

A feasibility study of a patient-centered educational strategy for rampant inhaler misuse among minority children with asthma

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Clinical Implications

- Inhaler misuse is highly prevalent among minority children. This study was the first to show that Teach-to-Goal is a feasible and effective approach in the short term to assess and teach the inhaler technique among minority school-aged children.

TO THE EDITOR:

Asthma affects more than 6 million children in the United States and leads to more than 600,000 acute care visits.¹ Minority children face a disproportionate burden of asthma, as African American children have 2 times higher prevalence (13% vs 7%) and 3 times greater morbidity (24% vs 8%) than white children.¹

Asthma can be effectively managed using medications, primarily delivered via respiratory inhalers, if used correctly. However, few children use inhalers correctly.² Guidelines recommend inhaler technique assessment and education at every opportunity for the improved technique, asthma control, self-efficacy, and morbidity.^{2,3} Technique demonstration plus verbal instruction is more effective than instruction alone⁴; however, demonstration occurs as little as 5% of the time.⁵

Practical solutions are needed for regular assessment and education of the inhaler technique.⁶ A patient-centered educational strategy called “Teach-To-Goal” (TTG) has proven to be feasible and effective in improving the inhaler technique and health outcomes among adults.^{7,8} Our objective was to evaluate TTG as a strategy to assess and teach a proper inhaler technique among school-aged children.

This prospective quasi-experimental study was conducted over 1 year (2016-2017) within an academic-school partnership on Chicago’s South Side with a predominately African American, low-income population. Children with physician-diagnosed asthma identified during school-based screening were recruited.⁹ Written consent and assent was obtained. University of Chicago’s Institutional Review Board approved the study.

An asthma educator met one-on-one for 45 to 60 minutes with each child and their parent at the school or a community location (eg, classroom, library) after-school or on weekends. The educator worked with each child to complete questionnaires about their asthma, inhaler usage, and demographics. The asthma educator assessed the child’s baseline inhaler technique (misuse: <10 of 12; mastery: 12 of 12 steps correct) with a metered dose inhaler and spacer using a validated 12-step checklist (Figure 1).^{7,8} Then, the educator taught and assessed the inhaler technique using TTG, using iterative rounds of

demonstration and instruction followed by child redemonstration as teach-back (maximum 3 rounds). Education was tailored to the child’s skills during teach-back.⁷

Inhaler technique scores at baseline and post-TTG were analyzed as continuous variables with paired *t*-tests. Mastery and misuse were analyzed as binary variables with McNemar’s test for pre-/post-tests. The primary outcome was the proportion of children with misuse post- versus pre-TTG education. Differences by age were examined using the Kruskal-Wallis test (categories: 8-9, 10-11, 12-14 years). Statistical significance defined by a 2-tailed *P* value of <.05. Analysis used STATA version 14 (StataCorp LLC, College Station, Texas).

Of 189 eligible children, 64 enrolled. Reasons for non-enrollment included parent not reached (*n* = 71), child ineligible (*n* = 8), and parent declined participation (*n* = 45); 1 child did not complete intervention (*n* = 1). Participants’ mean age was 10.7 years (SD = 1.7), about half were female (*n* = 30/64), and nearly all were African American (*n* = 58/64).

At baseline, participants completed a mean of 3.6 steps (SD = 2.5) correctly. Nearly all children (*n* = 62/64) misused their inhaler and only 1 child demonstrated mastery. There were no significant differences by age or gender (Table 1).

After TTG education, children completed a mean of 11 steps (SD = 2.2) correctly. Comparing baseline and post-TTG scores, there was a statistically significant improvement in the proportion of children performing each step correctly (*P* < .002) (Figure 1). The proportion of children misusing inhalers decreased significantly from 97% (*n* = 62) at baseline to 17% (*n* = 11) post-TTG (*P* < .001). Mastery improved from 2% (*n* = 1) to 75% (*n* = 48) of children (*P* < .001).

By gender and age, TTG led to a significant decrease in misuse and an increase in mastery in both genders and across all age categories (Table 1). Younger children (8-9 years) had higher rates of misuse and lower rates of mastery post-TTG; however, it was not statistically significant (*P* = .08 and *P* = .12).

This study was the first to evaluate and demonstrate that TTG is highly effective in the short term for inhaler technique assessment and education among school-aged children. Extending prior research in adults,⁷ our study shows that TTG is effective among 8- to 14-year olds. Although no statistically significant difference was seen by gender or age, results suggest that younger children may be less likely than older youth to reach desired outcomes of mastery or no misuse. Our study was not powered to detect this difference; thus future studies should examine if differences emerge by age and, if so, what adaptations are needed (eg, additional rounds, parental engagement).

The success of TTG is attributable, in part, to use of demonstration, as this component led children to be more likely to have a proper inhaler technique initially and after 1 month.⁴ By incorporating child demonstration of the inhaler technique, TTG promotes a tailored approach with educational content and quantity personalized for each child based on knowledge and skills at baseline and during teach-back. The end result is not simply education delivered, but also effective technique demonstrated by the child.

Along with being effective in the short term, TTG is a feasible approach. Our educators reported that TTG required

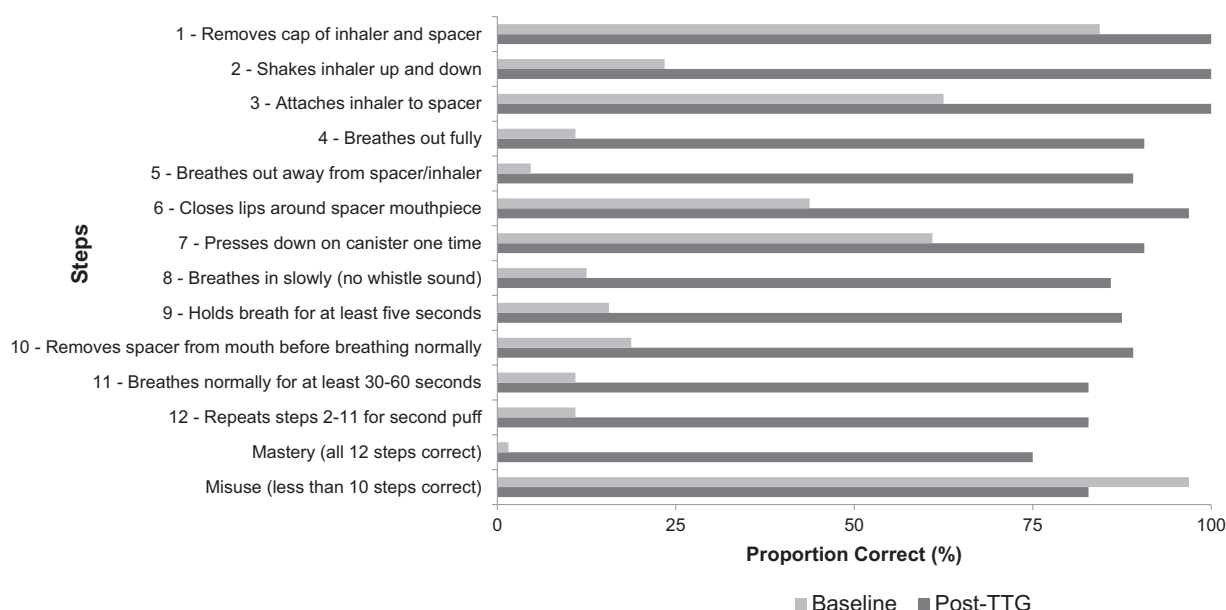


FIGURE 1. Inhaler technique assessment at baseline and post-Teach-to-Goal (TTG) educational intervention, based on each step, mastery, and misuse. Children demonstrated statistically significant improvement between baseline and post-Teach-to-Goal education for all steps (S), mastery, and misuse ($P < .002$). Proportion of children completing each step correctly pre- vs post-TTG: S1, 84% vs 100%; S2, 23% vs 100%; S3, 63% vs 100%; S4, 11% vs 91%; S5, 5% vs 89%; S6, 44% vs 97%; S7, 61% vs 91%; S8, 13% vs 86%; S9, 16% vs 88%; S10, 19% vs 89%; S11, 11% vs 83%; S12, 11% vs 83%.

TABLE I. Inhaler technique at baseline and post-TTG for all participants and based on age and gender

	Pre-TTG			Post-TTG			Pre/Post	
	Steps correct, mean $\pm$ SD	Misuse, n (%)	Mastery, n (%)	Steps correct, mean $\pm$ SD	Misuse, n (%)	Mastery, n (%)	Misuse P value	Mastery P value
All (n = 64)	3.6 $\pm$ 2.5	62 (97%)	1 (1.6%)	11 $\pm$ 2.2	11 (17%)	48 (75%)	<.001	<.001
Age (yr)								
8-9 (n = 19)	2.9 $\pm$ 1.9	19 (100%)	0 (0%)	9.8 $\pm$ 2.7	8 (42%)	10 (53%)	<.001	.002
10-11 (n = 25)	4.1 $\pm$ 2.9	23 (92%)	1 (4%)	11.6 $\pm$ 1.8	1 (4%)	22 (88%)	<.001	<.001
12-14 (n = 20)	3.7 $\pm$ 2.4	20 (100%)	0 (0%)	11.4 $\pm$ 1.6	2 (10%)	16 (80%)	<.001	<.001
P value		.87	.96		.08	.12		
Sex								
Female (n = 30)	4.3 $\pm$ 2.8	28 (93%)	1 (3.3%)	11.3 $\pm$ 1.6	4 (13%)	24 (80%)	<.001	<.001
Male (n = 34)	2.9 $\pm$ 2.0	34 (100%)	0 (0%)	10.7 $\pm$ 2.5	7 (21%)	24 (71%)	<.001	<.001
P value		.65	.81		.62	.52		

SD, Standard deviation; TTG, Teach-to-Goal.

approximately 10 minutes, though the duration depended on familiarity with spacer, willingness to learn, and rounds of education needed. Because health care professionals rarely provide education in clinical settings,⁵ this study shows that inhaler technique education can be incorporated into various fast-paced settings and nonclinical professionals can fill a much-needed care gap.

Although our study's generalizability may be limited because participants were primarily African American and low income, this population remains understudied when evaluating effective means for asthma control. Therefore, these results provide important insights about successful educational strategies to support self-management. Although this educational strategy leads to an improved technique immediately after intervention,

the impact on the technique weeks or months later remains unknown. Also, there was potential selection bias in this study, given low enrollment among eligible children and lack of randomization.

Our study shows that TTG is a feasible and effective strategy for providing much-needed assessment and education about a proper inhaler technique to children. Future longitudinal and randomized studies should assess TTG's short- and long-term impact on knowledge, skill, and morbidity outcomes among children of various ages and diverse backgrounds. Furthermore, consideration must be given to applying this educational strategy to all inhaler types (eg, diskhalers, turbobhalers) and determining the best real-world implementation approaches for this education in clinical settings. By improving the inhaler technique, this

tailored educational strategy has potential to increase asthma control and decrease morbidity among children.

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