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A smartphone application to educate undergraduate nursing students about providing care for infant airway obstruction

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ABSTRACT

Purpose: This study had two aims: (a) to develop a smartphone-based application and (b) to evaluate the effectiveness of the application by measuring nursing students' knowledge, skills, and confidence in simulated performance when providing that care.
Design: We conducted a randomized trial using a pre- and post-test design at a university in Korea. Seventy-three junior nursing students participated.
Methods: A smartphone-based app using a video was developed for the experimental group and one time lecture-based education was designed for the control group. We provided the app and information about its use to the experimental group, and we encouraged its use. We provided classroom instruction to the control group. Then, learning outcomes were evaluated. Results: The smartphone-based education group showed significantly higher scores on skills ($t = 4.774$, $p < 0.001$) and confidence in performance ($t = 2.888$, $p = 0.005$) than the control group. The scores on knowledge ($t = 0.886$, $p = 0.379$) and satisfaction with the learning method ($t = 0.168$, $p = 0.867$) for the experimental group were higher than for the control group, but the differences were not statistically significant.
Conclusion: This study suggests that smartphone-based education may be an effective method to use in nursing education related to teaching infant airway obstruction.

1. Introduction

Advances in medical technology and improved living standards have contributed to an overall decrease in the worldwide child mortality rate; however, unexpected accidents still cause disability or mortality in children (Kim et al., 2011). In the United States, from 1999 to 2014, nearly 2500 deaths occurred that were related to obstruction of the respiratory tract among children aged 0 to 14 years (Centers for Disease Control and Prevention, 2015). In South Korea, from 2012 to 2015, 7200 accidents were related to foreign body aspiration out of 74,600 reported accidents involving a child under the age of 14 (Korea Consumer Agency, 2015). In South Korea in 2014, 37 child deaths occurred because of obstruction of the respiratory tract and of those, 62% were infants (Statistics of Korea [SK], 2015). Despite improvements, children worldwide continue to suffer airway obstructions, and some of these children will die.

Airway obstruction can occur for various reasons including aspiration of foreign bodies into the airway. An airway obstruction can result in acute difficulty in breathing, which can lead to cardiac arrest; thus, early recognition and emergency care and management are essential (Korea Association of Cardiopulmonary Resuscitation [KACPR], 2011). The most dangerous age range for choking-related accidents is <3 years old, and >50% of choking victims are younger than 2 years old (Committee on Injury, 2010; Shah et al., 2010). Aspiration can occur in infants and toddlers less than three years of age as they explore their environments and occasionally insert objects into their mouths. That action combined with immature swallowing coordination can lead to foreign body obstruction (Shah et al., 2010). The purpose of this study was (a) to develop a smartphone application (app) designed to teach Korean nursing students information about preventing and managing infant airway obstruction and developing their related skills and (b) to compare the knowledge skills and confidence of students using the app with those receiving traditional lectures about infant airway obstruction.

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2. Literature

In 2015, 83% of the total Korean population (Korea Telecom Economic Research Institute, 2015) and 64% of adults in the US were smartphone users (Smith, 2015). A smartphone has advanced capabilities compared to a traditional phone including Internet access and real time video communication (Boulos et al., 2011). Electronic health (e-health) uses information technology to improve the health of persons through training health care workers (World Health Organization [WHO], 2016). Health-related smartphone apps are being actively studied in both countries for their use in a variety of clinical and other health-care situations, and medical professionals are being encouraged to develop and use apps as a new communication method in healthcare (Pandey et al., 2013; Terry, 2010).

Smartphone-based education can provide a self-directed learning environment that allows users to repeatedly access information and practice skills without any space and time limitations. Nursing students might feel pressure while learning and practicing nursing procedures in a lab or hospital. However, smartphone-based education could provide a non-judgmental learning environment, so students can practice several times without being anxious about making errors (Pyo et al., 2012). Moreover, using electronic technology in health-care delivery is cost-effective (Phillips et al., 2013). Thus, a smartphone-based app for teaching infant airway obstruction relief strategies could be an efficacious, accessible and cost-effective teaching strategy for nursing students.

Despite the many advantages of using smartphones to provide education, there is limited research on this teaching strategy. Fewer than ten research studies using smartphones in health education have been published in South Korea and in the U.S. the last five years (Cho et al., 2013; Einspruch et al., 2007; Park and Cho, 2015). In these studies, the app was found to be an effective method for increasing knowledge and improving skills. However, no studies have used a smartphone-app to educate nursing students about providing care for infant airway obstruction.

3. Methods

3.1. Design

This study used a pre- and post-test quasi-experimental design with an experimental and a control group. We measured knowledge, skills, and confidence in performance and evaluated each group's satisfaction with the learning method (see Fig. 1).

3.2. Ethical Considerations

Prior to the start of the study, approval was granted by the H University's Institutional Review Board in Korea (HIRB-2015-84). Students were informed about all aspects of the study and assured that there were no negative consequences for non-participation. After students were informed, they were asked to sign a consent form if they wanted to participate and also if they granted permission for videos to be recorded while testing the skills instrument.

3.3. Participants and Setting

We chose third year nursing students in Korea because they have previously primarily focused on basic care of children and are not trained to provide care for infant airway obstruction. Therefore, we considered these nursing students as representative of typical adults, who might not know how to provide emergency care for infants with an airway obstruction. The inclusion criteria were (a) junior-undergraduate, (b) completion of a three-credit Child Health Nursing course, (c) not having been exposed to child CPR education, and (d) no previous experience with smartphone-based learning in healthcare. Based on power analysis (G* Power 3.0; Faul et al., 2007) using a medium effect size of 0.50, a power of 0.80, and a significance level of 0.5, a sample size of 26 participants was required for each group. The study's purpose, procedures, and information about confidentiality were explained on a student bulletin board in a nursing

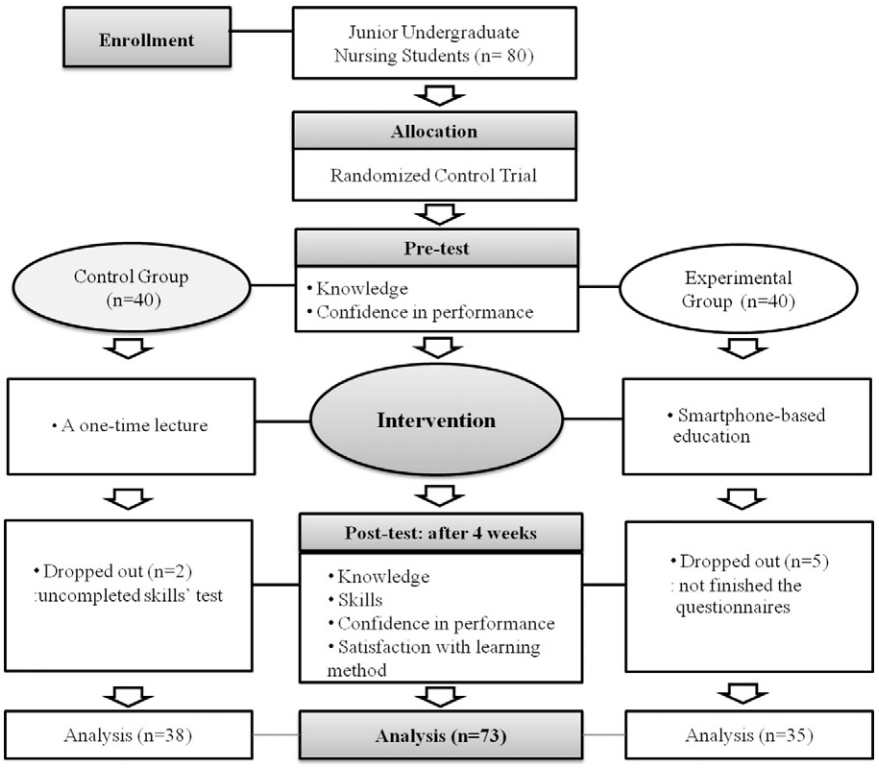

Fig. 1. Research process.