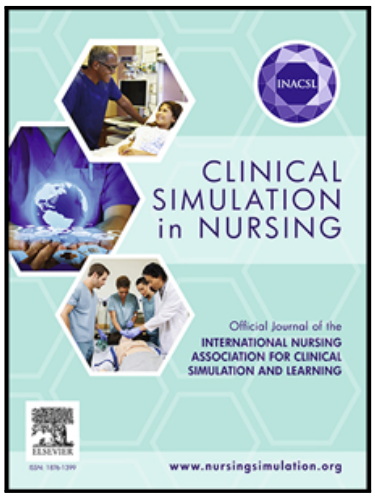

Rapid Development of a COVID-19 Assessment and PPE Virtual Simulation Game

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Highlights

- A rapid development of a comprehensive virtual simulation game (VSG) educational module focused on COVID-19 assessment and personal protective equipment (PPE)
- This innovation strengthens the capacity of graduating nursing students and practicing nurses to provide care during the COVID-19 health crisis.
- This bilingual educational module has been accessed by over 600,000 users and implemented in nursing programs across Canada and globally.

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

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

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Declaration of 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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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 developed 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.

Keywords: virtual simulation; simulation game; nursing education; COVID-19; infection control

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 (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 et al., 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.

VSG Development

Day 1 consisted of drafting specific learning outcomes and competency indicators (Luctkar-Flude et al., 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.

VSG 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 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. 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
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%C3%A9valuationepi/story_html5.html
4. **Rapid online VSG design process:** We developed an effective format for designing educational resources virtually using a video conferencing platform.

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 current pandemic. A sample of feedback posted to our website is shown in **Figure 2**.

Challenges

There were several challenges involved in rapidly developing this educational module:

1. **Short timeline:** As the need for this resource was immediate, we gave ourselves an extremely tight timeline of one week for the project. VSG design and filming took under a week, but peer review and edits extended delivery time to just under two weeks for the English version and several months for the French version.
2. **Collaborating virtually:** Collaborating virtually across multiple time zones created challenges to scheduling meetings. Technical issues were related to internet access quality for individual participants.
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 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.

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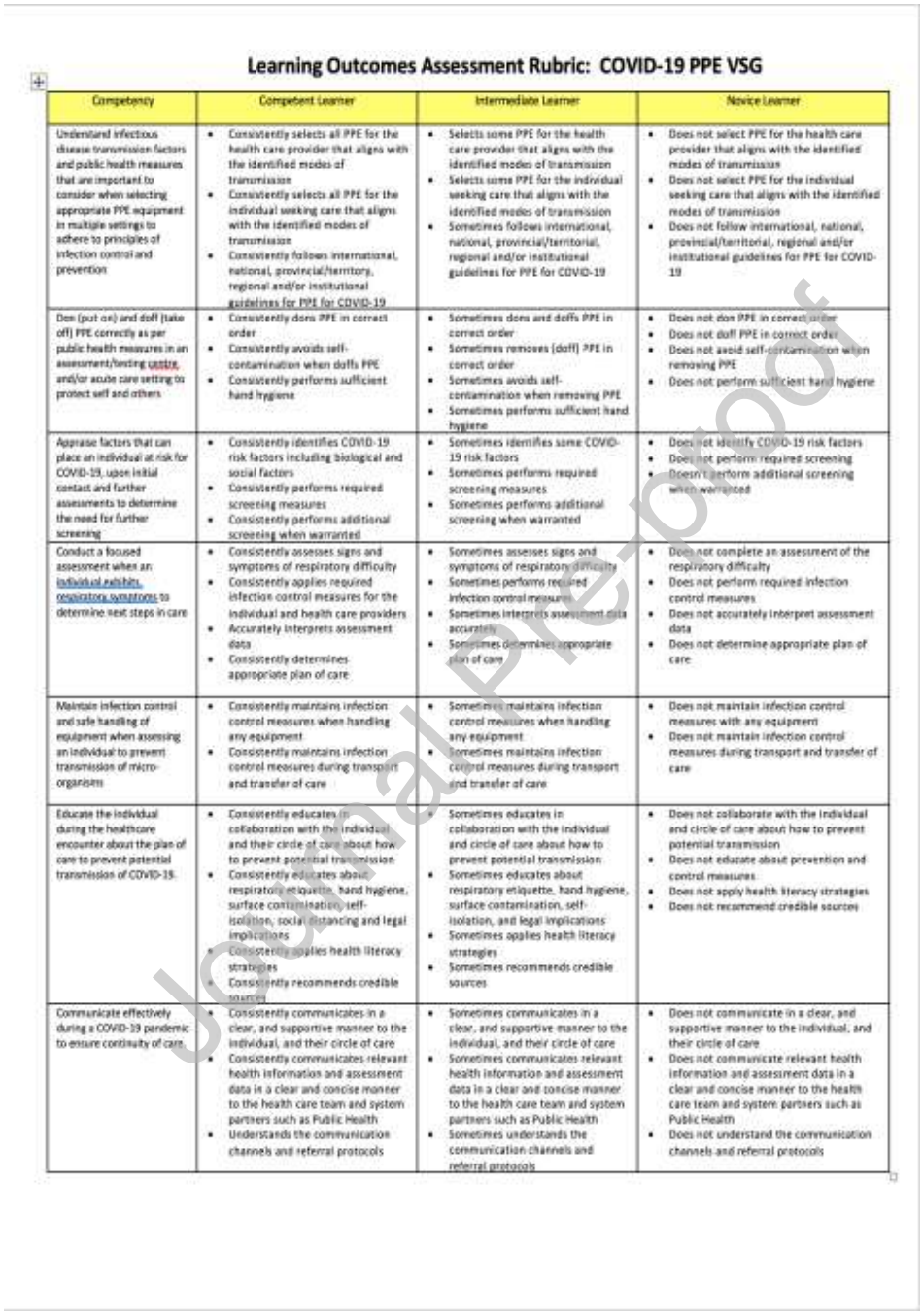
Figure 1: ***Self-Assessment Rubric***



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 • Consistently selects all PPE for the individual seeking care that aligns with the identified modes of transmission • Consistently follows international, national, provincial/territory, regional and/or institutional guidelines for PPE for COVID-19	• Selects some PPE for the health care provider that aligns with the identified modes of transmission • Selects some PPE for the individual seeking care that aligns with the identified modes of transmission • Sometimes follows international, national, provincial/territorial, regional and/or institutional guidelines for PPE for COVID-19	• Does not select PPE for the health care provider that aligns with the identified modes of transmission • Does not select PPE for the individual seeking care that aligns with the identified modes of transmission • Does not follow international, national, provincial/territorial, regional and/or 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 centre and/or acute care setting to protect self and others	• Consistently dons PPE in correct order • Consistently avoids self-contamination when doffs PPE • Consistently performs sufficient hand hygiene	• Sometimes dons and doffs PPE in correct order • Sometimes removes (doff) PPE in correct order • Sometimes avoids self-contamination when removing PPE • Sometimes performs sufficient hand hygiene	• Does not don PPE in correct order • Does not doff PPE in correct order • Does not avoid self-contamination when removing PPE • Does not perform 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 • Consistently performs additional screening when warranted	• Sometimes identifies some COVID-19 risk factors • Sometimes performs required screening measures • Sometimes performs additional screening when warranted	• Does not identify COVID-19 risk factors • Does not perform required screening • Doesn't perform additional screening when warranted
Conduct a focused assessment when an individual exhibits respiratory symptoms to determine next steps in care	• Consistently assesses signs and symptoms of respiratory difficulty • Consistently applies required infection control measures for the individual and health care providers • Accurately interprets assessment data • Consistently determines appropriate plan of care	• Sometimes assesses signs and symptoms of respiratory difficulty • Sometimes performs required infection control measures • Sometimes interprets assessment data accurately • Sometimes determines appropriate plan of care	• Does not complete an assessment of the respiratory difficulty • Does not perform required infection control measures • Does not accurately interpret assessment data • Does not determine appropriate plan of care
Maintain infection control and safe handling of equipment when assessing an individual to prevent transmission of micro-organisms	• 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 • Sometimes maintains infection control measures during transport and transfer of care	• Does not maintain infection control measures with any equipment • Does not maintain infection control measures during transport and transfer of care
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 • Consistently educates about respiratory etiquette, hand hygiene, surface contamination, self-isolation, social distancing and legal implications • Consistently applies health literacy strategies • Consistently recommends credible sources	• Sometimes educates in collaboration with the individual and circle of care about how to prevent potential transmission • Sometimes educates about respiratory etiquette, hand hygiene, surface contamination, self-isolation, and legal implications • Sometimes applies health literacy strategies • Sometimes recommends credible sources	• Does not collaborate with the individual and circle of care about how to prevent potential transmission • Does not educate about prevention and control measures • Does not apply health literacy strategies • Does not recommend credible sources
Communicate effectively during a COVID-19 pandemic to ensure continuity of care	• Consistently communicates in a clear, and supportive manner to the individual, and their circle of care • Consistently communicates relevant health information and assessment data in a clear and concise manner to the health care team and system partners such as Public Health • Understands the communication channels and referral protocols	• Sometimes communicates in a clear, and supportive manner to the individual, and their circle of care • Sometimes communicates relevant health information and assessment data in a clear and concise manner to the health care team and system partners such as Public Health • Sometimes understands the communication channels and referral protocols	• Does not communicate in a clear, and supportive manner to the individual, and their circle of care • Does not communicate relevant health information and assessment data in a clear and concise manner to the health care team and system partners such as Public Health • Does not understand the communication channels and referral protocols

Figure 2: ***COVID-19 Virtual Simulation Game User Feedback***

Highly educative, timely and an excellent visual presentation. Good job.
I learned new information from your article, you are doing an excellent job.
Very useful information
Thank you very much for the free game!
Really like the game. It was very helpful on refreshing my memory and it gave a lot of good information
Wow. Love it. Very informative. Thanks!
It is very informative and very helpful in recent situation.
Yes, very good opportunity! A well-produced simulation.
I first would like to say these are amazing!! I love these resources.
Thank you for the opportunity to play the game!
It was really useful information. During this game, I enjoyed a lot. Thank you for providing such good materials to us.
Thank you. I plan to use it in our nursing curriculum.
Virtual learning is very informative, and I really enjoyed solving quiz. Language and case scenarios are clear and understandable.
Very helpful and informative. Great way to learn/ review
I feel they are essential guidelines to properly follow the recommended use of PPE equipment. I believe they will serve me well in my career as a health care professional and I should refer to them regularly.
The game was so interesting it can still give an opportunity to answer the question correctly after making an error. It was just like revising what I do to my work on a daily basis about PPE especially now with the Covid-19.
Great information. Lucky me I came across your website by chance. I have bookmarked it for later!
This website really has all the information and facts I wanted about this subject and didn't know who to ask.
Thank You for giving me an opportunity to learn about COVID-19 Assessment and PPE.
I really enjoyed the game and learn preventative measures for COVID19.
Thank you deeply for creating this. I have an online college focusing on applied health disciplines and I will have this in the Moodle platform. I also am a Nurse Administrator in a Long-Term Care facility. I have shared this module with the president of our association and our families so that they can have accurate and clear information.

Table 1: ***COVID-19 VSG Decision Point Map***

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		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,
2	Patient walks into assessment centre	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	N95 mask	No mask required

			with hand sanitizer		
3	**Patient directed to nurse to complete assessment**	**What is the most appropriate PPE required for the nurse?**	**Surgical/Procedure Mask** **(WHO) - Ruth**	**N95 mask**	**Sterile surgical gloves**
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		**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**

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		**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	**Within 72 hrs patient returns to ER, before swab results have been confirmed**	**When possible, what distance should be maintained between the nurse wearing PPE and the patient?**	**No distancing required**	**2 meters**	**4 meters**
10		**What type of precautions are appropriate for confirmed/suspected COVID-19?**	**Contact, droplet, routine practices**	**Contact, droplet, airborne**	**Routine practices, contact**
11	**Patient has been admitted to a private room in the hospital**	**What are the appropriate steps when donning PPE equipment?**	**Hand hygiene, gown, mask, eyewear, gloves**	**Hand hygiene, gloves, gown, mask, eyewear**	**Hand hygiene, eyewear, gown, mask, gloves**
12	**HCP orders nebulized albuterol**	**What is the appropriate response?**	**Question the order**	**Perform nebulized medication but nurse wears N95**	**Perform medication administration with surgical mask**

				mask	
13	**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**
14	**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**
15		**What are the appropriate steps when doffing PPE equipment?**	**Gloves, gown, hand hygiene, eye protection, mask, hand hygiene**	**Gown, gloves, eye protection, mask, hand hygiene**	**Eyewear, mask, gown, gloves, hand hygiene**
16	**Handover to another staff member at shift change**	**What is the essential information that should be given when a handover report is given?**	**Exposure, swab status, clinical status, precautions required**	**Exposure, swab taken/status, precautions required**	**Clinical status, exposure, precautions taken**
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 centre**	**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	96000
April	308	123200
May	438	175200
June	597	238800
July	240	96000
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**