Journal of Pediatric Nursing (2016) **31**, 380–389

Using Tailored Videos to Teach Inhaler Technique to Children With Asthma: Results From a School Nurse-Led Pilot Study

Delesha M. Carpenter PhD, MSPH [a,*], Dayna S. Alexander DrPH, MSPH [a], Alice Elio RN [b], Darren DeWalt MD, MPH [c], Charles Lee MD [d], Betsy L. Sleath PhD [c]

[a] *University of North Carolina, Asheville, NC*
[b] *Buncombe County Department of Health, Asheville, NC*
[c] *University of North Carolina, Chapel Hill, NC*
[d] *Polyglot Systems, Inc, Morrisville, NC*

Received 6 October 2015; revised 9 February 2016; accepted 9 February 2016

Key words:
Asthma;
Children;
School nurses;
Medication;
Videos;
Metered dose inhaler

Background: Our purpose was to test whether a tailored inhaler technique video intervention: (1) could be feasibly implemented by school nurses and (2) improve the inhaler technique of children with asthma.
Methods: School nurses recruited a convenience sample of 25 children with asthma (ages 7–17) and assessed their inhaler technique. Children then watched a tailored video that provided: (1) step-by-step feedback on which steps (out of 8) they performed correctly, (2) praise for correctly-performed steps, and (3) statements about why incorrectly-performed steps are important. Nurses reassessed the child's inhaler technique immediately after watching the video and again 1 month later. Non-parametric Wilcoxon signed rank tests were calculated to assess whether children's technique significantly improved from baseline to post-video and baseline to 1-month follow-up. A focus group with the school nurses was conducted post-intervention to discuss feasibility issues.
Results: Children's inhaler technique improved by 1.2 steps (with spacer; $p = 0.03$) and 2.7 steps (without spacer; $p < 0.01$) from baseline to post-video. These improvements were maintained at 1-month follow-up. School nurses believed the intervention was feasible to implement and met an important educational need.
Conclusions: A school nurse-led tailored video intervention is feasible to implement and a promising method for improving children's inhaler technique.

Asthma affects nearly 7.1 million young people in the United States (Akinbami, Moorman, & Liu, 2011), and between 400,000 and 650,000 children under the age of 18 are newly diagnosed with asthma each year (Winer, Qin, Harrington, Moorman, & Zahran, 2012). Pediatric asthma is associated with high levels of health care utilization, including 3.4 million physician offices visits and 500,000 emergency department visits annually (Akinbami et al., 2011). Children with asthma miss approximately 2.5 more school days than children without asthma (Wang, Zhong, & Wheeler, 2005), which translates to approximately 10 million days of asthma-related school absences every year (Akinbami et al., 2011). Asthma is also associated with a high economic burden and is responsible for approximately $2 billion per year in health care expenses among school-aged children (Akinbami, Moorman, Garbe, & Sondik, 2009; Wang et al., 2005).

Reducing morbid and costly asthma exacerbations requires patient self-management, including proper use of inhaled control medications, such as corticosteroids (Clark, Gong, & Kaciroti, 2001). Although inhaled control medications are a critical component of asthma treatment,

* Corresponding author: Delesha M. Carpenter PhD, MSPH.
E-mail address: dmcarpenter@unc.edu.

http://dx.doi.org/10.1016/j.pedn.2016.02.005
0882-5963/

their therapeutic benefit is reduced when patients use their inhaler devices incorrectly (Crompton et al., 2006). In fact, incorrect inhaler technique has been associated with worse asthma control and more emergency department visits in children (Malone, Callahan, Chan, Sheets, & Person, 2004; Minai, Martin, & Cohn, 2004). Unfortunately, a previous study found that only 8 to 22% of children with persistent asthma use their inhalers correctly (Sleath et al., 2011).

Because national guidelines recommend that inhaler technique skills should be demonstrated at every patient care visit (National Heart, Lung, and Blood Institute [NHLBI], 2007), many people assume that children receive inhaler technique instruction at physicians' offices. However, one study found that physicians demonstrate correct inhaler technique during fewer than 12% of office visits (Sleath et al., 2011). Moreover, deterioration in children's technique has been seen as early as 1 month after receiving education (Carpenter et al., 2015). To prevent deterioration in technique, periodic retraining may be necessary (Basheti, Reddel, Armour, & Bosnic-Anticevich, 2007; Kamps, Van Ewijk, Roorda, & Brand, 2000). However, it may be difficult for physicians to teach inhaler technique on multiple occasions, especially if they only see children once or twice per year. Therefore, alternative settings that provide continual access to children, such as schools, may be better-suited for delivering inhaler technique instruction (Tinkelman & Schwartz, 2004). Although many school-based asthma interventions exist (Bartholomew et al., 2006; Evans et al., 1987; Joseph et al., 2007; Levy, Heffner, Stewart, & Beeman, 2006; Tinkelman & Schwartz, 2004), the extent to which these interventions provide inhaler technique education and whether children who participate in these interventions demonstrate improved inhaler technique have not been published.

Tailored and targeted interventions are more successful at changing behavior than generic interventions (Kreuter, Farrell, Olevitch, & Brennan, 2000; Strecher et al., 2008); therefore, tailored and targeted inhaler technique education could potentially lead to major improvements in children's inhaler technique. In-person tailored and targeted education can be difficult and expensive from a care delivery perspective. However, technology-based interventions can quickly and cost-effectively tailor educational messages to a specific individual's needs and also target those messages to specific patient characteristics, such as age, gender, and race/ethnicity.

Given that school-based asthma education programs have successfully improved children's outcomes (Bartholomew et al., 2006; Evans et al., 1987; Joseph et al., 2007; Levy et al., 2006; Tinkelman & Schwartz, 2004) and that children prefer multimedia interventions, like videos (Ayala et al., 2006; Baptist et al., 2011; Lee & Le, 2013), a school-based tailored video intervention may offer a simple and effective way to teach children with asthma how to use their inhalers correctly. The purpose of this mixed methods pilot study was to test whether a tailored inhaler technique video intervention: (1) could be feasibly implemented by school nurses and (2) improve the inhaler technique of children with asthma. In addition to measuring children's inhaler technique before and after watching the tailored video, we conducted a focus group with school nurses to identify whether it was feasible to implement a video-based intervention with their students with asthma and whether improvements could be made to the video. We hypothesized that children who watched a tailored inhaler technique video with their school nurse would demonstrate better inhaler technique immediately after watching the video, but that improvements in technique would not be sustained at 1-month follow-up.

Methods

Participants

Seven school nurses from seven different schools in volunteered to participate in the pilot study and recruit a convenience sample of children. Children were eligible if they: (a) were 7–17 years old, (b) could speak English, (c) had a diagnosis of asthma in their school medical records, and (d) were currently taking an inhaled medication delivered via metered dose inhaler (MDI).

Instrumentation

Inhaler Technique

Prior to the pilot study, school nurses were taught how to assess inhaler technique using a validated training process that was developed by a pediatric pulmonologist and clinical pharmacist (Carpenter et al., 2015; Sleath et al., 2011). School nurses viewed a DVD that had examples of optimal MDI technique. After observing the optimal technique examples, the nurses then watched recordings of three children using an MDI with and without a spacer with various omissions and errors. Spacers, also known as holding chambers, are add-on devices that attach to MDIs. Spacers reduce the need for children to coordinate activating their MDI and inhaling the medication by holding the medication in a contained chamber until the child is able to inhale all the medication. Nurses viewed 18 examples of incorrect technique and used a checklist to score these techniques. The nurse's checklists were reviewed by a Certified Respiratory Therapist who provided feedback about their scoring on the basis of her clinical judgment. The school nurses continued to review the DVD recording until they could accurately identify all errors and omissions in technique.

MDI technique was measured as the number of steps (out of eight possible steps) that the child performed correctly (Sleath et al., 2011). Table 2 lists each of the eight steps for using an MDI with and without a spacer. MDI technique was documented using a checklist that was developed by a pediatric pulmonologist and clinical pharmacologist. The checklist has been validated with children and used in two previous studies, which found that better child technique as assessed with the checklist was positively associated with provider demonstration of technique (Sleath et al., 2012) and receiving technique education (Carpenter et al., 2015). The