facilities experienced disproportionate mortality rates from COVID-19 when compared to the general population [1,2]. A Canadian study found that older adults in continuing care settings had a mortality rate 13 times higher than that of older adults living in the community [3], highlighting the need for prioritization of infection control in these vulnerable populations. Despite the availability of personal protective equipment, employees at continuing care facilities may struggle to correctly use it without adequate training [4]. The presence of ongoing training and education of nursing staff can directly impact the quality of patient care [5]. While educational interventions including simulation were implemented in acute care settings to prepare staff in mitigating the spread of the COVID-19 [6,7], continuing care facilities faced numerous barriers to staff education [8]. Continuing care facilities in Alberta struggled to provide just in time professional development for employees during the pandemic due to increased employee workload, restricted time for employees to attend educational opportunities, and limited English-speaking employees. During the COVID-19 pandemic, there was a need for focused and targeted frontline education about critical infection control measures; however, there was a lack of published literature that addressed how best to prepare continuing care staff to implement infection control strategies in the event of a pandemic. In response, the provincial simulation team at Alberta Health Services (AHS) used the simulation for systems integration approach of process walk through [7] to best understand the challenges and needs of continuing care facilities when implementing infection control practices.

Simulation for systems integration (also referred to as translational simulation) is the use of simulation in healthcare institutions to evaluate care delivery systems and organizational processes, thereby increasing patient safety [7,9]. This form of simulation allows educators and decision makers a pathway to observe a particular workflow while identifying safety threats and knowledge gaps [7]. Fuselli, et al. [10] used this simulation modality when commissioning new clinical space in anticipation of increased acute patients during the COVID-19 pandemic. They were able to identify latent safety threats and refine processes to meet the unique needs of the new clinical setting prior to its use [10]. While simulation for systems integration does not focus on individual healthcare provider knowledge and skill, its effects have a direct impact on nurses' workflow and patient care, potentially reducing patient harm [11-13]. O'Dochartaigh, et al. [14] conducted a translational simulation study examining 11 emergency departments to identify 158 latent safety threats such as missing medication, equipment

failure, and insufficient nurse training. Further, simulation with a systems perspective was used to address infection control concerns in the Ebola epidemic [15,16], and has been used during the COVID-19 pandemic to address infection control in acute care settings [17-19]. While much of the published literature on simulation for systems integration appears in the acute care settings [7,10,14], a gap remains if the same simulation modality can be applied to the continuing care setting to improve processes and patient safety.

Therefore, the aim of this case study is to describe the development of this novel just- in time quality improvement simulation for systems integration approach and education resource kit designed specifically for continuing care organizations with the goal to provide strategies on how to prioritize and assess new processes, workflows, and safety risks to better support staff confidence in managing quality patient care.

Methods

Case study description

As the COVID-19 pandemic unfolded in Alberta, the overwhelming majority of simulation-based support focused on education in acute care settings, specifically in high acuity areas. As seen in other provinces within Canada, Alberta continuing care patient populations were significantly impacted by COVID-19 [20]. Staffing challenges related to outbreaks highlighted the necessity to refocus resources to support the most vulnerable [20]. Existing COVID-19 support resources from other provinces, as well as simulation education previously provided in Alberta, sparked introductory conversations between the health authority, site operational leaders, and the provincial simulation program [7].

As an initial step, an expert simulation working group was formed. Recognizing the time sensitive nature, overwhelming breadth of continuing care sites, and limited frontline educators, the team needed to adapt ways of providing simulation-based education that matched these imminent needs, system deficiencies, and ever-changing guidelines to prepare and protect healthcare staff. The project team's goal was to create an easily adaptable education resource kit specific to address COVID-19 related infection control practices within continuing care sites across the province. Within Alberta Health Services, the continuing care sector is comprised of long term care, home care, designated supportive living, and palliative or end of life care (https://www.albertahealthservices.ca/cc/page15328.aspx). For this case study, the education resource kit was implemented in long-term care and designated supportive living facilities.

Applying the principles of quality improvement and system simulation approach, the team strived to create a just in time simulation that was adaptable for future use with the resource kit. Simulation consultants would then train and encourage continuing care educators to use the resource kit to engage in further simulations as needed, adapting it the local needs of the site. This train-the-trainer approach would enable continuing care organizations across the province to prioritize critical areas and implement new processes for quality improvement strategies. Ultimately, this would enable educators to give prompt and focused just in time education to frontline staff regarding crucial infection control strategies.

Need assessment and description of educational resource kit

An initial needs assessment with continuing care site operators across the province was completed and organizational perspectives of educational needs were identified. One significant identified need was to provide an educational package for frontline educators that could be further disseminated to provide targeted knowledge to frontline staff. A key priority was providing the most concise, applicably relevant material required at the frontlines that would be congruent to staff workflow.

These initial findings from the needs assessment informed the development of the COVID-19 Continuing Care Simulation Resource Kit. The kit included the Environmental Scan Tool, cognitive aides, outcome documents and a 'how-to' recorded presentation. The Environmental Scan Tool included a physical walkthrough style of simulation with probing questions to identify key areas that could be targeted to better support staff (see supplementary material). A physical walkthrough is a style of simulation for systems integration where key stakeholders assess an area from a systems perspective for topics such as workflow, processes, and environment [10]. This strategy provides an opportunity to assess safety risks and discuss solutions to support team and individu-

al staff confidence, and quality of care [10]. Participants in this simulation included key continuing care educators. During this physical walk through, the process of managing a suspected or confirmed COVID-19 positive patient was assessed. Within the Environmental Scan Tool, educators were able to record issues found, indicate the action required, and identify who should be responsible for that action. The how-to video presentation provided users with an outline of how to use the tool effectively and efficiently.

Additional elements included references from AHS such as a 13-minute video demonstrating donning and doffing of personal protective equipment, a module to train individuals to become personal protective equipment safety coaches, donning and doffing visual aids, and material regarding COVID-19 outbreak management. The resource kit was presented across the provincial healthcare system to educators and Infection Prevention and Control leaders, highlighting its use, diversity, generalizability, and adaptability for future assessments within the province's varied continuing care facilities.

Data collection and analysis

Data collection of the qualitative narratives were documented in real time on the Environmental Scan tool, following the physical walkthrough simulation. Data analysis included the theming of system-focused debriefing outcomes (e.g., tools/technology, tasks, environment, people/teams) based on highest risk and impact. All outcome data were analyzed to determine convergence of themes and repeated expression of reoccurring constructs. Discrepancies in labeling of themes were discussed by the core project team regularly and resolved; with themes simplified and altered accordingly until complete agreement was reached.

Results

Implementation of the Environmental Scan Tool between November 2020- March 2021 led to initial observations of several significant high risk, high impact outcomes provincially. During the COVID-19 pandemic, posters/cognitive aids were developed by the Infection Prevention and Control teams to assist staff with tips on donning, doffing, and communication with respect to isolation status. Over time, the number of cognitive aids posted outside the patient's room became overwhelming and distracting from the most important information for staff prior to entering the patient's room. Following the implementation of the Environmental Scan Tool, qualitative narratives and themes from the case study identified that the cognitive aids posted on the patient's door were minimized to contain only the most applicable and easily readable information.

Secondly the results from environmental scan identified a key latent safety threat of contamination of personal items. Using lessons learned from acute care regarding the risks of contamination when staff brought personal items into an isolation room (e.g., pagers) [7], the staff at the continuing care site implemented the recommendation of "personal items bins" placed in the donning areas for staff to deposit belongings prior to entering the isolation environment. In addition, COVID-19 fatigue with infection control practices was commonly reported among frontline workers, and the qualitative results from the environmental scan identified the potential for gaps in the proper set-up (e.g., equipment, location, cognitive aids) of the donning and doffing stations. To assist staff in the proper set-up of donning and doffing stations, an empty room was created as result, to provide a visual representation of a sample set-up. This included applicable equipment, signage, and supplies in the appropriate areas. A key reported system level outcome from the implementation of the Environmental Scan tool related to the proper set-up of the donning and doffing stations in and just outside the client's room. Outcomes from the scan informed the decision to clearly mark areas as "clean" and "dirty" to minimize contamination as well as rearranging some of the supplies to better support best practice for infection prevention and control in managing suspected or confirmed COVID clients.

Discussion

The provincial simulation team broadly shared the COVID-19 Continuing Care Simulation Resource Kit across Alberta among different levels of continuing care representatives through virtual presentations. More than 80 educators, infection control practitioners, and leaders participated in the initial presentations for dissemination to individual teams. Qualitative narratives with

continuing care educators validated the strong applicability, adaptability, and ease of use of the COVID-19 Continuing Care Simulation Resource Kit for other quality improvement initiatives within a continuing care setting. Using a previously unfamiliar approach to the delivery of simulation, local continuing care sites began to incorporate simulation into new quality improvement initiatives. For example, a significant finding from this case study is that the Environmental Scan tool and physical walk-through simulation could be adapted to assess systems processes and policies in other continuing care environments and settings, inside or out of a pandemic focus. Furthermore the relationship between the provincial simulation team and continuing care sites also resulted in fostering ongoing mentorship, taking initial steps in making inroads and building future collaborations.

This quality improvement case study highlights that the use of simulation for systems integration provides professionals a means to critically evaluate healthcare processes for logistical and safety concerns [14]. Research supports the use of simulation to evaluate and improve systems processes [14]. By using simulation in this way, continuing care educators were able to identify and provide the most crucial education to healthcare workers. Therein, the resource kit was critical for educators to provide the most concise, applicably relevant material required at the frontline in continuing care. This simulation modality allows healthcare decision makers to identify system challenges and safety threats, and implement policy and practice changes to address those safety issues in real time [19]. For example, in this case study, safety threats were found in the set-up of donning and doffing stations and there was a concern raised about contamination via personal items brought into the isolation room.

This research builds on the findings of translational simulation quality improvement studies, which reported similar findings where location of personal protective equipment and personal item contamination were identified as safety threats in the acute care setting [7,19]. While these researchers addressed personal item contamination by posting signs to remind staff to remove their personal items or place them in disposable plastic bags if they must be brought in [19], our educators instructed staff to put all personal items in personal item bins prior to entering the room. The slight disparity in intervention may speak to the inherent differences between the acute and continuing care setting. Healthcare professionals in the acute care setting can be responsible for multiple critically ill patients at one time [21], therefore it may be essential for staff to have a communication device always on their body. In continuing care, patients do not have the same level of acuity and demand for healthcare workers compared to critically ill patients [22]. This speaks to the need for more system integration simulation research in the continuing care setting, as not all findings in the acute care setting will easily translate to the continuing care setting. The relatively simple continuing care simulation intervention initiated during this case study highlights the importance of subsequent interventions applying simulation for systems integration approach to enhance safety for nurses and their patients in the continuing care settings.

As COVID-19 continues to evolve, the results of this simulation and continued use of this tool in the continuing care setting will be beneficial to ensuring Infection Prevention and Control policies are accurately implemented. The development of this novel just-in time simulation for system integration resource kit provided continuing care organizations with strategies to prioritize and assess new processes, workflows and safety risks. Furthermore, since the fundamental aspects of the Environmental Scan Tool are not disease specific, it can be used as an easily adaptable solution for rapid evaluation of infection control standards in the event of another pandemic or disease outbreak. This is important because the inherent structure of continuing care facilities can create a space for disease to rapidly spread [1,23]. While patients in the acute care setting can be effectively isolated, patients in continuing care have communal spaces, shared bedrooms, and it can be difficult to keep the mildly ill patients confined to their rooms [24]. This is especially challenging in patients with a dementia diagnosis [1,24]. It is essential that frontline staff have effective systems and tools in place to mitigate the spread of COVID-19 and other pathogens in subsequent pandemics. Having access to this adaptable Continuing Care Simulation Resource Kit may increase the organizations' ability to quickly respond to future infectious disease outbreak.

Limitations

The capacity of the project team was recognized as a limiting factor in its ability to reach the wide breadth of continuing care sites across the province in a timely manner. Paired with the variance in sites across the province, the lack of awareness with simulation-based education as a modality of learning impacted how the team set out to support creating a simulation resource kit for continuing care teams. The competing priorities of the pandemic in parallel with the rapid shifting timeline also influenced the process in the development of educational support for frontline staff.

Conclusion

The quality of patient care is directly impacted by the ongoing training and education of healthcare workers. The goal of this health system case study was to create an easily adaptable resource kit specific to COVID-19 related Infection Prevention and Control practices within continuing care sites across the province between 2020-2021. This quality improvement simulation-based case study aimed to improve patient care by developing, designing, and implementing an easily reproducible and adaptable COVID-19 Continuing Care Simulation Resource Kit and mentorship package for Infection Prevention and Control leaders and educators to support frontline staff in managing a global pandemic. This novel education resource kit was disseminated across the provincial healthcare system, underscoring its applicability, generalizability, and adaptability and provides opportunities for significant advancements in championing new opportunities for integration of system simulation in continuing care locally, nationally, and internationally.

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Acknowledgement of Conflict of Interest

AK is faculty for Healthcare Systems Simulation International, which provides education and consulting services. There are no conflicts of interest for all authors.

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Supplimentary File: 1

Long Term and Continuing Care (LTC) Environmental Scan Summary

What is it? A physical walkthrough using a scenario/case in the client environment with key stakeholders. The purpose is to identify safety issues and determine how the process with a suspected or positive COVID-19 client differs from your area's day to day process. An environmental scan supports team and individual staff confidence and readiness to provide safe care during the pandemic.

Initial Steps in Planning

1. **Include appropriate experts and key stakeholders**. These include anyone in contact with the client or client environment. (ie. environmental services, care team etc.) Don't forget to include Infection Prevention Control.
2. Gather cognitive aids/checklists/posters applicable to your area to bring on the day of the scan.
3. **Determine objectives**. Common objectives for COVID-19:

- Environmental scan of the client area for supplies, equipment etc.
- Walking and talking through processes and workflows specific to suspected or confirmed positive COVID client
- Determining/reviewing staff roles for clients with a suspected or confirmed positive COVID

Steps on the Day of an Environmental Scan (scripts and tools included)**:**

1. **Prebrief (Introduction):** This is an introduction to the Scan with your team. Key elements of the prebrief are: participant introductions, clarifying objectives and review of the walkthrough structure/plan.
2. **Physical Walkthrough:** A walking and talking environmental scan for missing equipment, supplies, workflow, set up of area. Participants reflect on day-to-day practice and process and how it is impacted by COVID. Allow representatives to pause at each step or transition to share their team's process, then gather feedback from all team members.
3. **Debrief:** This is a structured discussion to summarize findings and ensure action items have been assigned. How will you implement changes? How will you share information with your team(s)? Focus on the highest risk items.

Adapted for LTC by Barnes, Fuselli, Semaka November 2020

Supplimentary File: 2

Environmental Scan Tool This tool has been simplified to target a quick scan of one area of client care.

A scan can be broadened to include other key stakeholders (i.e. educators, frontline staff, housekeeping, kitchen) and expanded to explore other areas of care or bigger processes (i.e. Dietry food tray delivery, dining room and common area process, maintenance and cleaning processes for COVID-19, creation of a COVID-19 specific space).

Objectives: Assessment of the process of managing a suspected or confirmed COVID-19 positive client in your care environment.

Client Case Introduction: You are preparing to enter a room for a check/assessment on a client who is on contact and droplet isolation.

Care Transitions	Anticipated Issues, Gaps, Safety Threats	Action Items/Assigned
1. Outside Client Room	**PPE Cart:** · Clean and dirty areas kept separate? · Labels for clean area? · Supplies—adequate amount, not overstocked? (gloves, hand sanitizer, gowns, shield) **Donning** · PPE donning poster showing steps in donning. Is it simple and easy to follow? Is it visible at the donning station? · PPE buddy (if facility can support) to ensure donning is complete. · What PPE is required? (N95 for *Aerosolized Generating Medical Procedures-AGMP* i.e. patient on Continuous Positive Airway Pressure ***Tip**: **Minimize cognitive aids posted on the client's door to only those necessary (i.e. Contact and Droplet isolation sign and potentially donning sign).* ***Tip**: **AGMP STOP sign outside of room to alert staff if there is an N95 requirement.* **Designated Support Persons (DSP)** · What is the process for DSP or visitors on site? · Will DSP and visitors be notified/educated of isolation requirements, how to don/doff?	
2. Client Care in the Room	**Communication** · Strategies for communication between staff in and out of the isolation room? · How do you record vital signs in an isolation room while maintaining precautions? (i.e. bringing notes outside the room would risk contamination, so record vitals on whiteboard in the room and call out vitals to staff outside the room to record). · Consider phones or pagers becoming contaminated in room or when reaching under gowns. ***Tip**: **Consider buckets/bins to place personal items in, prior to entering an isolation room, to prevent reaching under PPE gowns and contamination.* ***Tip**: **Reaffirm with staff that complete doffing and re-donning must occur when leaving and re-entering the room.*	

3. Leaving Client Room	**Doffing** · Dirty doffing area in the client room (i.e. gown and gloves) and outside the client room (i.e. face shield and mask)? · Hand hygiene available in and out of the room? · Is there a garbage in and out of room, laundry inside? ***Tip**: **Place doffing signage both inside and outside of the door. Ensure the location of the cognitive aids is appropriate to where staff will be doffing.* **Dirty supplies and items brought into the room** (i.e. stethoscopes, pens, vital signs machines, thermometers) · Process for separating and placing dirty supplies/equipment? · How are items cleaned prior to going back into general circulation? · Consider the process for cleaning reusable PPE items (i.e. face shields, goggles) as they are removed from the room. ***Tip**: **Consider use of bins to place dirty equipment in as staff leave the room, but watch for tripping hazards if placed on floor.* ***Tip:** **You may want to consider a schedule for cleaning high touch surfaces (i.e. bedside tables, charting areas, blood pressure cuffs) as they have been identified as high risk transmission items.*	