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Developing and Evaluating a Pediatric Virtual Simulation for Nurse Practitioner Students in Advanced Pharmacology Courses

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Purpose:
The role of an advanced practice nurse as prescriber involves choosing the appropriate medication considering pathophysiology, understanding the expected outcome of the medication, and assessing the patient’s specific social factors that may determine the choice of prescribed medications and adherence to medication regimen. Moreover, pediatric patients pose a unique challenge to advanced practice nurses not only because children are constantly developing, but also because any treatment decision must consider the parent and the family situation (Woo, 2016). In order to address these challenges, virtual patient simulations have arisen as an innovative technology for students to practice safe prescribing for the pediatric population (Cant & Cooper, 2014; Duff et al., 2016; Foronda & Bauman, 2016)
The purpose of this study was twofold: 1) to illustrate how a simulation team developed a weight-based dosing virtual patient case that included learning activities for medication selection, dosage calculation, patient and parent education, and prescription writing, and 2) to evaluate a pilot version of this pediatric virtual simulation with nurse practitioner students.

Methods:
Participants: This pediatric virtual simulation was pilot tested asynchronously with 32 students who were enrolled in graduate-level nursing courses (MSN, DNP, FNP, CNS, CNL, etc.) across the United States using either the advanced health assessment or advanced pharmacology virtual patient simulations during the Fall 2018 semester.
Virtual Patient Simulation: A multidisciplinary team of nursing educators, pharmacists, narrative designers, programmers, and testing experts worked collaboratively on developing virtual learning activities for a weight-based dosing case of a 5-year-old child presenting with Group A Streptococcal Pharyngitis (GAS).
In this virtual simulation, students interview the child and her father, using therapeutic communication to obtain enough subjective data and determine the appropriate pharmacological therapy for the patient’s condition.
The virtual simulation incorporates learning activities that address both pharmacological and nonpharmacological patient outcomes relevant to the scenario. Pharmacological outcomes include prescribing the appropriate antibiotic (amoxicillin or penicillin V) to alleviate patient's GAS pharyngitis as well as suggesting acetaminophen or an NSAID if the fever gets worse. Nonpharmacological outcomes include educating the parent on when to return to the clinic if the child's symptoms do not get better, practicing therapeutic language with the parent, and practicing therapeutic language and age-appropriate language with a pediatric child.
The medication selection activity consists of selecting the best-choice medication to treat the patient’s condition. If the student selects the medication that is in accordance with best practice treatment and takes into account the patient’s preferences, they receive full credit for their selection. Students can also receive partial credit for selecting a valid medication that may not be the primary choice for the patient (e.g., not being the recommended administration route for a pediatric patient). Finally, students can also get minimal credit for selecting a medication that has been approved to treat the condition but may be too expensive or less palatable than other more effective medications. Every medication choice provides feedback for the student as well as a citation to let them know if there are guidelines available for a particular indication.

In the patient education activity, students educate the patient’s parent about the expected pharmacological impact on their physiology and disease pathology. Students can choose from several key pharmacological and nonpharmacological categories to provide education to the parent such as the treatment of the symptoms, recurrence prevention, compliance techniques, medication administration and course, adverse effects, and discontinuation. Students also get points depending on the choices they make, given that the number of selections is limited and some education items constitute a higher priority in the case.

The simulation also incorporates a pediatric weight-based dimensional analysis tutorial. The tutorial teaches students how to take into account the patient’s weight, the suspension of the medication, the appropriate daily dose, and the maximum daily dose to calculate a safe and effective dose of liquid medication for a pediatric patient based on their weight.

Lastly, in the prescription activity, students practice filling out electronic prescriptions using industry-standard drug guidelines to inform their patient-specific choices. In what resembles an electronic pad, students populate prescription fields such as strength, dosage, frequency, route, quantity, among others. The points students receive are weighted more heavily for areas related to safety and efficacy.

**Measures:** Students responded to a 16-item (5-point Likert-type and open-ended) online survey related to their overall experience with the virtual simulation, including the conversation with the patient and parent, the medication selection activity, the patient education activity, the weight-based dosing tutorial, the prescription-writing activity. Examples of the Likert-type items were “I feel that I understood how to successfully complete the assignment or “I feel that the assignment provided me with sufficient information on how to communicate with a guardian”. These items were evaluated on a scale of 1 to 5 were 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Examples of the open-ended questions were “What areas of the medication selection activity do you feel could be strengthened?” or “Overall, how was your experience with the prescription-writing activity?”.

**Procedure:** The pediatric virtual simulation had a post-exam activity that included a link to the online survey instrument. In the survey instructions, students were told that their answers would be confidential and that participating or opting-out of the survey would not interfere with their patient exam assignment in any way. In order to ensure anonymity, identifying information, including demographics, was not collected in the survey.

**Analysis:** The data included in this study employed both quantitative and qualitative elements in a mixed-model design (Creswell, 2018). Descriptive statistics were reported for Likert-type items. Responses to the open-ended questions were first coded for distinct concepts and themes.
Then, responses were counted within each of the identified themes to obtain frequencies of occurrence.

**Results:**
Results showed that 81% of the students were satisfied with the pediatric virtual simulation (n = 26). Only 4 students were dissatisfied with their experience (12.50%). Practicing prescriptions, the opportunity to interact with both the child and parent, having different options available in the medication selection activity, and the steps of the weight-based dosing tutorial were mentioned as factors contributing to student satisfaction. Students who were not satisfied with their experience reported conversation issues as the main source of their dissatisfaction (i.e., questions not recognized by the patient and/or parent as well as typical jargon and terms used with children). Even among satisfied students, conversation issues were brought up as the main aspect of the simulation that needed improvement.

When asked what areas of the conversation with the pediatric patient could be strengthened, students mentioned medication history, GI system related questions, more questions related to the onset of her symptoms, and being able to recognize more age-appropriate dialogue.

Regarding the areas of the conversation with the parent that needed improvement, students mentioned being able to recognize more questions related to his daughter’s GI system (e.g., fluid, appetite, nausea and vomiting), her medication compliance, and assessing the symptoms of her condition.

Students felt that they understood how to successfully complete the simulation (4.42 out of 5) and how their performance would be assessed (4.30). Students also highly evaluated the patient teaching (4.44), medication selection (4.16), and prescription writing activities (4.06).

**Conclusion:**
Safely prescribing for the pediatric population requires special considerations and skills. Children do not necessarily understand medical language as an adult might, and they may need help in understanding their illnesses and treatments in ways that do not frighten or disturb them. Integrating pediatric patient preferences into treatment when medically appropriate is not just patient-centered care, but can pre-empt the challenges of pediatric medication adherence (Brussee et al., 2016).

Virtual patient simulations present a viable, flexible, and standardized option for practicing patient-centered prescribing for the pediatric population. This study found that nurse practitioner students find value and realism in practicing therapeutic communication and pharmacological therapy using virtual patients. Virtual patient simulations can provide nurse practitioner students with opportunities to practice medication selection, patient education, and prescription writing in a safe and controlled manner before beginning actual patient care experiences with pediatric patients.

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**Abstract Describes:**
Completed Work/Project
Applicable category:
Academic, Students, Researchers

Keywords:
advanced pharmacology, pediatric population and virtual patient simulation

References:

Abstract Summary:
The purpose of this study is to illustrate how virtual patient simulations can be used with nurse practitioner students to practice medication selection, dosage calculation, patient and parent education, and prescription writing with pediatric patients in advanced pharmacology courses.

Content Outline:
- Background and Purpose of Study
- Methods
  - Participants
  - Virtual Patient Simulation
  - Measures
  - Procedure
- Results
- Conclusions and Recommendations for Practice