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Featured Article

Smart Pump App for Infusion Pump Training

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student nurse simulation;
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nursing medication error;
medication administration simulation;
medical apps

Abstract

Background: The best method for teaching novice infusion pump users is not known.

Method: Nursing students were randomized to traditional teaching or mobile application (app) for learning infusion pumps. Students were assessed on knowledge, simulation performance, and confidence. Students assessed the app using a modified System Usability Scale.

Results: No significant difference was noticed on outcomes of knowledge, simulation checklists, time spent on programming during simulation, or learner confidence of smart pumps. Students favorably rated the smart pump app as an educational tool.

Conclusions: Integrating the smart pump app for teaching infusion pumps was comparable with traditional methods in this study of novice infusion pump users.

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Medication error prevention has been a top priority since the Institute of Medicine report in 1999 attributed nearly 100,000 patient deaths per year to largely preventable errors (Kohn, Corrigan, & Donaldson, 1999). Nurses account for the largest group of health care providers, and research indicates that most errors in nursing are associated with medication administration (Bates, 2007; Leape, Epstein, & Hamel, 2002; Weeks, Sabin, Pontin, & Woolley, 2013). Recognizing the impact nurses can have on patient safety, the Quality and Safety Education for Nurses (QSEN) collaborative recommended implementing training based on key statements of knowledge, skill, and attitude (Fura, 2013). As a result of QSEN recommendations, nursing schools began training students using QSEN patient safety concepts (Gantt & Webb-Corbett, 2010). Efforts to improve patient safety were accompanied by the advent of a technology explosion in health

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care intended to protect patients from system and human errors (Gregory, Lowder, & Issah, 2013). A great deal of time and effort is dedicated to training nurses on technological equipment in an effort to improve patient safety, yet sometimes the educational methods fall short, lending to high error risk. The struggle to improvecost efficiency while improving patient safety requires health care educators to find creative cost-saving ways to produce competent nurses (Gregory, Guse, Dick, & Russel, 2007; Wulff, Cummings, Marck, & Yurtseven, 2011).

Key Points

- Integration of mobile applications (apps) into nursing student curriculum is not well studied.
- This study shows similar performance of students learning from a mobile app and those from traditional learning in a simulation setting evaluating programming an infusion pump.
- This study shows similar outcomes of students learning from a mobile app and those from traditional learning with regard to acquired medical knowledge and learner confidence of infusion pump use.

Medical technology must integrate complex human factors to ensure user competence and patient safety, even among the emergence of a technologically savvy generation (Orbæk, Gaard, Fabricius, Lefevre & Møller, 2015). Today's nursing students are largely a part of this technologically savvy generation or digital natives. Traditional pedagogy of didactic lectures combined with skills training does not always engage these digital natives (Sinclair, Kable, & Levett-Jones, 2015). Finding new ways to efficiently educate the digital generation is imperative as health care technology continues to gain momentum (Orbæk et al., 2015; Sinclair et al., 2015). In addition, as we move toward learner-centered education, our educational solutions should be geared toward competency (Bleich & Jones-Schenk, 2016). An educational app *smart pump* has been developed by health scholars for hospital-based nurses to stay current on smart intravenous medication infusion pump skills. In this study, we investigated the use of this app for educating inexperienced nursing students to use such infusion pumps.

Review of the Literature

Smart infusion pumps were designed to prevent medication and intravenous fluid dosing and administration errors. Some argue that intravenous smart pump technology should be used every time when administering intravenous therapy (Harding, Connolly, & Wilkerson, 2011). Education and implementation of such technology is imperative to improve medication safety and prevent workarounds or unintended consequences of safety technology (Kirkbride & Vermace, 2001). The benefits of using simulation as a teaching strategy are well documented (Blum & Parcells, 2012; Shearer, 2012; Swanson et al., 2011; Rutherford-Hemming, Lioce, Kardong-Edgren, Jeffries, & Sittner,2016). Although simulation is ubiquitous to nursing education, the best method for educating nursing students on the use of technology has not been established. Some scholars give evidence for the use of technology and a combination of the education methods, such as simulation integration, to provide competence and patient safety when dealing with technology (Brannan, White, & Long, 2016; Terry, Moloney, Bowtell, & Terry, 2016).

Early researchers of smart pump technology (Carayon, Hundt, & Wetterneck, 2010) examined the use of the smart intravenous infusion pumps in an academic hospital. Three longitudinal surveys were used to identify preimplementation process, six-week postimplementation survey, and one-year postsurvey. The initial survey revealed positive technology acceptance. However, implementation process and postimplementation performance did not consistently show improvement. Six-week and one-year postsurvey respondents viewed the training materials as confusing. The results of this study suggest that training materials and methods should be carefully developed and future studies recommended (Carayon et al., 2010).

One method of teaching smart infusion pumps would be a simulated interface of a smart pump. Elias, Moss, Shih, and Dillayou (2014) developed a simulated medical device called simulated smart pump interface technology, which provides visual, sound, and tactile cues to improve technological training. A study using fourth-year nursing students examined technological interface benefit to training and ways in which the technology can be modified for higher fidelity and subsequent patient safety. Results were largely successful in simulating a medical device interface and workflow representations (Elias et al., 2014).

Ultimately, such educational interventions would ideally have a positive effect on clinical behaviors. Sinclair et al. (2015) reviewed effectiveness of e-learning or electronic learning on clinician behavior and patient outcomes. Such electronic learning can be synchronous or asynchronous, although noting that asynchronous was more learner centered. Unfortunately, there are limited studies on the effect of such e-learning on the clinician's behavior; most studies focused on satisfaction and knowledge acquisition (Sinclair et al., 2015). One systematic review by Lahti, Hätönen, and Välimäki (2014) found that there were no statistical differences between traditional and e-learning educational outcomes relating to knowledge, skills, and satisfaction among nurses and nursing students (Lahti et al., 2014).

Using mobile applications or apps is a current e-learning trend for educational solutions in the medical community. A study evaluating students and professionals in the medical sector of the primarily 18 to 35 age range found that key determinants for a learner's intention to use apps