



# The Effects of Smartphone-based Nebulizer Therapy Education on Parents' Knowledge and Confidence of Performance in Caring for Children with Respiratory Disease



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## ABSTRACT

**Purpose:** This study aimed to identify the effects of smartphone-based nebulizer therapy education on the knowledge and confidence of parents while performing care for their children with respiratory disease.

**Design and Methods:** This quasi-experimental study employed a pretest-posttest design using a nonequivalent control group. Data were collected from children's parents who had not used nebulizer therapy for their children previously. Both the groups were given nebulizer therapy education using the same content but different learning methods. The experimental group ( $n = 36$ ) was taught using smartphones, while the control group ( $n = 36$ ) was taught using verbal and paper-based methods. The data were analyzed using the Chi Square test, repeated measures analysis of variance, and  $t$ -test.

**Results:** The mean scores on knowledge improvement ( $F = 100.949, p < 0.001$ ) and confidence in performing care ( $t = -6.959, p < 0.001$ ) were significantly higher for the experimental group as compared to the control group. Further, the scores on satisfaction with the learning method were significantly higher for the experimental group as compared to the control group ( $t = -5.819, p < 0.001$ ). Our results suggest that smartphone-based education on nebulizer therapy might be effective in improving parents' knowledge and confidence in performing care for their children.

**Conclusion:** This study suggests that smartphone-based education needs to be considered as an effective educational intervention in providing nursing support for parents of children with respiratory disease.

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## Introduction

### Background

#### Children's Respiratory Disease and Nebulizer Therapy

Respiratory disease, including upper and lower respiratory tract infection, is one of the most concerning health problems globally, it is recorded as the most frequent cause of children's visits to outpatient clinics, and it often results in hospitalization (Grewal & Goldman, 2016; Health Insurance Review & Assessment Service, 2016; Simoes et al., 2006). Statistics show that South Korea follows a similar trend wherein respiratory disease is ranked as the first cause of morbidity in children under the age of ten years (Health Insurance Review & Assessment Service, 2016). However, despite high prevalence of the

disease, appropriate treatment and care can lead to recovery without complications.

Children's anatomy and breathing patterns differ from that of adults. They face difficulties in following treatment instructions, have difficulty in cooperating with the instructions, and may reject breathing treatments (Simoes et al., 2006). Therefore, inhalation therapy using an aerosolized drug is preferred to treat respiratory disease in pediatric patients. Inhalation therapy, which aims to alleviate and prevent symptoms such as bronchospasm, airway reduction and inflammation, and mucus accumulation, helps to facilitate pulmonary function (DiBlasi, 2015; Kwok & Chan, 2014; Simoes et al., 2006).

Historically, nebulizer therapy has been the most common method of administering inhalation therapy (DiBlasi, 2015; Ramlal, Visser, Hop, Dekhuijzen, & Heijdra, 2013). Aerosolized medications offer many advantages because they can be administered directly into the lungs of children, require administration of lower doses, and do not cause gastric changes (Manríquez, Acuña, Muñoz, & Reyes, 2015). This technique comprises of a set of procedures for drug delivery into the respiratory system, most frequently used for treating lung diseases (Manríquez et al., 2015; Ramlal et al., 2013).

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Since children are dependent on their caregivers (Robins et al., 2016), if nebulizer therapy is required for pediatric patients, healthcare professionals educate the primary caregiver (usually the parent) on how to operate the equipment. However, limited education does not guarantee the understanding and proper administration of nebulizer therapy. Unlike professional healthcare providers, some parents may encounter difficulties while implementing these techniques accurately (Breuer, Shoseyov, Kerem, & Books, 2015; Capanoglu, Dibek Misirlioglu, Toyran, Civelek, & Kocabas, 2015). If prompt and repeated education is provided, it will reduce the number of errors in using the inhaler and minimize the clinical consequences of poor drug delivery (DiBlasi, 2015). Therefore, it is necessary to adopt new educational strategies to increase the retention of knowledge in caregivers (Capanoglu et al., 2015).

Education for patients with respiratory disease is a critical factor in the proper use of medications, such as inhalers (Hajian et al., 2016; Manríquez et al., 2015). Solis, Menchaca, Vega-Briceno, and Jaime Cerda (2008) observed that only 12.5% of the mothers of hospitalized infants used the correct inhaler technique. The efficacy of inhalation medications depends on the ability of the patient to adhere to the proper technique of using the inhaler (DiBlasi, 2015). Using the proper technique ensures sufficient deposition of drug particles in the distal airways and optimizes drug effectiveness (Hajian et al., 2016).

#### Smartphone-based Education for Health Care

During the past decades, there have been rapid advances in mobile technology, especially with the release of the smartphone (Aungst, Miranda, & Serag-Bolos, 2015; Dubey et al., 2014). They are used by approximately 87% of the global population (Bender, Yue, To, Deacken, & Jadad, 2013). In the United States, 64% of adults use smartphones (Smith, 2015) and 83% of the Korean population owns smartphones (Korea Information Society Development Institute, 2015). The percentage of smartphone users aged 20–40 years is above 90% and this is expected to increase (Korea Information Society Development Institute, 2015).

In modern society, mobile media platforms are rapidly replacing textbooks and print media. Consequently, health education has been forced to adapt to this change (Shaw & Tan, 2015). A smartphone is a mobile health tool, as many health workers already own and use it on a daily basis (Boulos, Wheeler, Tavares, & Jones, 2011). This new technology has great potential for education as it allows caregivers to access information efficiently. Smartphone-based education allows people to engage in self-directed learning as they can access information related to care without any space or time limitations (Bender et al., 2013; Bonk, Lee, Kou, Xu, & Sheu, 2015). In addition, the features of smart smartphones, such as the audiovisual component, double the learning effect (Dash, Kamath, Rao, Prakash, & Mishra, 2015).

Smartphone-based interventions thus facilitate health promotion and disease management (Bender et al., 2013). Therefore, we created smartphone-based video clips including the proper inhaler technique and precautions for pediatric patients with respiratory disease.

#### Purpose

The purpose of this study was to evaluate the effects between two educational interventions, a smartphone and verbal education group. The research hypotheses were as follows:

1. Parents who receive smartphone education will have higher knowledge scores than parents who receive verbal education will.
2. Parents who receive smartphone education will have higher levels of confidence than parents who receive verbal education will.
3. Parents who receive smartphone education will have higher satisfaction scores than parents who receive verbal education will.

#### Theoretical Framework

Ebbinghaus' theory of the forgetting curve (Jaber, 2016) and Edgar Dale's article on the use of audiovisual methods in teaching (Edgar, 1969) were used as the theoretical framework for this study. The forgetting curve pertains to the decline in memory retention with time. Therefore, in order to retain information, repeated practice is essential. The audiovisual method suggests that the retention is best if the information is presented and learned via audiovisual channels, as opposed to other mediums.

Therefore, based on these theories, we shaped a framework that influences positive outcomes, comprising (a) knowledge and (b) confidence in performing care. Because, enhanced knowledge level due to retained information may make people more confident in performance. These theories were used for our study since smartphone-based education can be delivered using an audiovisual method, and it allows for repeated practice (Fig. 1).

#### Methods

##### Design

This study used a pretest-posttest, quasi-experimental design with a nonequivalent control group. We measured parents' knowledge and confidence in performing care, and their satisfaction with the learning method for the experimental and control groups (Fig. 2).

##### Setting and Sample

This study was conducted in three public health care centers and four private pediatric clinics (servicing approximately 100 new pediatric patients each day) in the cities of Seoul, Gyeonggi, and Wonju in South Korea.

The criteria for inclusion of participants were being parents of children with respiratory disease who (1) have a smartphone and (2) had never received any education on nebulizer therapy. Participants were excluded if (1) they or their children had any experience receiving inhalation therapy.

When the children were diagnosed with respiratory disease, which requires nebulizer therapy, the first author explained the purpose of the study to the parents, who met the eligibility requirements, and asked if they were willing to participate in the study. Consent forms were obtained from the parents who were willing to participate. Later, based on the date of enrollment, parents were assigned to the control or experimental groups. Parents who were enrolled first were assigned to the control group until 45 parents had been enrolled. Subsequently, 45 parents were enrolled in the control group, we enrolled parents in the experimental group.

During the exposure of the nebulizer therapy, they were encouraged to use the educational methods (paper or smartphone) that they received if they needed to check the inhaler technique.

Based on a power analysis (Faul, Erdfelder, Lang, & Buchner, 2007) with an effect size of 0.80, a power of 0.95, and a significance level of 0.05, 70 participants (35 for each group) were needed. In this study, we recruited 90 participants. Out of them, 18 participants (9 from each group) were eliminated from the study because their answers were incomplete. Finally, the sample size was ended up with 72 (36 for each group) and it was considered acceptable.

The questionnaire was self-administrated and it took the participants approximately 10–15 min to complete it. It was administered twice: before the intervention and one week after intervention. The pretest questionnaire only measured the knowledge of the participants, and during the posttest, the confidence in performing care and satisfaction with the learning method were added to the same questionnaire. To ensure confidentiality, the researchers assigned numbers to the participants.

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