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The effects of mobile applications in cardiopulmonary assessment education☆

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ABSTRACT

Background: Mobile applications can be used as effective simulations for nursing education. However, little is known regarding the effects of mobile application-mediated training on nursing. The aim of this study was to determine the effectiveness of mobile applications by comparing the effectiveness of a high-fidelity human patient simulator to that of a mobile application on student learning.
Methods: Following lectures on the lungs and the heart, twenty-two students were separated into two groups to perform a simulation exercise. Then, the students' education effects were evaluated based on their knowledge of lung and heart assessments, their clinical assessment skill, and satisfaction with their education.
Results: After four weeks, the mobile application group maintained their knowledge, whereas the high-fidelity human patient simulator group exhibited significantly decreased knowledge of the lung assessment. Knowledge of the heart assessment was significantly increased in both groups. There was no significant difference in clinical assessment skill or educational satisfaction between the groups.
Conclusions: We found that mobile applications provide educational tools similarly effective to a high-fidelity human patient simulator to maintain memory and to teach cardiopulmonary assessment skills.

Introduction

Nursing educators are challenged to provide safe opportunities for students to practice patient-monitoring functions and effective management skills in rapidly changing patient situations (Larew et al., 2006). Simulation produces a low risk environment in which students can successfully master the skills relevant to clinical practice. Simulation also permits errors in diagnosis or management that can be followed through to their natural conclusion (Maran and Glavin, 2003). For these reasons, simulation has become an important teaching strategy of nursing educators. Evidence-based practice related to the use of human patient simulators has become an essential component of contemporary nursing education (Bremner et al., 2008). A high-fidelity human patient simulator can present an especially realistic circumstance, such as cardiac arrest, hypoglycemia, or hypovolemic shock, allowing students to improve their assessment skills in a simulated environment. The use of a high-fidelity simulator together with case scenarios provides opportunities for students who have different learning styles to internalize and apply new information in a safe and a nonthreatening setting (Curtin and Dupuis, 2008; Landeen and Jeffries, 2008).

Several advantages of using simulations in nursing education have been recently reported, including that simulation-based learning consistently decreases anxiety among novice nursing students in their first clinical experience (Szpak and Kameg, 2011), and simulation promotes their self-confidence and clinical competence (Brannan et al., 2008). Although the use of a high-fidelity human patient simulator displays benefits and positive outcomes, such as improving students' knowledge (Bogossian et al., 2013) and self-efficacy (Cardoza and Hood, 2012), its high cost with respect to technical and human resources has prompted administrators and faculty to contemplate its value (McCausland et al., 2004). In addition, some studies have reported disadvantages of a high-fidelity human patient simulator, such as the limited number of students that can be trained at one time(Hicks et al., 2009), and negative transfer when the instructor fails to make clear to the students the differences between the training device and the real situation(Bond et al., 2007).

Simulation options range from low-fidelity to high-fidelity simulators (Tosterud et al., 2013). The effectiveness of simulation, as with all educational modalities, depends on how well it is used. Therefore, nursing educators should consider various simulation methods with regard to the characteristics of their students.

According to a 2013 survey by the Pew Research Center (Smith, 2013), 79% of American adults between 18 and 24 years old own a smartphone, and the number of mobile phone owners continues to increase. Smartphone ownership in South Korea is the highest in the

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world (YonhapNews, 2013). Modern-day individuals, and especially college students, are very familiar with web-based environments. They access the Internet, send or receive text messages, check email, and even video chat with others, quite literally from the palms of their hands (Kuznekoff and Titsworth, 2013).

Rapid development of new mobile technologies is influencing all aspects of learning. In particular, mobile technology is rapidly affecting the field of education. Various mobile learning applications have already been developed and can be downloaded from application stores. Mobile learning has recently become a popular format for the delivery of continuing education to healthcare professionals and students (Cleary et al., 2011; Lahti et al., 2013). It has been extended to various medical education fields, including dermatology (Rajasekaran and Iyengar, 2013), surgery (de Sena et al., 2013), and nursing (Walton et al., 2005). Some studies have reported advantages of mobile learning in medical practice (Albrecht et al., 2013; Rajasekaran and Iyengar, 2013). Therefore, connecting mobile and nursing education may make nursing education more accessible.

During cardiopulmonary assessment education, a key practice is the detection of abnormal sounds. Successful learning is determined based on the ability to distinguish between normal and abnormal sounds. Mobile learning is an appropriate method for cardiopulmonary assessment education because it provides easy access to learning on the go, at a time and place that is convenient to students. Many mobile applications for learning lung and heart sounds have already been developed, and users can download cardiopulmonary sound applications from the application store corresponding to their mobile phone. Some educators (Airth-Kindree and Vandenbark, 2014) recently have been interested in mobile applications in nursing education, but studies of their use for cardiopulmonary assessment education have yet to be performed. This study examines the effectiveness of using a mobile application for cardiopulmonary assessment education by comparing its educational outcomes with those of a high-fidelity human patient simulator.

Methods

Methods, participants, and data collection

A quasi-experimental pre- and post-assessment design was used to compare the effectiveness of education using a high-fidelity human patient simulator and a mobile application. All participants were full-time university students in their second year of undergraduate nursing training in South Korea. The participants were 22 female students who did not have any clinical experience in lung or heart assessment. To prevent unilateral bias, the students were separated into two groups according to a matching method based on the students' fundamental nursing and practicum grades from the previous semester. For example, the highest- and second highest-scoring students were separated into opposite groups. Each group consisted of 11 students. The study was conducted as follows (Fig. 1):

· Pre-test: Prior to the start of the study, a pre-test measuring the students' knowledge of lung and heart assessments was performed. The pre-test included standard written questions, and questions that involved listening to heart and lung sound.

· The first week (the lecture on lung assessment): All participants took the 3-hour class about lung assessment in the same classroom.

· The second week (divide the group for the practice of lung assessment): Students were separated into two practice groups, one that used a human patient simulator, and another that used a mobile application, to complete a practical exercise on lung assessment. Both groups compared normal and abnormal sounds in lung assessment scenarios, such as wheezing, rhonchi, crackles, and stridor lung sounds.

· The third week (the lecture on heart assessment): All participants took the 3-hour class about heart assessment in the same classroom.

· The fourth week (divide the group for the practice of heart assessment): Students were separated into a mobile application group and a human patient simulator group to complete a practical exercise on heart sound assessment. For the heart assessment practice, the group using the human patient simulator for the lung assessment practice was re-assigned to the mobile application mode. For the heart assessment practice, the group using the mobile application for the lung assessment practice was re-assigned to the human patient simulator mode. Both groups compared normal and abnormal sounds in heart assessment scenarios, such as aortic stenosis, pulmonary stenosis, mitral regurgitation, aortic insufficiency, pulmonary regurgitation, mitral stenosis, and tricuspid stenosis.

· Post-test: The post-test was completed one week after completing the final practice. The post-test included knowledge of the cardiopulmonary assessment through the standard questions and questions that involved listening to heart and lung sound, clinical assessment skill demonstration, and self-reported education satisfaction. The clinical assessment skill demonstration was measured using a high-fidelity human patient simulator. Both groups participated in the same evaluation on the same day. The clinical assessment skill demonstration included listening to heart and lung sounds using auscultation, attitude, and skill procedures such as appropriate stethoscope placement.

The human patient simulator group could use the high-fidelity human patient simulator for 3 h while at school. To facilitate small group sessions, the human simulator group was separated into three small simulation groups. Each small human simulator group consisted of three or four students. All simulator groups practiced on the same

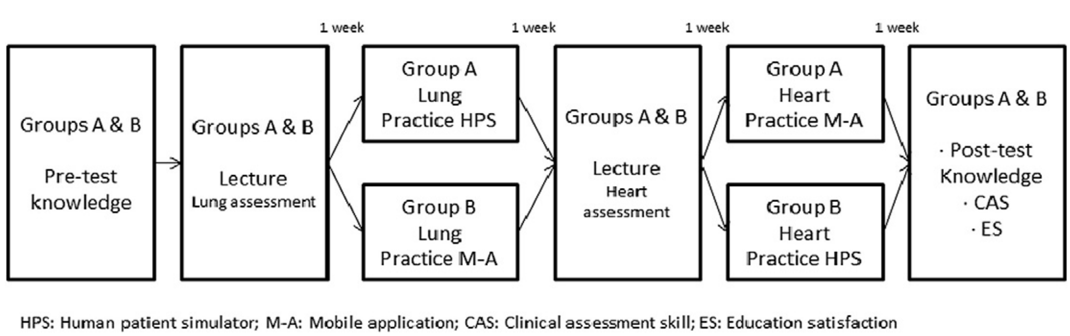

Fig. 1. Study protocol describing the groups that attended the lecture and practiced lung and heart assessments.