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Innovations in Simulation

Rapid Development of a COVID-19 Assessment and PPE Virtual Simulation Game

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Abstract
Objective: A virtual simulation game (VSG) educational module focused on COVID-19 assessment and personal protective equipment (PPE) was designed to strengthen the capacity of graduating nursing students and practicing nurses to provide care during the COVID-19 health crisis.
Methods: In less than two weeks, a team of simulation and clinical experts from the Canadian Alliance of Nurse Educators using Simulation (CAN-Sim), the Canadian Association of Schools of Nursing (CASN) and the Canadian Nurses Association (CNA) collaborated to virtually develop a high-quality virtual simulation module.
Results: A bilingual VSG and related resources was created, focusing on the assessment and PPEs required when caring for a patient with or suspected of contracting COVID-19.
Conclusions: This educational module has been accessed by over 600,000 users and implemented in nursing programs across Canada and globally.

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Background
Registered nurses (RNs) are frontline responders in the COVID-19 health crisis and critical to the effective delivery of health care services. Retired RNs are being called on to re-register, and the graduating class of nursing students are being recruited to provide care in a non-registered nursing role. Entering a highly stressed health care system, many may receive less mentoring, orientation and support than usual. They will also face advanced, high acuity, and high-risk nursing care demands that will be new to them and carry exposure risks.

In response to demand for COVID-19 educational resources by nurse educators across Canada, the executive director of the Canadian Association of Schools of Nursing (CASN) invited simulation design experts from the Canadian Alliance of Nurse Educators using Simulation...
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(CAN-Sim) to partner in the rapid development of an online simulation module. In Canada, CASN is the national voice for nursing education and scholarship and the national accrediting agency for degree-granting nursing programs. CAN-Sim is a collaboration of nurse educators that provides shared resources, support, mentorship and faculty development. Thus a collaboration between CASN and CAN-Sim provided both the clinical and educational expertise required to develop relevant, high-quality resources.

A virtual simulation game (VSG) was proposed as the focus of the online educational module. VSGs are animated or video-based clinical scenarios that integrate simulation and gaming features to promote learner engagement and critical thinking (Luctkar-Flude et al., 2020). Learning outcomes associated with well-designed VSGs are comparable to live simulations (Cant & Cooper, 2014), but VSGs are more cost-effective and accessible for delivery to large groups of learners (Kalkman, 2012). CAN-Sim project leaders had previous experience creating VSGs (Keys, Luctkar-Flude, Tyerman, Sears, & Woo, 2020) and have developed a streamlined VSG design process and faculty development workshop traditionally delivered face-to-face. To incorporate expertise from nurse educators across Canada, it was necessary to lead the team through this process in a virtual format. The educational module developed will support patient safety for nurses and nursing students entering the health care workforce during the COVID-19 pandemic.

Objective

The purpose of this paper is to describe the creation of a virtual simulation game (VSG) educational module focused on COVID-19 assessment and personal protective equipment (PPE). The overarching goal of the project is to strengthen the capacity of graduating nursing students and practicing nurses to provide care during the COVID-19 health crisis and potential future pandemics.

Methods

A team of public health nurse experts was assembled to guide content development. In recognition of the urgency and importance of the project, all parties provided their time and expertise on an in-kind basis. The team met via a video-conferencing platform during the last week of March to design the VSG using CAN-Sim VSG templates shared in Google Docs documents that could be viewed and edited by multiple individuals simultaneously.

Target Audience

The target audience included undergraduate nursing students during their practicum experience, graduating nursing students, retired nurses recruited to return to the workforce, practicing nurses, and nurse educators preparing students to provide care during this pandemic.

Virtual Simulation Game Development

Day 1 consisted of drafting specific learning outcomes and competency indicators (Luctkar-Flude, Tregunno, Egan, Sears, & Tyerman, 2019) to guide the VSG development. Learning outcomes focused on required personal protective equipment (PPE) and assessment for individuals diagnosed or having symptoms of COVID-19. Competency indicators, levelled according to Benner’s Novice to Expert Theory (Benner, 1982), outlined learner expectations. Learning outcomes and indicators provided content for the self-assessment rubric (Figure 1).

Day 2, using the CAN-Sim Decision Point Map template, we developed 17 decision points based on the learning outcomes to guide gameflow (Table 1). Each decision point included a critical thinking question with three responses. Response A was the correct response, while responses B and C were either ‘not the best/incorrect’, and included common clinical errors or lower priority actions. Rationale describing why responses were either correct or incorrect was based on guidelines from international sources such as the World Health Organization (WHO, 2020) and national sources such as the Public Health Agency of Canada (PHAC, 2020), as well as provincial, regional and institutional guidelines.

Day 3 involved writing the filming script focused on the dialogue between actors and detailed filming direction such as the setting (including equipment and props), acting directions (including tone of voice, mood, movement), and scene blocking. Our VSG featured a telehealth consultation with a Public Health Nurse, testing at the COVID-19 Assessment Centre, and assessment at the Emergency Department.

Peer Review

Content experts from the Canadian Nurses Association (CNA), the Community Health Nurses of Canada, and the CASN Public Health Nurse Interest Group peer-reviewed the rubric and script. Reviewer feedback was collated, evaluated, and appropriate edits were made. Actors also reviewed the script prior to filming to ensure realism and comfort with dialogue. Once the VSG was created, another peer review was conducted.

Virtual Simulation Game Filming and Assembly

Special filming permission at the University of Ottawa was obtained. All actors and filming crew wore PPE, including face masks, and practiced physical distancing. No participant reported COVID-19 symptoms post-filming. Video clips were assembled using the CAN-Sim VSG template
| Decision Point | Scene | Question | Response A (Correct) | Response B (Incorrect) | Response C (Incorrect) |
|----------------|-------|----------|----------------------|------------------------|------------------------|
| 1              | Persons calls the public health phone line | What is the most important information the PHN needs to gather over the phone from the person? | Fever, cough, difficulty breathing, travel history and relevant social factors | Sore throat, fever, cough, travel history, | Fever, cough, diarrhea, family event |
| 2              | Patient walks into assessment center | What education is the most appropriate at this point? | Both wear a mask, wash hands frequently, self-isolation, avoid close contact, worsened cough, call for an appointment at testing center, comfort. Clean & disinfect frequently touched surfaces | Both wear mask, wash hands frequently, avoid close contact, call for an appointment at testing center, comfort, Clean & disinfect frequently touched surfaces | Wash hands frequently, avoid close contact, go to the testing center, |
| 3              | Patient directed to nurse to complete assessment | What is the most appropriate PPE required for the individual requiring COVID-19 Assessment? | Level 1 procedure mask (BC Centre for Disease Control (“if you are sick”) Show – also washing hands with hand sanitizer | N95 mask | No mask required |
| 4              | WHO video and Ruth sent this am Dr. Mark Loeb | What is the most appropriate method to apply a surgical mask | Apply behind ears then fit over nose/under chin | Hold mask in palm of hand, apply to face and ears | Apply behind ears, slightly below tip of nose/under chin |
| 5              | Role model questions to ask to identify risk of COVID-19 Traveling – returned from Florida | What other type of PPEs are required for patient contact? | Eye protection, clean gloves and non-sterile isolation gown | Sterile gloves and sterile surgical gown | Eye protection, no gloves and no gown required for assessment |
| 6              | Role model questions to ask to identify risk of COVID-19 Traveling – returned from Florida | What additional PPEs are required for NP swab application? | No additional PPE required | Patient wears N95 mask | Nurse wears N95 mask |

(continued on next page)
| Decision Point | Scene | Question | Response A (Correct) | Response B (Incorrect) | Response C (Incorrect) |
|----------------|-------|----------|----------------------|------------------------|------------------------|
| 7              | Nasopharyngeal swab has been obtained | What information should be provided to the individual upon release to home? | Self-isolation in the home for 14 days | Social distancing when leaving the home | Only leave the house to get groceries or medications |
| 8              | Within 72 hours patient returns to ER, before swab results have been confirmed | What symptoms would warrant the individual go to the ER for assessment? | Increased SOB, chest pain, fever, worsening cough | SOB, cough, fever, vomiting | Cough, fever, diarrhea, nausea |
| 9              | Patient has been admitted to a private room in the hospital | When is the appropriate response? | Contact, droplet, routine practices | Contact, droplet, airborne | Routine practices, contact |
| 10             | HCP orders nebulized albuterol | What type of precautions are appropriate for confirmed/suspected COVID-19? | Hand hygiene, gown, mask, eyewear, gloves | Hand hygiene, gloves, gown, mask, eyewear | Hand hygiene, eyewear, gown, mask, gloves |
| 11             | Needs to take vital signs | How should the nurse maintain infection control while using equipment? | Keep all equipment in room | Cover equipment with biohazard bag | Use low-level disinfectant after equipment use |
| 12             | Patient needs to leave the room for x-ray Notify x-ray first | In addition to wearing a surgical/procedure mask, what precautions should be taken? | Resp hygiene, new bedclothes and bedding before leaving the room | Resp hygiene, new bedding | Gloves, gown |
| 13             | Handover to another staff member at shift change | What is the essential information that should be given when a handover report is given? | Gloves, gown, hand hygiene, eye protection, mask, hand hygiene | Gown, gloves, eye protection, mask, hand hygiene | Eyewear, mask, gown, gloves, hand hygiene |

Table 1 (continued)
using Articulate Storyline 3 software. In compliance with accessibility standards, the VSG provided closed captioning options, screen readers, increased player font size and video sliders for rewinding video content.

**French Translation and Development**

Translation of VSG materials was facilitated by CASN and recorded a voice-over French dialogue was dubbed over the English video clips. A game with French subtitles was also developed.

**Results**

This brief collaborative project resulted in the following key outputs:

1. **Virtual simulation game (VSG):** A novel, evidence-based VSG was created about COVID-19 assessment, and PPE selection, donning and doffing was posted online less than two weeks from project start and is hosted on the CAN-Sim website: [http://www.can-sim.ca/games/covid19ppe/story_html5.html](http://www.can-sim.ca/games/covid19ppe/story_html5.html). The VSG has been disseminated by CASN, CNA, Simulation Canada, International Nursing Association for Clinical Simulation and Learning (INACSL), Society for Simulation in Healthcare (SSH), and National League for Nursing (NLN) on their websites and social media. All VSG content is routinely reviewed and updated to reflect current practice. For example, the Epidemiology of COVID-19 video produced by the World Health Organization was updated in January 2021 to reflect current information and guidelines.

2. **Learning management system (LMS) course:** The COVID-19 VSG was embedded within an LMS with learning outcomes, assessment rubric, reflective questions and relevant resources, to provide a comprehensive learning experience: [http://www.can-sim.ca/games/courses/covid-19-assessment-and-ppe/?tab=tab-curriculum](http://www.can-sim.ca/games/courses/covid-19-assessment-and-ppe/?tab=tab-curriculum).

3. **French version of the VSG:** A French version of the VSG was completed and is hosted on the CAN-Sim website: [http://www.can-sim.ca/games/covid19%20valuationepi/story_html5.html](http://www.can-sim.ca/games/covid19%20valuationepi/story_html5.html).

4. **Rapid online VSG design process:** We developed an effective format for designing educational resources virtually using a video conferencing platform.

**Table 1** (continued)

| Decision Point | Scene | Question | Response A (Correct) | Response B (Incorrect) | Response C (Incorrect) |
|----------------|-------|----------|----------------------|------------------------|------------------------|
| 17             |       | What should the nurse do now after caring for a patient diagnosed with COVID-19? | Remove hospital scrubs prior to leaving the hospital or the assessment center | Self-isolate from family for 2 weeks | Do not return to work for 2 weeks |

**Table 2** Estimated Use of the COVID-19 VSG March to July 2020

| Month      | Bandwidth GB Used | Estimated Users |
|------------|-------------------|-----------------|
| March      | 240               | 96,000          |
| April      | 308               | 123,200         |
| May        | 438               | 175,200         |
| June       | 597               | 238,800         |
| July       | 240               | 96,000          |
| August     | 270               | 107,988         |
| September  | 690               | 275,932         |
| October    | 415               | 166,000         |
| November   | 499               | 199,516         |
| December   | 271               | 108,400         |
| January    | 677               | 266,800         |
| Total # of users |                  | 1,853,836       |

**Impact**

The VSGs and resources are available open access for virtual delivery synchronously or asynchronously. We have seen an exponential increase in the number of “hits” to the CAN-Sim website. Website analytics indicate the COVID-19 VSG was accessed over 500,000 times over a 4-month period (Table 2). Many schools of nursing are making this a mandatory non-academic requirement for students prior to re-entry into clinical settings. We have received informal feedback from nurse educators, nurses, nursing students and other health professionals across Canada, the U.S. and beyond who have used the COVID-19 VSG or LMS course to prepare for clinical practice during the
Learning Outcomes Assessment Rubric: COVID-19 PPE VSG

| Competency                                                                 | Competent Learner                                                                 | Intermediate Learner                                                                  | Novice Learner                                                                 |
|----------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| • Understand infectious disease transmission factors and public health measures that are important to consider when selecting appropriate PPE equipment in multiple settings to adhere to principles of infection control and prevention. | • Consistently selects all PPE for the health care provider that aligns with the identified modes of transmission. | • Selects some PPE for the health care provider that aligns with the identified modes of transmission. | • Does not select PPE for the health care provider that aligns with the identified modes of transmission. |
| • Identifying people who are at risk for COVID-19. | • Consistently selects all PPE for the individual seeking care that aligns with the identified modes of transmission. | • Consistently follows international, national, provincial/territorial, regional and institutional guidelines for PPE for COVID-19. | • Does not follow international, national, provincial/territorial, regional and institutional guidelines for PPE for COVID-19. |
| • Don (put on) and doff (take off) PPE correctly as per public health measures in an assessment/testing area and/or acute care setting to protect self and others. | • Consistently dons PPE in correct order. | • Sometimes removes (doff) PPE in correct order. | • Performs sufficient hand hygiene. |
| • Appraise factors that can place an individual at risk for COVID-19, upon initial contact and further assessments to determine the need for further screening. | • Consistently identifies COVID-19 risk factors including biological and social factors. | • Consistently performs required screening measures. | • Does not identify COVID-19 risk factors. |
| • Conduct a focused assessment when an individual exhibits respiratory symptoms to determine next steps in care. | • Consistently assesses signs and symptoms of respiratory difficulty. | Sometimes identifies appropriate plan of care. | Sometimes identifies some COVID-19 risk factors. |
| • Maintain infection control and safe handling of equipment when assessing an individual to prevent transmission of microorganisms. | • Consistently maintains infection control measures when handling any equipment. | • Consistently maintains infection control measures during transport and transfer of care. | • Sometimes maintains infection control measures when handling any equipment. |
| • Educate the individual during the healthcare encounter about the plan of care to prevent potential transmission of COVID-19. | • Consistently educates in collaboration with the individual and their circle of care about how to prevent potential transmission. | • Sometimes educates in collaboration with the individual and their circle of care about how to prevent potential transmission. | • Does not collaborate with the individual and circle of care about how to prevent potential transmission. |
| • Communicate effectively during a COVID-19 pandemic to ensure continuity of care. | • Consistently communicates in a clear, direct, and supportive manner to the individual, and their circle of care. | • Sometimes communicates in a clear, direct, and supportive manner to the individual, and their circle of care. | • Does not communicate in a clear, direct, and supportive manner to the individual. |

Figure 1: Self-assessment rubric.

3. **Evolving guidelines**: The most critical challenge was the selection of resources to support game development, as there were inconsistencies between international, national, regional, and institutional guidelines that were changing on a daily basis.

4. **COVID-19 restrictions**: Closure of university campuses and physical distancing requirements precluded face-to-face planning meetings and the ability to film at one university site. This necessitated travel to a second university where special permission was obtained.

**Discussion**

Despite several logistical challenges, we demonstrated that it was possible to design, create and implement a VSG rapidly and collaboratively to advance best practices in assessment and PPE utilization during a global pandemic.
The rapid turnaround time can be attributed to the visionary leadership of the CASN executive director, the experienced leadership of the CAN-Sim project leads, and the dedication of a small group of volunteer Public Health Nurses recruited to the project. Over a short period of time, the VSG and LMS module has been accessed and implemented at academic and clinical sites across the country and internationally, as evidenced by website analytics and informal feedback.

Demonstrating the feasibility of collaborating and delivering simulation design faculty development over a video conferencing platform has implications for the development of educational resources in the future. Where previously we collaborated in face-to-face settings to lead groups of educators through the CAN-Sim simulation design and VSG design processes, we have shown it is possible to provide the same education virtually.

Endorsement of the VSG by organizations such as CASN, CNA, INACSL, SSH, Simulation Canada and the NLN signifies the value of this much-needed resource during the COVID-19 pandemic. In collaboration with CASN our VSG design team has received funding from the Health Canada Health Care Policy and Strategies Program to design and disseminate five additional VSG modules in both official languages to build capacity among graduating and new registered nurses entering the health care workforce during the COVID-19 pandemic.

**Conclusion**

In response to an emerging public health crisis, this collaborative project demonstrated the feasibility of creating a quality online educational module, including a

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**Figure 2** COVID-19 virtual simulation game user feedback.
comprehensive VSG, in a timely, cost-efficient manner. Our innovative educational module can be utilized in both academic and healthcare settings as both provide professional development and to better prepare the next generation of nurses and health professionals to care for individuals who have or are suspected of being infected with COVID-19. This module may also be applicable to similar infectious diseases that may emerge in the future. In collaboration with CASN, our CAN-Sim VSG design team has received funding from the Health Canada Health Care Policy and Strategies Program to design and disseminate five additional open-access COVID-19 related VSG modules in both official languages. The goal of this new project is to build capacity among graduating and new registered nurses entering the health care workforce during the COVID-19 pandemic.

Declaration of Competing Interest

Dr. Jane Tyerman and Dr. Marian Luctkar-Flude are co-Presidents of the Canadian Alliance of Nurse Educators Using Simulation (CAN-Sim). Dr. Cynthia Baker is the Executive Director of the Canadian Association of Schools of Nursing (CASN). This project was unfunded.

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