Published in final edited form as:

Respir Med. 2020 ; 174: 106191. doi:10.1016/j.rmed.2020.106191.

Association between inhaler technique and confidence among hospitalized children with asthma

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Abstract

Objective: Proper use of respiratory inhalers is crucial to asthma self-management and associated with improved outcomes. Previous studies conducted in outpatient and community settings show parents and children are overconfident in children's ability to use inhalers properly, which may lead healthcare providers to not teach or review inhaler technique. This study examined whether children and parents' confidence were associated with proper inhaler technique among children hospitalized with asthma.

Methods: Children between 5 and 10 years old hospitalized with asthma at an urban academic medical center demonstrated inhaler technique using metered dose inhalers and spacers. Technique was scored based on a validated 12-step scale. Confidence was measured using three items assessing 1. Knowledge to use inhaler, 2. Skills to use inhaler, and 3. Ability to independently use inhaler. These items were five-point scales and analyzed as binary variables. Independent t-tests were used to measure associations between confidence and number of steps performed correctly.

Results: None of the confidence items, when asked to parents or children (n = 70), were associated with the number of steps performed correctly. Further, while the majority of children and parents (59–70%) were confident based on each item, the mean number of steps correctly completed was 6.4 out of 12.

Conclusions: Children and parents' confidence in children's knowledge, skills, and ability to independently use an inhaler were all poor proxies for proper inhaler technique. Inpatient

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CRediT authorship contribution statement

Henry K. Litt: Conceptualization, Methodology, Formal analysis, Writing - original draft. **Valerie G. Press:** Conceptualization, Supervision, Writing - review & editing. **Ashley Hull:** Conceptualization, Writing - review & editing. **Michelle Siros:** Methodology, Investigation, Supervision, Writing - review & editing. **Viridiana Luna:** Investigation, Supervision, Writing - review & editing. **Anna Volerman:** Conceptualization, Methodology, Formal analysis, Supervision, Funding acquisition, Resources, Data curation, Writing - review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

healthcare professionals should objectively evaluate technique and teach proper inhaler use to all children with asthma to optimize outcomes.

Keywords

Childhood asthma; Inhaler technique; Metered dose inhalers; Education

1. Introduction

Asthma affects 5.5 million children in the United States and leads to 546,000 emergency department (ED) visits and 80,000 hospitalizations annually [1]. A key component of asthma management is the use of respiratory inhalers to deliver quick-relief and controller medications [2]. Proper inhaler use is associated with fewer symptoms and emergency room visits, yet technique among children is poor [3–11].

Expert guidelines recommend assessment and education about inhaler technique at each clinical encounter, however this is rarely performed [2,11,12]. Healthcare professionals have identified a lack of time, knowledge, and demonstration supplies as barriers to teaching proper inhaler use to patients [11]. Consequently, they may rely on parent and/or child confidence as alternatives to determine when education is needed. This practice is problematic since previous studies conducted in outpatient and community settings show that both children and their parents are overconfident about their inhaler technique [13–15]. These studies have assessed confidence with a single question focused on children's skills [13–15].

Importantly, the association between confidence and inhaler technique has not been examined among hospitalized youth with asthma. Since these children are at high-risk for asthma morbidity [16–19], it is vital to know whether they and their parents are also overconfident in the children's ability to use inhalers properly. If so, these patients may not be receiving critical education needed for asthma self-management, which can contribute to increased hospitalizations. This study aims to determine whether children and parents' confidence in children's knowledge, skills, or ability to independently use an inhaler are associated with proper technique among these patients.

2. Materials/methods

This cross-sectional study was conducted using baseline data from a randomized controlled trial involving children between 5 and 10 years old hospitalized with asthma at an urban academic medical center. Written consent and assent were obtained. University of Chicago's Institutional Review Board approved the study.

Participating children and their parents answered age-appropriate questions about demographics, morbidity (ED visits and hospitalizations in past year), inhaler use, and confidence. Child and parent confidence were measured using three items assessing: 1. Knowledge to use inhaler, 2. Skills to use inhaler, and 3. Ability to independently use inhaler. These items were five-point scales and analyzed as binary variables (confident = 4–5 versus not confident = 1–3). Age (5–7 versus 8–10 years), gender, ED visits (0–1 versus 2 or

more), and overnight hospitalizations (0–1 versus 2 or more) were treated as binary variables. Frequency of quick-relief inhaler use was categorized as 0–1 times per week, 2 or more times per week, or several times per day.

Prior to any intervention, participants demonstrated inhaler technique with metered dose inhalers (MDIs) and spacers. Research assistants scored technique based on a validated 12-step scale, with one point per step performed correctly [20].

Independent t-tests were used to measure associations between confidence and number of steps performed correctly. Chi-squared tests were utilized to measure associations between child confidence and age, gender, frequency of quick-relief inhaler use, ED visits, and hospitalizations; this analysis was repeated for parent confidence. Significance was defined as two-sided p -value < 0.05 . Analyses utilized STATA version 15 (StataCorp).

3. Results/discussion

Of 140 eligible families, 70 children enrolled in the study along with a parent/guardian (81% mothers). Among children, 60(86%) were Black and 36 (51%) were male. Children's mean age was 7.8 years (SD = 1.6). Most children used quick-relief inhalers at least twice per week (64%, $n = 37/58$) and had visited the ED (86%, $n = 60/70$) or been hospitalized (69%, $n = 48/70$) at least twice in the past year due to asthma.

The majority of children and parents (59–70%) were confident based on each of the three items. Both were most confident in children's knowledge (69–70%) and least confident in their ability to use an inhaler independently (59–64%).

For inhaler technique, the mean number of steps correctly completed was 6.4 out of 12 (SD = 1.9). None of the confidence items, when asked to parents or children, were associated with the number of steps performed correctly (Fig. 1). Age, gender, frequency of inhaler use, ED visits, and hospitalizations were not associated with any confidence items.

This study is the first to examine associations between inhaler technique and confidence among hospitalized children with asthma. Similar to previous studies in outpatient and community settings, children and parents proved to be overconfident in children's ability to use MDIs properly [13–15]. When compared to prior studies, this study shows lower levels of parent confidence, suggesting that parents may lose confidence when their children are hospitalized [13–15]. While other studies have also enrolled mostly Black children, this study's participants were on average 2–3 years younger (7.8 versus 10 and 10.7 years), which may contribute toward differences in confidence [13,15].

This study demonstrates that confidence is a poor proxy for proper inhaler use, regardless of how confidence is measured. These findings support guidelines that recommend assessment and teaching of correct inhaler technique at each encounter [2]. Inpatient healthcare professionals cannot rely on child or parent confidence alone to determine whether the child needs education about proper inhaler use. Rather, it is crucial that they assess and teach correct inhaler technique to all children hospitalized with asthma, particularly since these patients are high risk for repeat hospitalizations and may have suboptimal longitudinal care

[18]. Inpatient settings may also be better equipped to overcome identified barriers to inhaler education by engaging children and parents/guardians, having demonstration supplies, training nurses or respiratory therapists to teach proper technique, and leveraging available time to deliver repeated education using proven interventions [7, 12,21–24].

This study's generalizability is limited because most participants were Black. While research with other ethnic/racial groups may lead to different results, this study provides valuable insight into a population disproportionately affected by asthma [1,16–18,25]. Also, this study exclusively studied MDIs, and thus findings may not translate to other inhalers. Finally, social desirability bias may have affected how participants reported their confidence.

4. Conclusions

Overall, this study shows that children and parents' confidence in children's knowledge, skills, and ability to independently use an inhaler were all poor proxies for proper inhaler technique among hospitalized children with asthma. Inpatient healthcare professionals should objectively evaluate technique and teach proper inhaler use to all children with asthma to optimize outcomes.

Funding

This work was supported by the CHEST Foundation; Bucksbaum Institute of Clinical Excellence. Funders had no role in study design, collecting, analyzing, or interpreting data, writing the manuscript, and the decision to submit for publication.

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Fig. 1.

Differences in inhaler technique between confident and non-confident children and parents for all three confidence items ($n = 70$). Technique was based on mean number of correct steps out of 12. P -values calculated using independent t-tests. Error bars represent 95% confidence intervals.

1 Assessed through the statement: "I/My child know(s) all the steps to use my/their inhaler correctly."

2 Assessed through the statement: "How sure are you that you/your child can use your/their inhaler correctly?"

3 Assessed through the statement: "I/My child use(s) my/their inhaler correctly without help."