

Research Article

# A Study of Knowledge About Metered-Dose Inhaler Technique Among Health Care Providers in a Tertiary-Level Hospital

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## Abstract

**Background:** According to the National Asthma Prevalence Study (NAPS), around seven million people in Bangladesh suffer from asthma. While inhaled medications are key to asthma treatment, incorrect inhaler techniques remain a global issue. This study aimed to assess healthcare providers' knowledge of metered-dose inhaler techniques in a tertiary hospital. **Aim of the study:** The aim of the study was to evaluate the knowledge and proficiency of healthcare providers in performing nine-steps of the metered-dose inhaler technique in a tertiary-level hospital. **Methods:** This cross-sectional observational study in the Department of Internal Medicine at Bangabandhu Sheikh Mujib Medical University (BSMMU) Hospital, Dhaka, from July to December 2015, involved 108 healthcare providers. Ethical approval and informed consent were obtained. Data were collected via interviews and observations, and analyzed using SPSS version 17.0 with Chi-square tests, considering  $p < 0.05$  as significant. **Results:** In a study of 108 healthcare providers, 42.2% were in their fourth decade of life, with a mean age of 30.8 years. Of the respondents, 74.1% were doctors, while 25.9% were nurses. All respondents counseled on inhaler use, and 72.2% recommended inhaler medications. Over 70% removed the cap and shook the inhaler vigorously, with 96.3% breathing out slowly and completely. Doctors outperformed nurses in most steps, with significant differences except for breathing out slowly and completely ( $p = 0.228$ ). **Conclusion:** Healthcare providers, particularly nurses, lack proficiency in the final steps of the metered-dose inhaler technique, with doctors generally outperforming nurses in all steps.

## Keywords

Metered-Dose Inhaler, Healthcare Providers, Inhaler Technique, Asthma Management, Tertiary Hospital

## 1. Introduction

Asthma is a major cause of chronic morbidity and mortality worldwide, and its prevalence is increasing, especially among children. [1] Despite recent advances in the understanding of asthma, its pathophysiology, and the availability of effective treatments, the disease continues to be a major cause of morbidity, leading to a significant economic burden

on individuals and societies. [2] Poor asthma control has been linked to several common and important issues, including underdiagnosis and inadequate treatment, poor patient understanding of the disease and its treatment, [2, 3] non-compliance, [4-6] and incorrect use of inhaler devices. [5, 6] Inhaled medications are the cornerstone of asthma treatment.

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[7] However, poor patient inhaler technique has been identified as a common and persistent problem worldwide. [8-12] Up to 90% of adult patients have been reported to have inadequate inhaler technique, with higher rates of errors in children and older patients. [7-10] Poor inhaler technique reduces drug delivery to the airways, decreasing the efficiency of the inhaled medication. [6]

The high prevalence of incorrect inhaler technique among patients has been attributed to several factors. [11, 12] Most healthcare providers do not spend sufficient time educating patients on the correct use of inhalers. [13-18] Another issue is the absence of routine evaluations of patients' inhaler technique, which are necessary to ensure proper use. [12, 13] More importantly, studies show that many providers themselves have poor inhaler technique, [14, 15] which can lead them to give incorrect instructions to patients. [14] The correct use of inhalers has been shown to be influenced by patients' characteristics, such as their age and their understanding of asthma and its treatment. [16] As a result, the severity of the problem may vary among different populations.

Formal training and demonstration of the correct use of inhalers have been shown to improve the inhaler skills of both patients and healthcare providers [16, 5]. Local baseline information is, therefore, essential for each country to develop its own asthma care services and educational programs tailored to their specific problems and needs [1]. The present study aims to collect information on the metered-dose inhaler technique suggested by service providers to asthma patients in our country.

## 2. Objective

The aim of the study was to evaluate the knowledge and proficiency of healthcare providers in performing the metered-dose inhaler technique in a tertiary-level hospital.

### Methodology & Materials

This cross-sectional observational study was conducted in the Department of Internal Medicine, Bangabandhu Sheikh Mujib Medical University (BSMMU) Hospital, Dhaka, from July 2015 to December 2015. A total of 108 healthcare providers (doctors and nurses) who met the inclusion and exclusion criteria were purposively selected for the study.

### Inclusion Criteria:

- 1) Doctors and nurses of any age and either sex working at BSMMU Hospital.
- 2) Healthcare providers involved in prescribing or demonstrating metered-dose inhaler (MDI) techniques to asthma patients.

### Exclusion Criteria:

Healthcare providers unwilling to participate.

Informed consent was obtained from all participants, ensuring voluntary participation, confidentiality, and the right to withdraw at any time. Ethical approval was obtained from the Ethical Review Committee of Bangabandhu Sheikh Mujib Medical University, Dhaka, following the Helsinki Declara-

tion. Data were collected through structured interviews and observations, assessing participants' skills in performing the nine-step metered-dose inhaler technique using a checklist. Demographic information and performance data were recorded for analysis. Data were cleaned, coded, and analyzed using SPSS version 17.0, with descriptive statistics summarizing the data and the Chi-square ( $\chi^2$ ) test employed to compare variables. A p-value < 0.05 was considered statistically significant.

## 3. Results

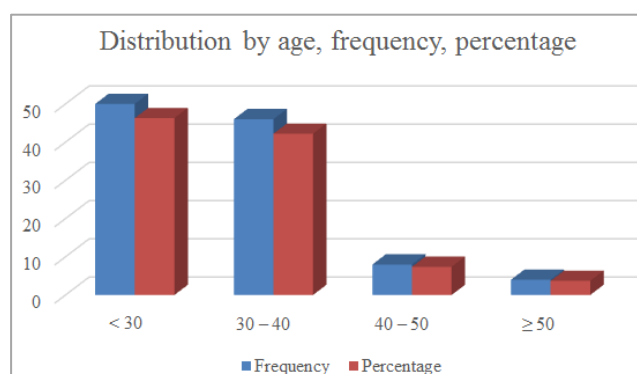


Figure 1. Distribution of Healthcare Providers by Age (n = 108).

Figure 1 shows the age distribution of the 108 healthcare providers involved in the study. Of the respondents, 46 (42.2%) were in their 4th decade of life, followed by 31.5% in their 3rd decade, 14% in their 2nd decade, and 7.4% in their 5th decade. The mean age of the respondents was  $30.8 \pm 6.3$  years, with the youngest being 22 years and the oldest being 51 years. All respondents were urban residents.

### Figure 2. Sex distribution:

Nearly two-fifth (57%) of the respondents was male and 42.6% female giving a male to female ratio of roughly 3:2 (Figure 2).

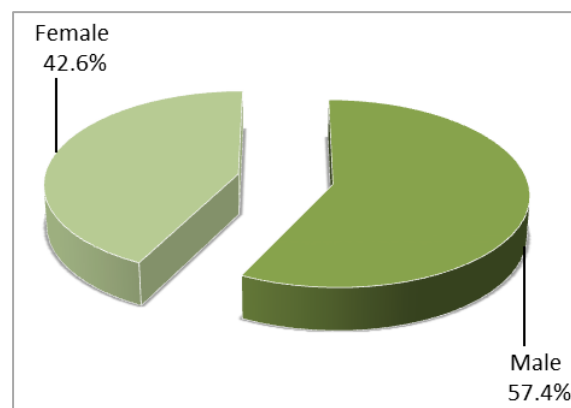


Figure 2. Distribution of respondents by sex (n=108).

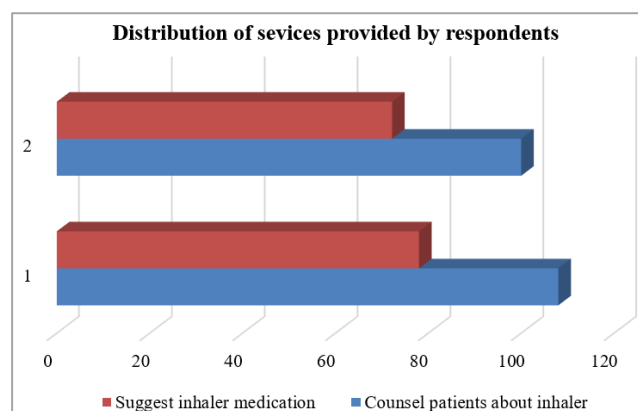
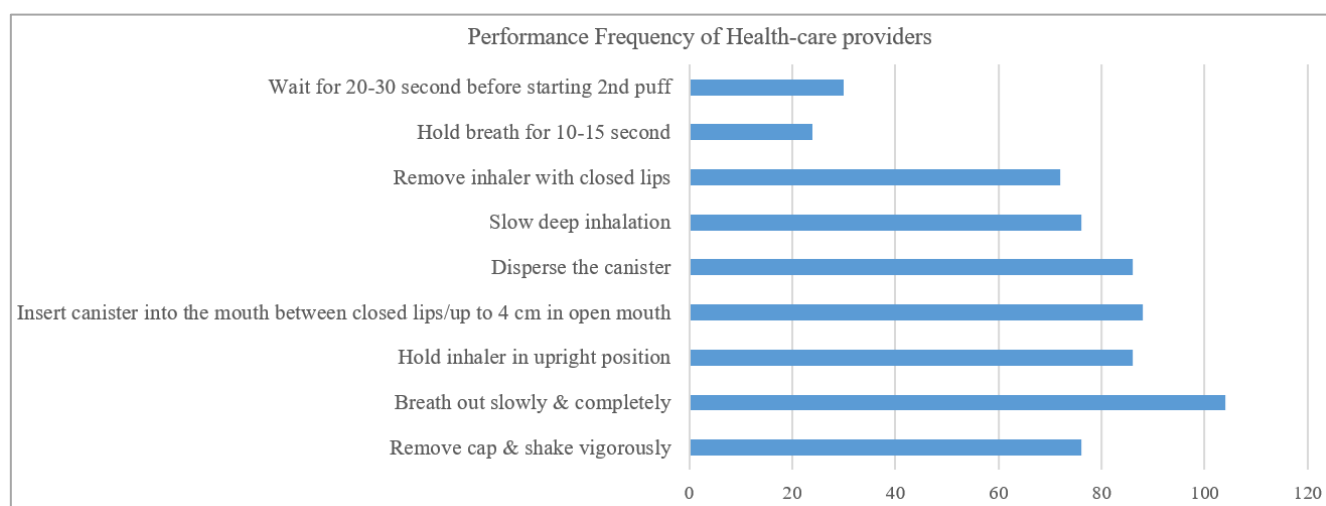
**Table 1.** Distribution of Healthcare Providers by Professional Identity (n = 108).

Professional identity	Frequency	Percentage
Doctor	80	74.1
Nurses	28	25.9

Table 1 presents the distribution of healthcare providers by their professional identity. Of the total respondents, 80 (74.1%) were doctors, while the remaining 28 (25.9%) were nurses.

Figure 3 illustrates the types of services provided by the respondents. All respondents reported counseling asthma patients on inhaler use and demonstrating proper inhaler techniques. Additionally, 72.2% of the respondents recom-

mended inhaler medications to asthma patients.

**Figure 3.** Distribution of Services Provided by Respondents.**Figure 4.** Adherence to the 9-Step Metered-Dose Inhaler Technique.

Respondents were asked to demonstrate their performance skills in using the nine-step metered-dose inhaler technique, which was observed by the investigator. Over 70% of the respondents removed the cap and shook the container vigorously before use. The majority (96.3%) breathed out slowly and completely, and nearly 80% held the inhaler in an upright position. More than 80% inserted the canister into the

mouth between closed lips or up to 4 cm away from an open mouth. About 80% dispersed the canister, but only 70% inhaled the medication with slow, deep inhalation. However, adherence to the 8th and 9th steps—holding the breath for 10-15 seconds and waiting 20-30 seconds before starting a second puff—was disappointingly low.

**Table 2.** Comparison of Performance Skills Between Doctors and Nurses (n = 108).

Performance skills	Group		P-value
	Doctors (n = 80)	Nurses (n = 28)	
Remove cap & shake vigorously	62(77.5)	14(50.0)	0.006
Breath out slowly & completely	76(95.0)	28(100.0)	0.228

Performance skills	Group		P-value
	Doctors (n = 80)	Nurses (n = 28)	
Hold inhaler in upright position	76(95.0)	10(35.7)	<0.001
Insert canister into the mouth between closed lips/up to 4 cm in open mouth	74(92.5)	14(50.0)	<0.001
Disperse the canister	76(95.0)	10(35.7)	<0.001
Slow deep inhalation	68(85.0)	8(28.6)	<0.001
Remove inhaler with closed lips	62(77.5)	10(35.7)	<0.001
Hold breath for 10-15 second	22(27.5)	2(7.1)	0.026
Wait for 20-30 second before starting 2 <sup>nd</sup> puff	26(32.5)	4(14.3)	0.046

Figures in the parentheses indicate corresponding %;

\*Chi-squared Test ( $\chi^2$ ) was done to analyzed the data

Table 2 presents the comparison of performance skills in the nine-step metered-dose inhaler technique between doctors and nurses. Doctors outperformed nurses in all steps with statistically significant differences ( $p < 0.05$ ), except for the 2nd step—breathing out slowly and completely—where performance was comparable between the groups ( $p = 0.228$ ). Notably, 77.5% of doctors and 50% of nurses removed the cap and shook the inhaler vigorously. While 95% of doctors held the inhaler upright, only 35.7% of nurses did the same. Similarly, 92.5% of doctors inserted the inhaler correctly compared to 50% of nurses. Adherence to steps such as slow deep inhalation (85% vs. 28.6%), holding the breath for 10-15 seconds (27.5% vs. 7.1%), and waiting 20-30 seconds before starting a second puff (32.5% vs. 14.3%) was notably higher among doctors than nurses.

## 4. Discussion

The present study revealed that over two-thirds of the doctors and nurses were skilled in performing the first seven steps of the nine-step metered-dose inhaler technique. However, the skills for the 8th and 9th steps, such as holding the breath for 10-15 seconds and waiting for 20-30 seconds before starting the second puff, were disappointingly low. More than 70% of the respondents removed the cap and shook the container vigorously before use. They then breathed out slowly and completely and held the inhaler in an upright position. The majority inserted the canister into their mouth between closed lips or up to 4 cm in an open mouth and dispersed the canister. However, inhaling the drug with slow, deep inhalation was somewhat low. When comparing the skills of doctors and nurses in inhaler technique, it was evident that, in every step, doctors performed significantly better than nurses ( $p < 0.05$ ), except in the 2nd step (breathing out slowly and completely), where there was no significant difference between the two groups ( $p = 0.228$ ).

Inhaled medications form the cornerstone of asthma

treatment. However, incorrect inhaler technique has been identified as a common and persistent problem in many studies worldwide. [19] Up to 90% of adult patients have been reported to have inadequate inhaler technique, with higher rates of errors in children and elderly patients. [20] Poor inhaler technique reduces drug delivery to the airways, decreasing the efficiency of the inhaled drug. Most healthcare providers do not spend sufficient time educating patients on the correct use of inhalers. Another problem is the lack of regular periodic assessment of patients' inhaler technique, which is essential to ensure proper use. [20] More importantly, studies show that most providers themselves do not have technical knowledge of inhaler techniques, as was evident in 20-30% of cases in our study. If we consider that all nine steps need to be performed correctly to make the inhaler technique effective, the majority of our service providers are not competent enough to educate their patients on how to use inhalers properly. Around 70-80% of doctors and nurses were unable to perform the last two steps (holding the breath for 10-15 seconds and waiting for 20-30 seconds before starting the second puff) as they should have been performed. Thus, they are most likely providing incorrect instructions to their patients. [21, 22]

In addition, the correct use of inhalers has been shown to be influenced by patients' characteristics, such as age, literacy, and their understanding of asthma and its treatment. [23] Therefore, the magnitude of the problem may vary in different populations. Hence, poor inhaler technique among asthma patients will not be completely solved by making service providers competent alone. Simultaneous education of the patients is a must. Formal training and demonstration of the correct use of inhalers have been shown to significantly improve inhaler use skills in both patients and healthcare providers. Local baseline information about inhaler technique is, therefore, essential for each country to develop its own asthma care services and educational programs targeted at their specific problems and needs.

Nurses are an important part of the healthcare team and, in many countries, are often the first point of contact and sometimes the closest interaction for people with asthma. They play a vital role in educating patients. Thus, nurses are expected to educate and train patients when inhaler devices are prescribed. However, in our country, doctors' chambers are the first-place asthma patients visit. Therefore, the management knowledge of both doctors and nurses can positively or negatively impact treatment outcomes. Studies in other parts of the world have reported a very low level of knowledge about asthma and inhaler technique among nurses and concluded that there is a need for sufficient knowledge to effectively teach and participate in asthma care. [24] Poor asthma knowledge and inhaler techniques among patients have been associated with poor asthma control and health outcomes. [25]

The quality of asthma care depends on the healthcare provider's knowledge, attitude, experience, and expertise in educating patients on inhaler technique. We hope that the findings derived from this study will have implications for improving the existing asthma care situation in our country.

## 5. Limitations of the Study

This study had some limitations:

- 1) Conducted at a single center, limiting diversity and affecting external validity.
- 2) The sample size was small, may limit generalizability.
- 3) Relied on self-reporting, introducing potential bias.

## 6. Conclusion

Based on the findings of the study, it can be concluded that healthcare providers (doctors and nurses) lack sufficient proficiency in performing all nine steps of the metered-dose inhaler technique. Consequently, they may not be adequately equipped to instruct asthma patients on proper inhaler use. While most doctors and nurses demonstrated proficiency in the first seven steps, adherence to the last two steps—holding the breath for 10-15 seconds and waiting for 20-30 seconds before starting a second puff—was notably low. However, doctors outperformed nurses in demonstrating their skills in using the metered-dose inhaler technique.

## Abbreviations

BSMMU	Bangabandhu Sheikh Mujib Medical University
MDI	Metered-Dose Inhaler
NAPS	National Asthma Prevalence Study
SPSS	Statistical Package for the Social Sciences
$\chi^2$	Chi-square Test
SD	Standard Deviation (if Mentioned Elsewhere in the Results or Figures)

## Author Contributions

Mohammad Abdul Motalib is the sole author. The author read and approved the final manuscript.

## Conflicts of Interest

The author declares no conflicts of interest.

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