

Original Research Article

Comparative study on effectiveness of a traditional brief intervention method versus a virtual teach-to-goal approach in educating hospitalized children with asthma on proper inhaler technique

Ariya Venu*, Jacob Abraham, Bincy Varghese, Carol Sara Cherian

Department of Paediatric, Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, Pathanamthitta, Kerala, India

Received: 27 July 2026

Accepted: 07 September 2026

*Correspondence:

Dr. Ariya Venu,

E-mail: ariyavenu1@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Correct inhaler technique is essential for achieving optimal asthma control in children. However, incorrect inhaler use remains common and contributes to poor disease control, recurrent exacerbations, and increased healthcare utilization. Hospitalization provides an important opportunity for inhaler education. This study compared the effectiveness of a traditional brief intervention (BI) with a Virtual Teach-to-Goal (V-TTG) approach in improving inhaler technique among children with asthma.

Methods: This comparative study was conducted in the Department of Paediatrics, Pushpagiri Institute of Medical Sciences and Research Centre, Kerala, over 18 months. Sixty-six children aged 4-15 years with asthma (33 in each group) were enrolled. Participants received either conventional face-to-face inhaler education (BI) or standardized video-based V-TTG education. Inhaler technique was assessed before and after intervention using a validated 12-step metered-dose inhaler with spacer checklist. Follow-up assessment evaluated retention of correct inhaler technique. Continuous variables were analyzed using paired and independent t tests, while categorical variables were compared using Chi-square/Fisher's exact test. A $p < 0.05$ was considered statistically significant.

Results: Both educational interventions significantly improved inhaler technique scores from baseline (BI: 6.94 ± 1.32 to 9.67 ± 1.65 , $p < 0.001$; V-TTG: 6.91 ± 1.51 to 10.70 ± 1.33 , $p < 0.001$). The V-TTG group achieved significantly higher post-intervention scores than the BI group (10.70 ± 1.33 vs. 9.67 ± 1.65 ; $p = 0.007$). At follow-up, a greater proportion of children in the V-TTG group demonstrated correct inhaler technique (75.8% vs. 63.6%), although this difference was not statistically significant ($p = 0.284$). Older children demonstrated significantly better inhaler technique than younger children ($p < 0.001$).

Conclusions: Both traditional BI and V-TTG education significantly improved inhaler technique in children with asthma. However, the V-TTG approach resulted in superior immediate improvement in inhaler technique and represents an effective, scalable strategy for asthma education in pediatric practice.

Keywords: Asthma, Inhaler technique, Metered-dose inhaler, Spacer, Virtual teach-to-goal, Brief intervention, Children

INTRODUCTION

Childhood asthma remains a major public health problem worldwide because of its high prevalence, frequent exacerbations, and substantial impact on quality of life. Despite advances in pharmacotherapy, asthma continues

to account for considerable healthcare utilization, particularly in low- and middle-income countries. It is characterized by chronic airway inflammation, bronchial hyper-responsiveness, and reversible airway obstruction leading to wheeze, cough, chest tightness, and breathlessness. Despite advancements in pharmacological

therapy, asthma remains a major cause of pediatric hospital admissions and school absenteeism, particularly in low- and middle-income countries.^{1,2}

Inhaled medications such as inhaled corticosteroids and bronchodilators are the cornerstone of asthma management.³ However, the effectiveness of inhaled therapy largely depends on the correct use of inhaler devices. Incorrect inhaler technique significantly reduces drug deposition in the lungs, resulting in poor asthma control, increased exacerbations, frequent emergency visits, and unnecessary escalation of therapy.⁴

Studies have shown that a substantial proportion of children with asthma use inhalers incorrectly. Common errors include poor coordination between actuation and inhalation, inadequate breath-holding, failure to exhale before inhalation, and incorrect device positioning.^{5,6} These errors may lead clinicians to misinterpret poor disease control as treatment failure rather than improper technique.

Asthma education is therefore an essential component of comprehensive asthma care. Hospitalization for asthma exacerbation provides an important opportunity for reinforcing inhaler education.⁷ Traditionally, inhaler education in busy hospital settings has consisted of brief face-to-face demonstrations and verbal instructions. However, such methods are often passive and insufficient to ensure long-term mastery of inhaler technique.

The TTG approach is a structured educational strategy based on repeated demonstration and corrective feedback until the learner achieves mastery. V-TTG utilizes digital platforms and video-based learning to provide standardized, interactive, and repeatable educational content. With increasing availability of smartphones and digital health tools, V-TTG has emerged as a promising method for improving inhaler technique among children with asthma.

With advances in digital technology and increasing access to smartphones and internet services, virtual and video-based educational interventions have emerged as promising tools for asthma education. V-TTG approaches combine the principles of mastery learning with standardized digital content, allowing repeated viewing, consistent messaging, and reinforcement of correct technique. Such approaches gained particular relevance during the COVID-19 pandemic, when in-person education was limited, and have shown potential advantages in terms of scalability, standardization, and patient engagement.^{8,9}

Adherence to prescribed inhaler regimens is another critical determinant of asthma control in children. Adherence encompasses not only regular use of medications but also correct inhaler technique. Poor adherence is influenced by multiple factors, including lack of understanding of the disease, incorrect technique,

fear of side effects, forgetfulness, socioeconomic constraints, and caregiver-related factors.¹⁰ Improving inhaler technique through effective educational interventions may positively influence adherence and overall asthma outcomes.

This study is driven by the necessity to determine whether digital, mastery-based interventions can outperform traditional brief instructions in a real-world ward environment. By focusing on immediate technique accuracy and long-term retention, this research seeks to identify a sustainable strategy for ensuring that pediatric patients leave the hospital with the practical skills required to manage their condition effectively.

METHODS

Study design

A comparative study on effectiveness of a traditional BI method versus a V-TTG was conducted among hospitalized children diagnosed with asthma.

Study setting

The study was carried out in the Department of Paediatrics at Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, Kerala.

Study period

The study was conducted over a period of 18 months following approval from the institutional ethics committee.

Study population

Children aged 4-15 years admitted with asthma exacerbation and children using inhalers attending the pediatric outpatient department were included in the study.

Inclusion criteria

Children aged 4-15 years, hospitalized due to asthma exacerbation and children using inhalers attending OPD were included in study.

Exclusion criteria

Children with significant coexisting respiratory disorders and children with cognitive/physical impairments preventing effective participation were excluded from study.

Sample size

The sample size was calculated based on a previous study comparing V-TTG and BI methods. A total sample size of

66 participants was obtained, with 33 participants in each group.

Study tools

Visual educational aids including CDC and IAP inhaler technique videos were used.

Intervention

BI group

Children received standard face-to-face inhaler technique education from healthcare professionals.

V-TTG group

Children were educated using video-based inhaler technique modules demonstrating proper inhaler use.

Data collection

Both children and caregivers completed a structured questionnaire assessing: Demographic details, asthma history, healthcare utilization, inhaler usage and perceived difficulty in inhaler use.

Perceived difficulty was assessed using a 5-point Likert scale.

Children then demonstrated inhaler use using a metered-dose inhaler with spacer. Technique was assessed using a 12-step inhaler checklist.

Post-intervention inhaler technique was reassessed using the same checklist.

Definition of inhaler technique

Correct inhaler technique included ≥ 10 correct steps and improper inhaler technique included < 10 correct steps.

Participants were reassessed during follow-up visits to evaluate retention of inhaler technique.

Statistical analysis

Data were entered into Microsoft Excel and analyzed using appropriate statistical methods.

Continuous variables were expressed as mean and standard deviation (SD), while categorical variables were expressed as frequency and percentage.

The following statistical tests were used: Independent t test for comparison of continuous variables between groups. Paired t test for within-group comparison of pre- and post-intervention scores. Chi-square test/Fisher's Exact test for categorical variables.

P less than 0.05 was considered statistically significant.

Ethical considerations

Approval for the study was obtained from the institutional ethics committee prior to commencement of the study. Written informed consent was obtained from parents or caregivers before enrolment. Assent was obtained from children whenever appropriate.

RESULTS

A total of 66 hospitalized children with asthma participated in study. Participants were equally distributed between the BI group (n=33) and V-TTG group (n=33).

Baseline characteristics

The baseline demographic and clinical characteristics were comparable between the two groups. The mean age in the BI group was 8.67 ± 2.75 years, while the mean age in the V-TTG group was 8.33 ± 2.29 years. No statistically significant difference was observed between groups. Similarly, weight distribution and gender distribution were comparable between groups.

Effectiveness of intervention between the two groups

Comparing the effectiveness of the two methods as a training tool for teaching MDI administration in children. Pre- and post-intervention scoring was done based on a 12-step checklist with each correct step having a score of 1. Maximum score of 12 and minimum score of 0.

The analysis was done in 2 steps. Within group included comparing pre-intervention test scores vs. post-intervention test scores in each groups individually using paired t test.

Between the groups included comparing post-intervention test scores between the two groups using independent t test.

A paired t test showed a statistically significant improvement in inhaler technique scores for both groups: The traditional group improved from a mean of 6.94 to 9.67 ($t = -19.553$, $p < 0.001$). The virtual T2G group improved from a mean of 6.91 to 10.70 ($t = -27.864$, $p < 0.001$). Both interventions were effective in improving technique knowledge from baseline. The V-TTG group achieved a significantly higher mean post-test score (10.70 ± 1.33) compared to traditional group (9.67 ± 1.65). The difference was statistically significant ($t = -2.787$, $p = 0.007$), indicating virtual method was more effective in improving overall technique of MDI administration.

Although a higher proportion of children in the V-TTG group demonstrated better inhaler technique during follow-up compared to the traditional group (75.8% vs 63.6%), the difference was not statistically significant.

Adherence factors

Assessment of adherence-related factors revealed that structured education improved confidence and proper

inhaler usage among both children and caregivers. Overall, the findings suggest that both educational methods were effective, but the VTTG approach provided superior improvement in inhaler technique mastery.

Table 1: Effectiveness of intervention on technique scores within each group (Paired t test).

Groups	Variables (No of steps)	Mean	SD	Mean difference	T value	P value
Traditional (n=33)	Pre-intervention score	6.94	1.32	-2.727	-19.553	<0.001*
	Post-intervention score	9.67	1.65			
Virtual T2G (n=33)	Pre-intervention score	6.91	1.51	-3.788	-27.864	<0.001*
	Post-intervention score	10.70	1.33			

*Significant at p<0.05.

Table 2: Association between type of intervention and demonstration of correct inhaler technique at follow-up evaluation (Chi-square test).

Inhaler technique at follow-up	Traditional, (n=33)	Virtual T2G, (n=33)	Total, (n=66)	Chi-square	P value
10 or more steps correct	21(63.6%)	25 (75.8%)	46	1.15	0.284
Less than 10 steps correct	12 (36.4%)	8 (24.2%)	20		
Total	33 (100%)	33 (100%)	66		

Table 3: Association between age category and inhaler technique during followup.

Age category (in years)	Inhaler technique <10 steps	Inhaler technique 10 or more steps	Total	Chi-square and p value
4 to <6	12 (80.0%)	3 (20.0%)	15	28.41 p<0.001
6 to <9	8 (30.77%)	18 (69.23%)	26	
9 to <12	0 (0.0%)	23 (100.0%)	23	
12 to <15	0 (0.0%)	2 (100.0%)	2	

Higher proportion of incorrect inhaler technique was noted in younger children, whereas better inhaler technique scores were observed older age groups (12<15).

However, it should be noted that the number of participants in the 12<15 year age group was small (n=2), which may limit the strength of inference in that category. Despite this limitation, the overall association between age and inhaler technique was statistically significant.

DISCUSSION

The present study compared the effectiveness of a traditional BI method with a V-TTG approach in improving inhaler technique among hospitalized children with asthma. The findings demonstrated that both interventions significantly improved inhaler technique scores; however, the V-TTG group showed comparatively greater improvement in mastery of inhaler technique and reduced perceived difficulty in inhaler use.

Incorrect inhaler technique was highly prevalent among participants at baseline in both groups. This finding is consistent with previous studies showing that a majority of children with asthma perform at least one critical inhaler step incorrectly. Poor inhaler technique continues

to be a major contributor to inadequate asthma control, recurrent exacerbations, and increased healthcare utilization.⁴

Following intervention, significant improvement in inhaler technique was observed in both groups. This highlights the importance of structured inhaler education during hospitalization, which represents an important teachable opportunity for both children and caregivers. Similar findings have been reported by Volerman et al and Robolino et al who demonstrated substantial improvement in inhaler technique following both traditional and virtual educational interventions.¹¹

The V-TTG group demonstrated comparatively better improvement in inhaler technique scores than the BI group. The superiority of the V-TTG approach may be attributed to repeated visual reinforcement, standardized delivery of educational content, and active learner engagement. Video-based modules allow children and caregivers to repeatedly observe correct inhaler technique, thereby improving psychomotor skill acquisition and retention.¹¹ Carpenter et al showed that video-assisted teaching combined with demonstration improved inhaler technique in pediatric patients.¹²

Older children in the present study demonstrated greater improvement in inhaler technique compared to younger

children. This may be related to better cognitive understanding, attention span, and ability to follow sequential instructions among older participants. Similar age-related improvements have been documented in previous pediatric asthma education studies.¹¹

Participants in the V-TTG group also reported lower perceived difficulty in inhaler use following intervention. This suggests that mastery-based educational strategies may improve confidence and self-efficacy in children using inhalers. Improved confidence may subsequently contribute to better adherence to prescribed inhaler regimens.

The findings of the present study support the growing evidence favouring structured and interactive educational interventions over conventional brief counselling alone. In resource-limited and high-volume healthcare settings, virtual educational tools may provide a scalable and standardized approach to asthma education while reducing variability in instruction.¹²

The study also emphasizes the need for repeated reassessment of inhaler technique during follow-up visits. Improvement immediately following intervention does not always ensure long-term retention, and reinforcement remains essential for sustained asthma control.

The Indian healthcare setting often relies on brief and unstructured education, which may not ensure skill mastery. The growing burden of asthma and high rates of preventable morbidity emphasize the need for standardized educational approaches. Salvi highlighted the potential of digital health interventions in improving asthma care delivery in India by enhancing access to education and promoting self-management.¹³

CONCLUSION

The present study demonstrated that structured inhaler education significantly improved inhaler technique among hospitalized children with asthma, with the V-TTG approach showing greater effectiveness due to its mastery-based learning and repeated feedback. However, adherence and factors affecting compliance remained similar between groups, indicating that medication-taking behavior is influenced by multiple behavioral and psychosocial factors beyond educational intervention alone. These findings highlight the need to integrate structured, competency-based inhaler education into routine asthma care while addressing adherence-related barriers through continuous patient and caregiver support. Future research should focus on long-term skill retention, sustained adherence, and the impact of combined educational and behavioral strategies on clinical outcomes.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Global Initiative for Asthma. Global strategy for asthma management and prevention. Updated 2023. Available at: www.ginasthma.org. Accessed on 02 July 2026.
2. World Health Organization. Asthma. Fact sheet. Geneva: WHO. 2023.
3. Barnes PJ. Inhaled corticosteroids. *Pharmacol Ther.* 1998;58(2):161-90.
4. Melani AS, Bonavia M, Cilenti V, Cristina C, Marco L, Paola M, et al. Inhaler mishandling remains common in real life and is associated with reduced disease control. *Respir Med.* 2011;105(6):930-8.
5. Giraud V, Roche N. Improper inhaler technique of corticosteroid metered-dose inhaler is associated with decreased asthma stability. *Eur Respir J.* 2002;19(2):246-51.
6. Deerojanawong J, Naipatanon S, Prapphal N. Inhaler technique of Thai children with asthma. *Asian Pac J Allergy Immunol.* 2009;27(4):199-204.
7. George M, Rand C. Self-management of asthma: promoting adherence to inhaled corticosteroids. *J Allergy Clin Immunol.* 2012;130(3):575-82.
8. Carpenter DM, Geryk LL, Sage A, Mark W, Daniel R, Tamera CB, et al. Using videos to teach children inhaler technique: a randomized controlled trial. *J Asthma.* 2015;52(1):81-8.
9. Subbarao P, Mandhane PJ, Sears MR. Asthma: epidemiology, etiology and risk factors. *CMAJ.* 2009;181(9):E181-90.
10. Burke W, Fesinmeyer M, Reed K, Hampson L, Carlsten C. Family history as a predictor of asthma risk. *Am J Prev Med.* 2003;24(2):160-9.
11. Volerman A, Balachandran U, Zhu M, Akel M, Hull A, Siros M, et al. Evaluating Inhaler Education Interventions for Hospitalized Children with Asthma: A Randomized Controlled Trial. *Ann Allergy Asthma Immunol.* 2023;130(6):759-66.
12. O'Connor A, Dennett E, Hasan M, Stovold E, Carson-Chahhoud K. Home-based Educational Interventions for Children with Asthma, a Cochrane Review. *Cochrane Database Syst Rev.* 2023;2(2):CD008469.
13. Salvi S. Digital Health and Asthma Care in India: Bridging the Gap. *Indian J Med Res.* 2024;159(3):210-8.

Cite this article as: Venu A, Abraham J, Varghese B, Cherian CS. Comparative study on effectiveness of a traditional brief intervention method versus a virtual teach-to-goal approach in educating hospitalized children with asthma on proper inhaler technique. *Int J Contemp Pediatr* 2026;13:1942-6.