

**KNOWLEDGE ON ASTHMA AND USE OF METERED-DOSE
INHALERS AMONG HEALTHCARE PROFESSIONALS AT HEALTH
CENTRES AND REGIONAL REFERRAL HOSPITALS IN
DAR ES SALAAM**

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**MMed (Internal Medicine) Dissertation
Muhimbili University of Health and Allied Sciences
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Muhimbili University of Health and Allied Sciences

Department of Internal Medicine



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By

Aisha A. Awadh

**A Dissertation Submitted in (Partial) Fulfillment of the Requirements for the Degree
of Master of Medicine (Internal Medicine) of**

**Muhimbili University of Health and Allied Sciences
October, 2021**

CERTIFICATION

The undersigned certifies they have read and hereby recommends for acceptance by Muhimbili University and Allied Sciences a dissertation entitled; **“Knowledge on asthma and use of metered dose inhaler among healthcare professionals at health centers and Regional Referral Hospitals in Dar es Salaam”**, in (partial) fulfillment of the requirements for the degree of Master of Medicine (Internal Medicine) of Muhimbili University of Health and Allied Sciences.

Dr. Grace Shayo

(Supervisor)

Date

Dr. Mwanaada Kilima

(Co-Supervisor)

Date

DECLARATION AND COPYRIGHT

I, **Aisha Ahmed Awadh**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature.....

Date.....

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DEDICATION

This dissertation is dedicated to my parents Mr. and Mrs. Ahmed Awadh who have effortlessly supported me in my journey.

I also dedicate this to my husband Maqbul and my children Ahmed, Swiyaam and Swahib who have been patient with me and their companionship has guided me to where I am today.

This study is also dedicated to my supervisor, Dr Grace Shayo whose guidance throughout has been important.

Lastly, I dedicate this dissertation to all asthmatic patients and healthcare professionals dealing with their care.

ABSTRACT

Background: The metered-dose inhalers (MDIs) are the most commonly used devices to deliver asthma inhalational drugs. Inhaler use technique is very challenging especially when no proper training is given to patients. Healthcare professionals are tasked with educating the patients on correct use and their knowledge on asthma and inhaler technique is of paramount importance.

Objective: To assess knowledge on asthma and use of metered-dose inhaler among healthcare professionals in health centers and regional referral hospitals in Dar es Salaam.

Methodology: This was a cross-sectional multi-centers, hospital-based study conducted at regional referral hospitals of Amana, Mwananyamala, Temeke and health centers of Sinza and Kigamboni. Participants included healthcare providers (HCPs) in the departments of internal medicine, pediatrics, emergency medicine and pharmacy.

Questionnaires were used to collect participant's demographic data and to assess for knowledge on asthma and its management. For asthma knowledge, an 18 questions HCP asthma knowledge questionnaire (HQ) was used. Each correct answer was awarded one point while a zero point was given to wrongly answered or unattempted question. Knowledge was considered adequate if the score was 13/18 or higher as per HQ otherwise it was considered inadequate.

HCPs technique in using MDIs was assessed using placebo inhalers against a 12 step published checklist. Correct technique participants had to get all the steps correctly, otherwise it was poor technique.

Data analysis was done using SPSS version 23.0. Chi-square was used to compare categorical data and one way ANOVA for comparison of mean scores for asthma knowledge and inhaler technique across HCPs cadres. A p-value less than 0.05 was considered significant.

Results: A total of 114 participants were enrolled in the study. Among the participants, 57% were medical officers, 59.6% had work experience of less than 5 years and 53.5% had no training on inhaler technique. Placebo inhalers for demonstration to patients were not available at work place in any of the facilities involved in the study. Among the HCPS, 75.4% had inadequate knowledge on asthma. Medical specialists had the highest mean score (14.5) for asthma knowledge. Factors associated with good asthma knowledge included age more than 40 years ($p=0.039$) and being a medical specialist ($p=0.002$). . Only 4.4% of the participants did all the steps of inhaler technique correctly. The highest mean score on inhaler technique was seen among medical specialists (6) while the lowest was among nurses (3).

Conclusion: Knowledge on asthma and inhaler technique is generally poor among healthcare providers in Dar es Salaam. None of the health facilities had placebo inhalers for patients' training on inhaler technique.

Recommendation: Training on asthma and inhaler demonstration should be offered to all cadres and should be continued at work places. Availability of placebo inhalers should be ensured for demonstration to patients.

TABLE OF CONTENTS

CERTIFICATION	i
DECLARATION AND COPYRIGHT	ii
ACKNOWLEDGEMENT	iii
DEDICATION	iv
ABSTRACT	v
TABLE OF CONTENTS	vii
LIST OF TABLES	x
LIST OF FIGURES	xi
LIST OF ABBREVIATIONS	xi
CHAPTER ONE	1
1.0 INTRODUCTION	1
1.1 Background	1
1.2 Literature Review	4
1.3 Statement of the problem	8
1.4 Rationale	9
1.3 Conceptual Framework	10
1.4 Research Questions	11
1.5 Study Objectives	11
1.5.1 Broad objective	11
1.5.2 Specific objectives	11
1.6 Study Hypothesis	11
CHAPTER THREE	12
3.0 METHODOLOGY	12
3.1 Study Design	12
3.2 Study Setting	12
3.3 Study Population	12
3.3.1 Inclusion Criteria	12
3.3.2 Exclusion Criteria	13

3.4 Sample Size Calculation	13
3.5 Study Procedure and Data Collection Instruments	14
3.6 Data Analysis	15
3.7 Ethical Issues	15
CHAPTER FOUR	16
4.0 RESULTS	16
4.1 Socio-demographic characteristics of participants.....	16
4.2 Level of knowledge among healthcare professionals	18
4.3 Asthma knowledge means scores among Healthcare professionals	19
4.4 Health care workers' skills on inhaler use	20
4.5 Stepwise demonstration of inhaler use.....	21
4.5 Relationship between knowledge on asthma and inhaler technique score.....	22
4.6 Factors associated with knowledge on asthma.....	23
4.7 Inhaler technique mean scores among healthcare professionals.....	25
CHAPTER FIVE	27
5.0 DISCUSSION.....	27
5.1 Knowledge on asthma.....	27
5.2 Inhaler technique.....	28
5.3 Training impact.....	29
5.4 Demonstration to patients	30
5.5 Role of educating patients on asthma and inhaler technique	30
5.6 Study Strength.....	31
5.7 Study limitation.....	31
CHAPTER SIX.....	32
6.0 CONCLUSION AND RECOMMENDATION	32
6.1 Conclusion	32
6.2 Recommendations.....	32
REFERENCES	33

APPENDICES	38
Appendix I: Informed Consent Form	38
Appendix II: Clinical Research Form	41

LIST OF TABLES

Table 1: Participants socio-demographic and professional characteristics 17

Table 2: Factors associated with the knowledge on asthma 24

LIST OF FIGURES

Figure 1: Conceptual Framework 10

Figure 2: Level of knowledge on Asthma among healthcare professionals 18

Figure 3: Mean scores of asthma knowledge among healthcare professionals 19

Figure 4: Demonstration of Inhaler use among HCPs..... 20

Figure 5: Health care workers’ percentage performance of steps of inhaler use technique 21

Figure 6: Relationship between knowledge on asthma and inhaler technique scor 22

Figure 7: Comparison of inhaler use mean scores among healthcare professionals 25

LIST OF ABBREVIATIONS

COPD	Chronic Obstructive Lung Disease
DPIs	Dry Powder Inhaler(s)
FEV1	Forced Expiratory Volume in One Second
GINA	The Global Initiative for Asthma Management
HCP	Health Care Professionals
ICS	Inhaled Corticosteroid(s)
LABA	Long Acting β 2-Agonist
MDI	Metered Dose Inhaler(s)
Pmdi	Pressurized Metered Dose Inhaler(s)
SABA	Short Acting β 2-Agonist

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Definition of asthma

According to GINA, Asthma is a heterogeneous disease, usually characterized by chronic shortness of breath, chest tightness and cough that vary over time and in intensity together with variable expiratory airflow limitation (1).

Burden of asthma

Asthma, is a burden globally affecting people of all ages and in all parts of the world, carrying both premature death and reduced quality of life. In 2016 the global burden of disease study estimated that there were 339.4million people affected by asthma, with an increase by 100million by 2025. Annual death reported worldwide is 250,000. Asthma across all ages contributed 23.7million DALYS globally. Asthma is ranked 28th among the leading causes of burden of disease in the world and 27th in the low and middle income countries (1).

Prevalence of asthma in Tanzania has been noted to be increasing. In 2004, it was estimated among secondary school pupils in coastal districts of Tanzania to be around 2.2-5% (2) and in 2014 prevalence among secondary school goers in coastal districts of Tanzania was estimated to be at 11.8% with higher prevalence in urban area than in rural area (3).

Diagnosis of asthma

1. **History of variable respiratory symptoms** –Wheeze shortness of breath, chest tightness. The symptoms occur variably over time and vary in intensity, are often worse at night or on waking, often triggered by allergens, cold air exercise and often appear or worsen with viral infections.

2. **Confirmed variable expiratory airflow limitation**-Documented excessive variability in lung function and documented expiratory airflow limitation. A positive bronchodilator reversibility test with an increase in FEV1of >12% and 200ml from baseline 10-15 minutes

after 200-400mcg salbutamol or equivalent inhaled, or excessive variability in twice daily PEF over 2 weeks with average daily diurnal variability in adults of >10% or significant increase in lung function after 4 weeks of anti-inflammatory treatment with increase in FEV₁ by >12% and 200ml from baseline (1).

Management of asthma

According to Global Initiative for Asthma, the goal of controlling Asthma is to prevent attacks, to relieve day and night symptoms and improve quality of life. The pharmacological treatment of asthma consists of inhaled medications. These medications are short acting beta agonists such as Salbutamol, long acting beta agonists such as Formoterol, inhaled corticosteroids such as Budesonide and anti-muscarinics such as Ipratropium bromide. Other medications include oral or parenteral steroids, methyl xanthenes and leukotriene inhibitors such as Montelukast (1).

Appropriate use of asthma medication leads to asthma control, thereby reducing asthma morbidity and mortality, as well as health care costs. Components in asthma management include: 1. Assessment and monitoring of lung function 2. Patient education for an efficient partnership in asthma care, 3. Identifying and controlling environmental factors and co-existing conditions that may affect asthma and 4. Pharmacotherapy (4).

Inhalation is the main delivery route of choice for asthma treatment (bronchodilators and anti-inflammatory drugs). Its main advantages are rapid and fast onset of action, delivery to target organ, therefore fewer side effects.

There are three main types of inhaler devices:

1. Metered- dose inhalers also called MDIs or aerosol inhaler. MDIs are commonly used and prescribed because of availability and are relatively affordable compared to the other types.(5) The disadvantage is that it has many steps and needs coordination.(6)
2. Dry powder inhalers which include Turbuhaler, Accuhaler, Rota haler, Ellipta, Breezhaler.
3. Respimat device or soft mist inhalers.

Challenges in use of inhaler devices

Reported prevalence of incorrect inhalation technique among asthma patients vary from 27 to 89%.(7) For this reason, clinical practice guidelines for asthma and COPD consider the training to use inhalation devices as an essential part of non-pharmacological aspects of treatment. For the same reason European Respiratory Society and the international society for aerosols in medicine recently developed a consensus statement for the pulmonary physician that includes detailed recommendations on how to use inhalational devices correctly (8).

Poor inhalation technique is not only common among patients but reports also reveal poor technique among the health care professionals. Since HCPs are tasked with teaching patients to use inhalers, poor inhalation technique among HCPS themselves may result in patients receiving incorrect training and advice. A study done at two major academic hospitals in Saudi Arabia by Hamdan Al-Jahadali et al(9) on inhaler technique found that 60% of the patients had physician regular follow up. Among the participants, 44.5% reported to receive education from physicians, 7.8% from asthma educators and 4.7% from pharmacists. Notably, 36.7% had 3 and more visits to the emergency department per year. An unpublished study done at Muhimbili national hospital by Kilima M, et al on use of MDIs among asthma patients reported incorrect MDI use in 97.1% of the participants. In this study, 64% of the participants reported to have received training on inhaler use from doctors, 20% from nurses, 12% from pharmacists and 2% from non-HCPS.

In clinical practice, it is important to maximize the opportunities to deliver this education across the spectrum of healthcare settings. Every healthcare provider involved in asthma management needs to take the opportunity to educate patients on asthma and its management including inhaler technique.

Both knowledge and skills are important components that constitute HCPs' competence in clinical practice. Knowledge refers to learning concepts, principles and information regarding a particular subject, while skills refer to the ability of using information and applying it in a specific context. Competence is achieved when HCPS possess the knowledge and skills required to provide direct care to patients.

1.2 Literature Review

Knowledge on asthma

In a study done in the United States of America by Jansen et al (10) showed that a significant number of doctors were unaware of the pathophysiology and treatment modules of asthma. The specialists in general were more knowledgeable on asthma, more likely to diagnose asthma objectively 27% of primary care doctors used spirometry while 73% of specialists used spirometry, and followed guidelines as compared to primary care doctors.

In sub-Saharan Africa, a study done in Nigeria (11) to assess knowledge of asthma among doctors revealed that 80% recognized the pathogenic significance of bronchospasm in exacerbation while 59% considered chronic inflammation as a significant factor in pathogenesis. However, knowledge of GINA guidelines for asthma management was poor with up to 58% of the view that Aminophylline was the first line agent in exacerbation.

Still within the African continent, in Ghana a study done by Hesse et al (12), among newly qualified doctors to assess the knowledge on asthma found insufficient knowledge on pathophysiology of asthma, not using standard drugs and being unaware of international guidelines, up to 94% used intravenous Aminophylline for severe asthma. Nebulizer bronchodilators were not well known with only 21% of the participants reported to have ever prescribed them. For chronic asthma care, 65% reported to have prescribed inhaled bronchodilator and only 35% put their patients on inhaled anti-inflammatory medication.

In the study by Basheti et al (13) in Jordan on Inter-professional education studying association between asthma knowledge and inhaler technique done in both public and private facilities found that nurses lacked adequate knowledge of asthma and inhaler technique demonstration skills. Pharmacists also scored fairly low and this was attributed to missing of the practical element on the current standard educational training on correct use of inhalers in a representative Jordanian faculty of pharmacy.

Inhaler demonstration skills

A study done in Spain among physicians to assess the level of knowledge, attitude and preference related to inhaled therapy revealed that 85.8% of HCPS had poor inhaled therapy knowledge, 14.2% had adequate knowledge. The super specialist such as pulmonologist and allergists scored better than the primary care doctors and the internal medicine doctors

(14). Another study done in Spain by Jordi G et al, (15) among nurses on knowledge and attitude about inhaled therapy showed that general level of knowledge regarding the use of inhalation devices is low among nurses, in which only 14% had adequate knowledge about inhaled therapy. It was surprising that 23% stated that their knowledge came from personal experience and that only 37.6% indicated that their source was scientific literature and meetings. This reflects lack of formal training and may explain the poor results, highlighting the need for educational training to be included in undergraduate programmes.

In a survey among Swiss physicians, 90% of all Swiss physicians declared being personally involved in educating their asthma patients using an inhaler device. Of those who implemented patient education and inhaler training themselves, most made usage of a second education layer by either handing out a descriptive flyer, requesting additional training by their practice assistant, recommending to read the package insert, directing the patient to the pharmacist for training or indicating other external resources such as a Web link. The physicians who did not educate their patients themselves, delegated inhaler training to either their practice assistant or the pharmacist and/or distributed a handout or recommended reading the package insert. However, Patient skills with regard to inhalation technique and effective inhaler handling were generally not monitored on a regular basis. Only 34.0% of all participating physicians declared systematically checking inhalation technique at the follow-up visit. (16)

In a study by Shubhakaran Sharma et al,(17) on the knowledge, attitude and practices of inhalational therapy among nursing staff posted at tertiary care teaching hospital, 34% could not mention a single side effect of inhalational therapy, 51% always assessed the patient for correct inhalational technique every time and 61% always trained the patient for correct inhalational technique. Those who responded indicated that knowledge came from attending clinical meeting, courses or workshops 47%. For 26% it came from clinical personal experience and common sense and in 18% it came from reading articles or specialized books or device leaflets. The findings revealed that total knowledge about steps for correct inhalation was at an unsatisfactory level. This finding was attributed to a possibility that the nurses may have not attended the training program and workshop regularly.

A cross-sectional study done by Emadia Mohammed et al in 2013, which was assessing both theory and practical aspect of MDI and spacer use among HCPS in a pediatric hospital in Riyadh Saudi Arabia consistently showed a lack of skill in using the MDI and spacer device by the healthcare providers. Where 16.6% had good knowledge and demonstrated good skills, 44.4% had fair knowledge and skills while 39% had poor knowledge and skills on the device.(18)

In a prospective interventional study among healthcare professionals in a Nepalese Teaching Hospital by Kishore.P.V. et al, which evaluated doctors, nurses, pharmacists and interns on their knowledge on MDI found that knowledge was poor and was cutting across in all fields. Post intervention assessment showed marked improvement thus amplifying the need of continuous education among healthcare workers. (19)

In a study evaluating the skills on correct use of metered-dose inhalers by healthcare professionals and medical students in Gauteng province, South Africa (20), found that only 16% of all participants were able to perform the technique correctly. Among the healthcare professionals 57% reported they did not observe patients MDI technique. 40% admitted to never demonstrating the technique to patients, while 50% stated that they routinely

demonstrated the technique; the study showed poor techniques by HCPS which translated to incorrect MDI technique being taught to patients. Among the participants, 45% felt it was the doctors sole responsibility to educate the patients while, 21% were of the opinion that this was the nurses' responsibility, the remaining expressed it was all HCPS involved in care should educate the patient. The authors recommended that all teaching institutions, departments of internal medicine and emergency medicine should have educational programs in place dedicated to teach correct techniques to HCPS and patients. They should be familiar with treatment protocols for patients on inhaled therapy and placebo device be accessible to all hospitals to enable HCPS to demonstrate to patients.

A study conducted in Ethiopia(21) on competence in metered dose inhaler technique among dispensers reported that healthcare providers' skill in the MDI technique among pharmacists and druggists was found to be very poor. None of them were able to perform all steps correctly indicating the need for establishing regular educational programs for health care providers. Moreover, the authors suggested research on the effect of health professionals dispensing advice on patients' treatment outcome. Continuous reinforcement among the professionals was found to be necessary, to make them realize the importance of asthma education and training which will ultimately enhance the patient care quality.

1.3 Statement of the problem

Asthma continues to be a major cause of morbidity and mortality worldwide. Poorly controlled asthma is a significant burden, as it increases costs, to both the patient and the country.

Inhalers are the mainstay of asthma treatment, yet assessment of inhaler technique reveals limited expertise not only among patients but also health care professionals. Prevalence of incorrect inhaler technique is as high as 89% around the world, with higher prevalence in our setup of 97.1% among patients attending MNH clinic.

Several factors have been attributed to poor inhaler technique. There are patient related factors such as old age which is accompanied by frailty and diseases such as osteoarthritis or Parkinsonism that cause difficulty with using inhalers. Type of devices used to deliver inhalational medications also does matter because some of them involve many steps for the patient to remember. and healthcare workers factors (lack of training during medical school, lack of practicing skills while at work due to high number of patient ratio, and attributing not demonstrating as not part of their job description.)

In asthma management, 10% is medication and 90% is education.

There are several studies in literature on knowledge of asthma and incorrect inhaler technique among healthcare professionals but in Tanzania such information is lacking.

1.4 Rationale

Information about knowledge on asthma and its management including appropriate use of inhaler devices among HCPS is lacking in our set up. There is need to address this knowledge gap. Correct use of inhaler device is fundamental for effective drug delivery and to improve the quality of asthma care.

Knowledge on asthma and of inhaler technique among health care professionals would be passed to patients leading to treatment success.

Optimizing therapy delivery by correct inhaler use technique can help avoid unnecessary escalation of treatment which is associated with unwanted side effects and misplacement of health care resources.

This study aspired to contribute in reducing the burden of chronic respiratory diseases by shedding more light on inhaler technique, which is a fundamental aspect of not only asthma therapy, but other chronic respiratory diseases as well.

1.3 Conceptual Framework

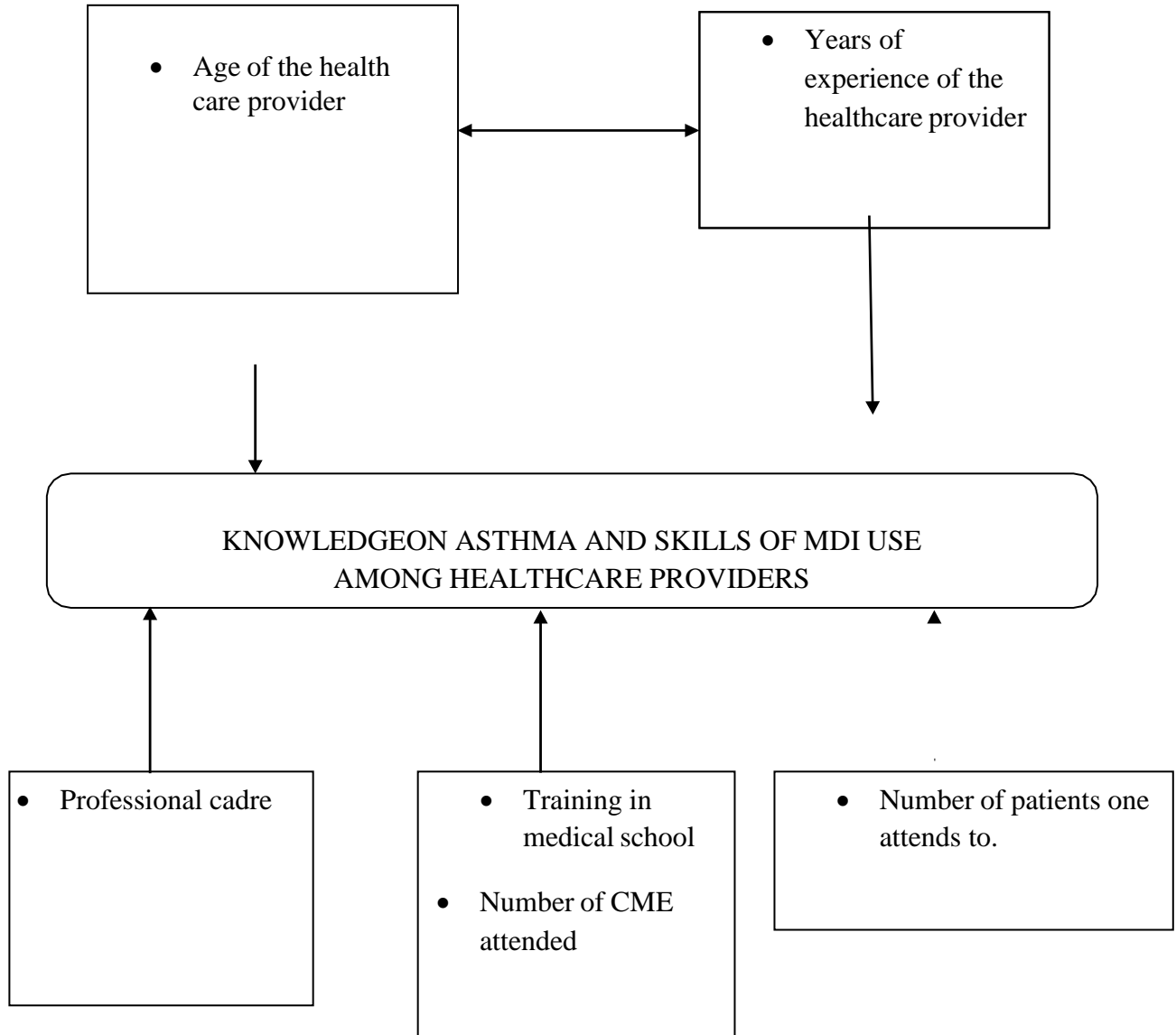


Figure 1: Conceptual Framework

Several factors impact the knowledge on asthma and skills of metered-dose inhaler use among the health care providers. The factors include age, years of experience, training in medical school or CMEs, the professional cadre and number of asthma patients one attends to.

1.4 Research Questions

- i. What is the level of knowledge on asthma among healthcare professionals at healthcenters and regional referral hospitals in Dar es Salaam?
- ii. What factors affect level of knowledge on asthma among HCPS at health centers andregional referral hospitals in Dar es Salaam?
- iii. What is the level of skills on MDI use among healthcare professionals in health centersand regional referral hospitals in Dar es Salaam?
- iv. Is there a relationship between knowledge on asthma and inhaler technique?

1.5 Study Objectives

1.5.1 Broad objective

To assess knowledge on asthma and metered dose inhaler use among HCPS at health centers and regional referral in Dar es salaam

1.5.2 Specific objectives

- i. To evaluate the level of knowledge on asthma among HCPS at health centers andregional referral hospitals in Dar es Salaam.
- ii. To determine factors affecting knowledge on asthma among HCPS at health centersand regional referral hospitals in Dar es Salaam.
- iii. To assess skills on inhaler use among HCPS at health centers and regional referralhospitals in Dar es Salaam.
- iv. To determine the relationship between asthma knowledge and MDI technique.

1.6 Study Hypothesis

It is hypothesized that knowledge on asthma and use of metered-dose inhaler among healthcare professionals at regional referral and health centers in Dar es Salaam is poor.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Design

A cross-sectional, multi-sites hospital-based study.

3.2 Study Setting

The study setting was conducted at regional referral hospitals (Amana, Mwananyamala and Temeke) and health centers (Sinza palestina and Kigamboni) in Dar es Salaam. The facilities picked were a representation of all the districts in Dar es Salaam city covering for the population in their respective municipalities.

Asthma patients were seen at the emergency department and outpatient clinics. Most of the facilities had no separate emergency department; staff allocated at the internal medicine department rotates between the two areas.

Number of HCPs at each facility Mwananyamala. Amana, Temeke, Sinza District and Kigamboni at the 3 departments (Internal medicine, pediatric, emergency department) were approximated to be 50, 45, 45, 15, 15 respectively. This approximation was as per the data of HCPs in each facility from medical officer in charge office.

3.3 Study Population

Health care professionals included medical specialists, medical doctors, nurses, clinical officers, interns, pharmacists and pharmacy assistants.

3.3.1 Inclusion Criteria

- i. Consent to participate
- ii. Current practice at the regional referral and health centers outpatient and inpatient.
- iii. Working in departments dealing with asthma patients –internal medicine, pediatric and emergency departments, pharmacy.

3.3.2 Exclusion Criteria

- i. None

3.4 Sample Size Calculation

Sample size was calculated using the Kish Leslie formula below: $n = \frac{Z^2 P [1-P]}{E^2}$

Where:

n = Sample size

P = Prevalence of MDI incorrect technique from a study by done in Gauteng South Africa. (16%)

E = Maximum acceptable error = 0.05 $n = \frac{1.96 \times 1.96 \times 16(100-16)}{0.05 \times 0.05}$

n = Hence Sample size is 206

Then using the correction formula for a finite population to acquire a feasible sample size, the approximate total population of HCPS at Mwananyamala. Amana, Temeke, Sinza District and Kigamboni at the 3 departments (Internal medicine, pediatric, emergency department) to be 50, 45, 45, 15, 15 respectively making it a total of 170.

Proportion of HCPS at Mwananyamala, Temeke, Amana: $50/170 \times 100 = 29.4\%$ Proportion of HCPS at Sinza and Kigamboni: $15/170 \times 100 = 8.8\%$

N = 170

n = 206.

NC = corrected sample size

$$N_c = \frac{n}{1+n/N} = \frac{206}{1+206/170}$$

Nc = 93

Based on the proportion of the population, recruited HCP from Mwananyamala, Amana and Temeke will be:

$29.4/100 \times 93 = 27$ participants from each facility.

From Sinza and Kigamboni will be:

$8.8/100 \times 93 = 8$ participants from each facility.

The minimum sample size for this study was 93 participants which was achieved. Furthermore, 21 more participants were recruited in the study to bring the total sample size of the study to 114.

Purposeful sampling was done recruiting majority of participants to be medical practitioners followed by nurses with least numbers to pharmacist.

3.5 Study Procedure and Data Collection Instruments

All participants underwent interviews. Demographic characteristics such as age, sex, years of experience, history of having received education or training on inhaler use technique in the past, time since last education on inhaler use technique , profession (physician, medical officer, clinical officer, Pharmacist, Pharmacy assistant, nurse) were recorded.

Participants were also asked to self - complete a HCP asthma knowledge questionnaire (HQ).The HQ comprises of 18 true/false questions about asthma and its treatment. The questions are universal and applicable to all healthcare professionals as they are formulated using the current GINA guidelines as published by Kritikos et al.(23) Each correctly answered question was awarded one point. Question not attempted or wrongly answered got zero point. HQ score is therefore presented as a score of correctly answered questions out of 18. A score of 13 or higher as per the HQ was regarded as a high score and meant the individual had adequate knowledge, a score of 12 or lower was regarded as a low score and meant the healthcare professional had inadequate knowledge.

Inhaler technique was assessed using a previously published check list.(24) . The checklist comprises of 12 steps. The participant's inhaler technique was assessed using placebo inhalers. Participants were given a score out of 12, corresponding to the number of steps correctly completed. Incorrectly performed step or steps not performed scored as zero. They were judged as good technique if all steps were correctly done and as poor technique if missed on any step. The investigator was the sole observer for the study.

After completion, participants were educated on the correct MDI technique.

3.6 Data Analysis

The questionnaires and the checklist were reviewed for consistency and appropriate coding prior to data entry. Data was analyzed using SPSS software version 23. Data was presented as mean (SD) for continuous variables such as knowledge mean scores and inhaler technique scores and as percentages for categorical variables. The dependent variable was the HCPS asthma knowledge or inhaler technique and the independent variables were the age of the healthcare worker , sex, years of experience ,training on asthma and inhaler and demonstrates to patients .Comparison of categorical variables between groups was performed using Chi-square tests. One way (ANOVA) was used for comparison of the mean asthma knowledge score and the mean inhaler technique score between cadres of the healthcare professional. Median scores of those with adequate knowledge was compared to the median score of those with inadequate knowledge and performance of the two groups on inhaler technique was assessed. Mann- Whitney U-test was used .This was because after summing up all scores the distribution of these values was assessed and found to be not normally distributed hence median was used. A P value of < 0.05 was considered as statistically significant.

3.7 Ethical Issues

Approval to conduct the study was obtained from MUHAS Ethical Review Board. Permission was also obtained from District medical officers of each health facility. Each participant signed and provided a written informed consent (appendix I) before they were enrolled in the study. The study was anonymous and questionnaires and check list had no names of the participants. HCPS with incorrect technique were instructed on correct MDI technique.

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-demographic characteristics of participants

The socio-demographic and professional characteristics are tabulated below where in a total of 114 participants, 96/114 (84.2%) were from regional referral hospitals and 18/114 (15.8%) were from health centre facilities. Male were 55.3% and female 44.7%. Majority 65/114 (57%) were medical doctors and young'61/114 (53.5%) in the age group of 21-30years. Majority of the participants (59.6%) had work experience of less than 5 years.

Table 1: Participants socio-demographic and professional characteristics N=114

Variable	Categories	Frequency (n)	Percentage (%)
Age group (years)	21 – 30	61	53.5
	31 – 40	33	28.9
	>40	20	17.5
Sex	Male	63	55.3
	Female	51	44.7
Health care cadre	Pharmacy Technicians	5	4.4
	Pharmacists	8	7.0
	Clinical Officers	6	5.3
	Nurse	22	19.3
	Medical officers	65	57.0
	Medical specialist	8	7.0
Work experience	< 5 years	68	59.6
	5 – 10 years	21	18.4
	>10 years	25	21.9
Training on asthma and inhaler technique	No	61	53.5
	Yes:	53	46.5
Time since last training*	≤ 6 Months	7	13.2
	7 – 12 Months	14	26.4
	>12 Months	32	60.4
Demonstrate inhaler use to patients	Yes	66	57.9
	No	48	42.1
Availability of placebo inhalers in the place of work	Yes	0	0.0
	No	114	100.0
Facility level	Health centers Regional	18	15.8
	referral	96	84.2
Participants' opinions as whose role is teaching inhaler technique to patients	Medical Specialist	7	6.1
	Medical Officer Clinical	40	35.1
	Officer	4	3.5
	Nurse	10	8.8
	All health care providers	24	21.1
	Pharmacist	25	21.9
	Pharmaceutical Technician	4	3.5

*Variable has less than total due to it being a subset.

4.2 Level of knowledge among healthcare professionals

Among 114 healthcare professionals, 28 participants (24.6 %) had adequate knowledge on asthma while 86 participants (75.4%) had inadequate knowledge.

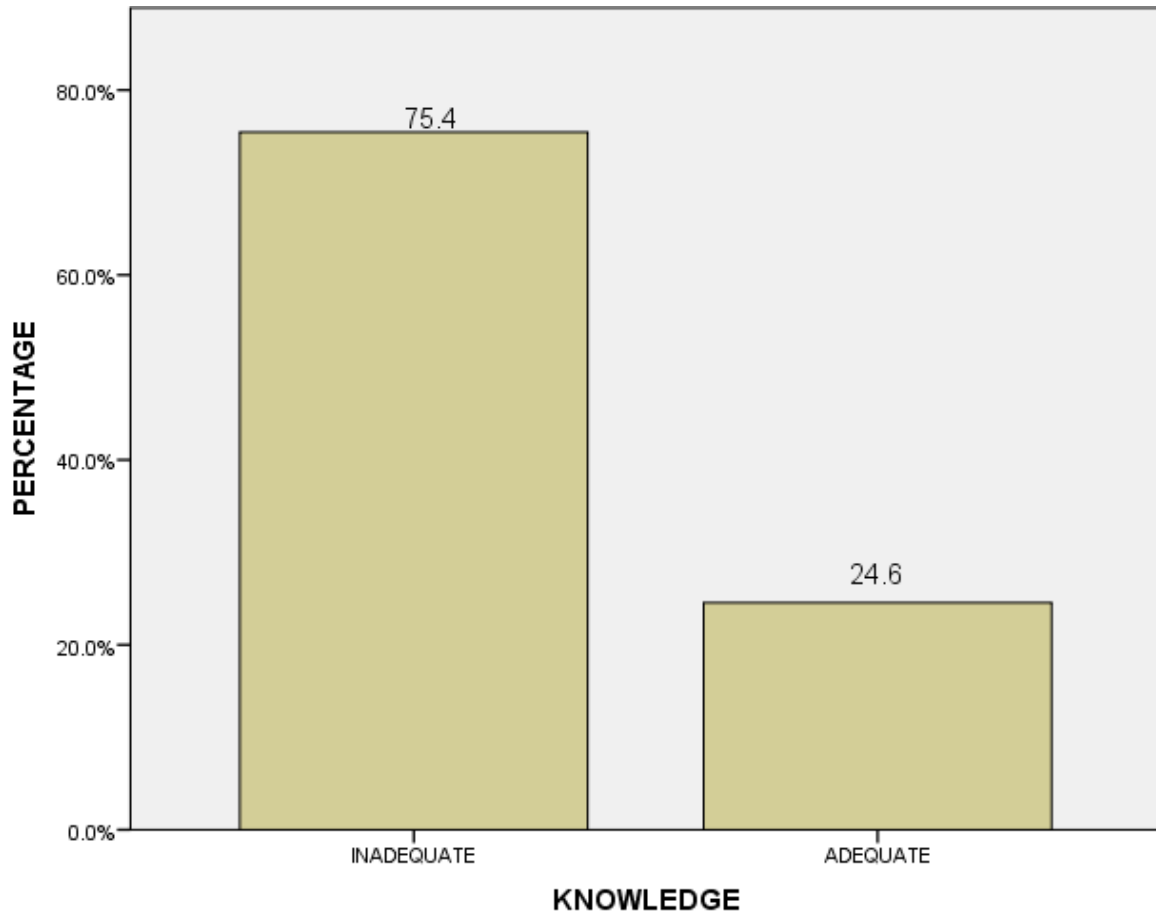


Figure 2: Level of knowledge on Asthma among healthcare professionals

4.3 Asthma knowledge means scores among Healthcare professionals

The figure below shows the mean scores out of 18 on asthma knowledge among the healthcare professional

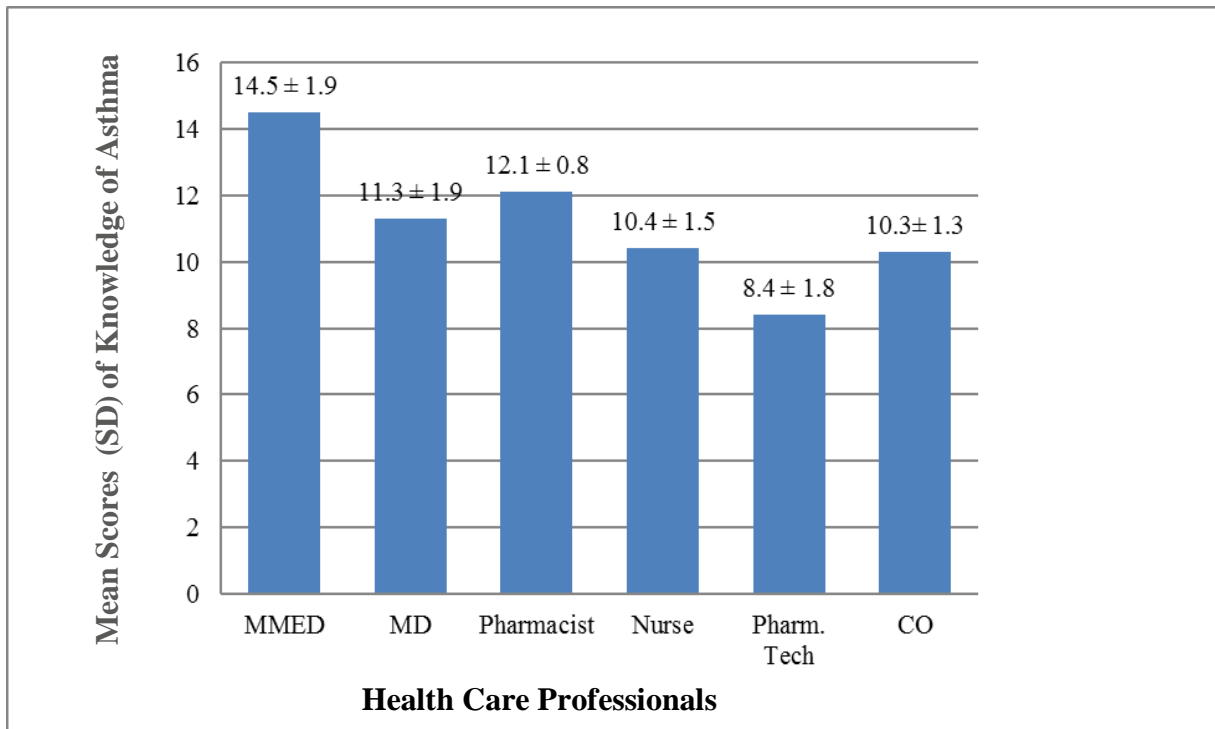


Figure 3: Mean scores of asthma knowledge among healthcare professionals

There was a statistically significant difference in mean scores for asthma knowledge between HCPS cadres as determined by one-way ANOVA ($F(5, 9.7) = 8.3$, $p < 0.001$). In the post hoc analysis, using medical specialists as the comparator, The mean score for asthma knowledge for medical specialists was statistically significantly higher than that of the medical doctors, ($p < 0.001$), the nurses ($p < 0.001$), pharmacy technicians ($p < 0.001$) and clinical officers ($p < 0.001$). Using other cadres as the comparator did not show any significant difference.

4.4 Health care workers' skills on inhaler use

Among 114 participants, only 5 (4.39%) did all the steps of inhaler use correctly. Of the 5 who did all steps correctly, 2/5 (40%) were medical specialists, 2/5 (40%) were medical officers and 1/5 (20%) was a clinical officer. No nurse or pharmacist was able to perform all the steps correctly, (Figure 4).

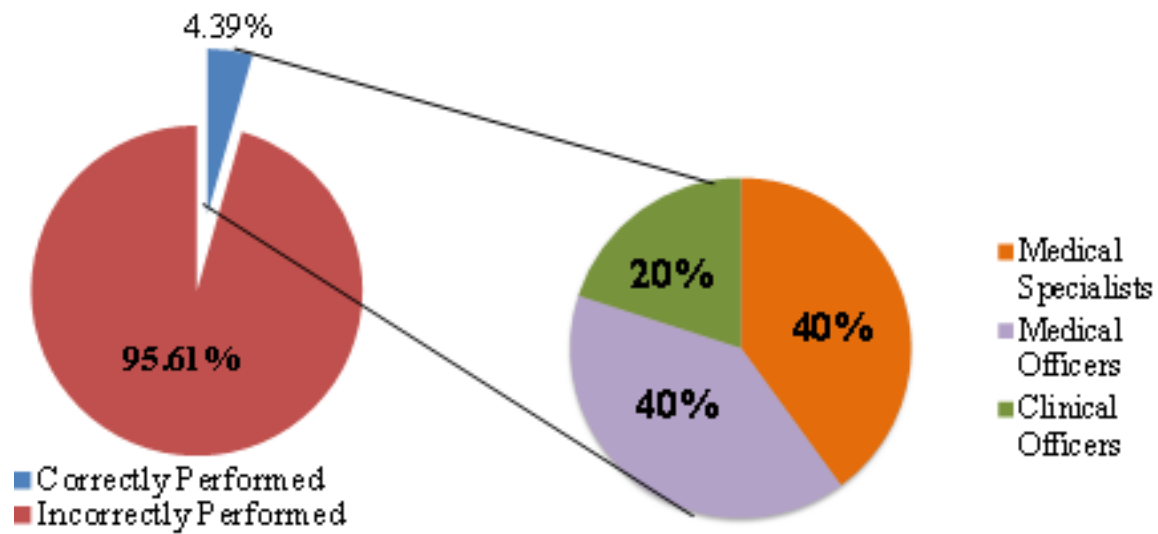


Figure 4: Demonstration of Inhaler use among HCPs

4.5 Stepwise demonstration of inhaler use

Healthcare workers were asked to demonstrate the steps of inhaler use. More than a quarter 33/114 (28.9%) of the healthcare workers forgot to remove the cap while 26/114 (22.8%) held the device upside down. Only 7% breathed out initially, 7.9% remembered to take a breath before actuation and only 37.7% held their breath for 6 to 10 seconds after drug inhalation. No step was 100% performed by all participants, (Figure 5).

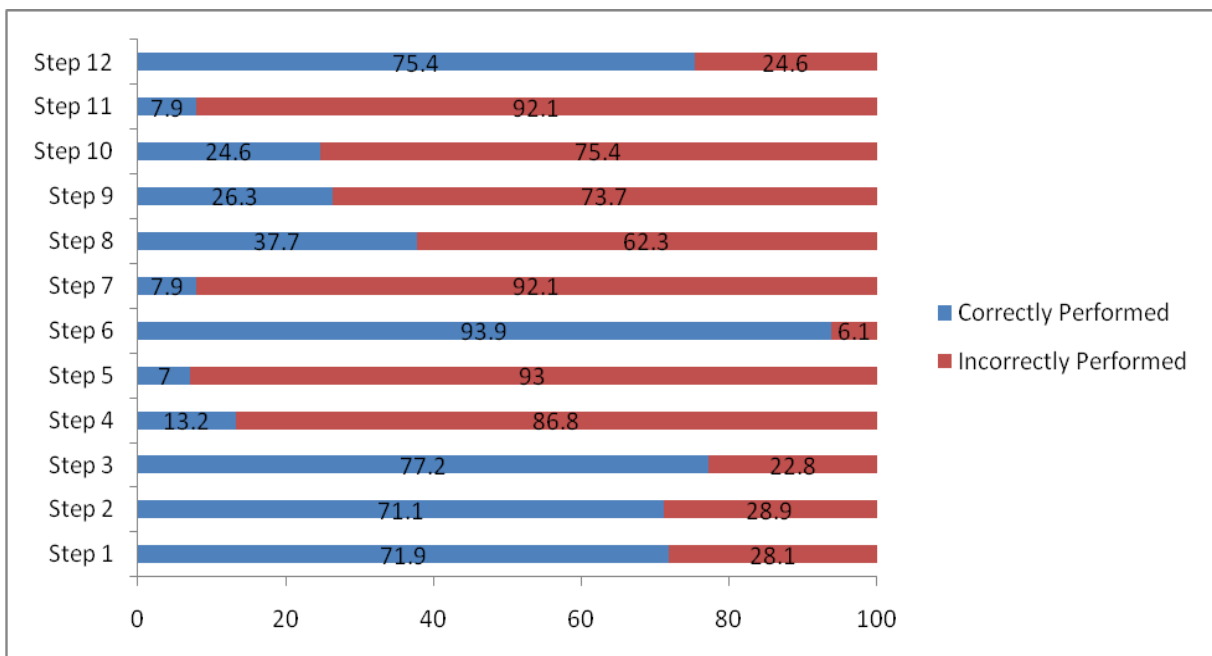


Figure 5: Health care workers' percentage performance of steps of inhaler use technique

STEPS IN USING METERED-DOSE INHALER

Step 1: Shake the content well
Step 2: Remove the cap

Step 3: Hold inhaler upright

Step 4: Tilt the head back slightly
Step 5: Breath out slowly

Step 6: Put the inhaler in mouth with lips tightly sealed around it.

Step 7: Breath in slowly and deeply through the mouth and then actuate the canister once

Step 8: Hold breath for 10-20 seconds

Step9: Exhale and wait for 1minute before the next dose.

Step 10: Breath in slowly and deeply through the mouth, actuate the canister once Step 11:

Shake the contents before the 2nd dose

Step12: Recap the inhaler

4.5 Relationship between knowledge on asthma and inhaler technique score

Participants with adequate knowledge on asthma presented with a significantly higher median score of 6 on inhaler technique demonstration compared to those with inadequate knowledge on asthma who had a median score of 5 $p=0.02$, (Figure 6)

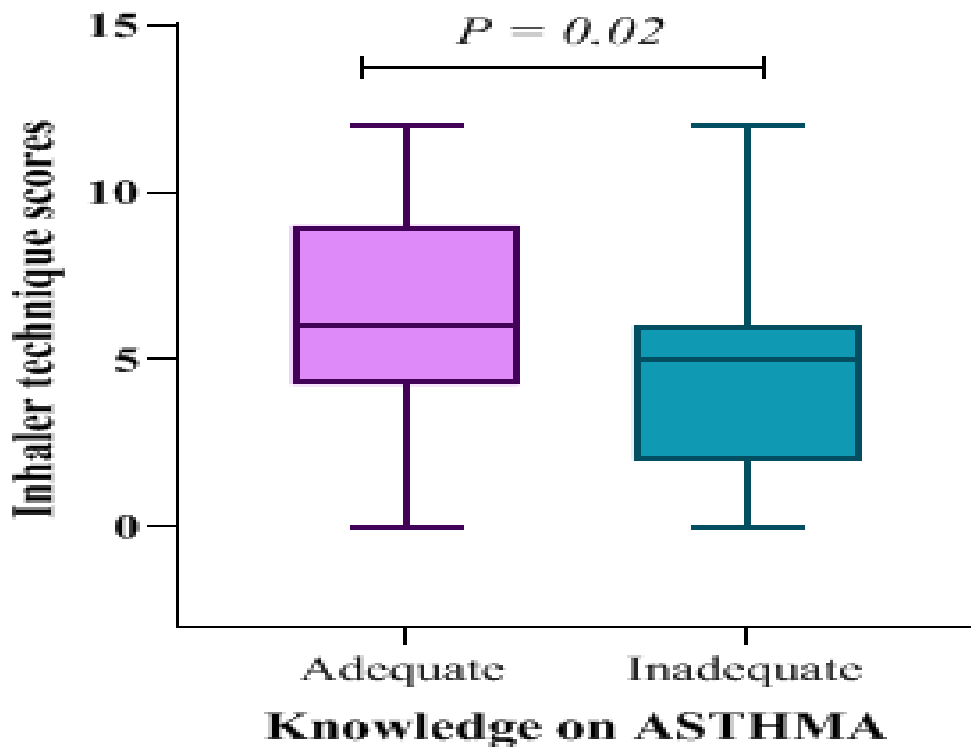


Figure 6: Relationship between knowledge on asthma and inhaler technique scor

4.6 Factors associated with knowledge on asthma

Participants aged more than 40 years presented with more people (45%) who were knowledgeable on asthma than were participants aged 31-40 (27.3%) or 21 to 30 years (16.4%), ($p = 0.039$). Majority of the medical specialists (75%) had adequate knowledge on asthma compared to pharmacists (37.5%) and nurses (4.5%) ($p = 0.002$). There was no significant difference on knowledge on asthma with regards to participants' sex, years of experience, previous training on inhaler use or demonstration of inhaler use to patients.

Table 2: Factors associated with the knowledge on asthma

Knowledge on asthma				
Variable	Categories	Adequate knowledge (%)	Total number of participants (100%)	P-value
Age	21-30	10(16.4)	61	0.039
	31-40	9(27.3)	33	
	>40	9(45.0)	20	
Sex	Male	17(27.0)	63	0.504
	Female	11(21.6)	51	
Profession	Medical specialists	6(75.0)	8	0.002
	Medical officers	17(26.2)	65	
	Pharmacists	3(37.5)	8	
	Nurses	1(4.5)	22	
	Pharmacy technicians	0(0.0)	5	
	Clinical officers	1(16.7)	6	
Experience	<5yrs	12(17.6)	68	0.075
	5-10yrs	6(28.6)	21	
	>10yrs	10(40.0)	25	
Training on asthma and inhaler Technique	Yes	14(26.9)	53	0.592
	No	14(22.6)	61	
Time since last training	<6months	0(0.0)	7	0.292
	7-12months	4(28.6)	14	
	>12months	10(31.2)	32	
Demonstrate To patients	Yes	17(25.8)	66	0.728
	No	11(22.9)	48	

4.7 Inhaler technique mean scores among healthcare professionals

Figure 7 shows mean scores for the inhaler skills among different healthcare professionals cadres. The medical specialist scored the highest (mean score 10 ± 1.5) followed by pharmacist (mean score 7.4 ± 2.1) while the nurses scored the lowest (mean score 3 ± 2.1).

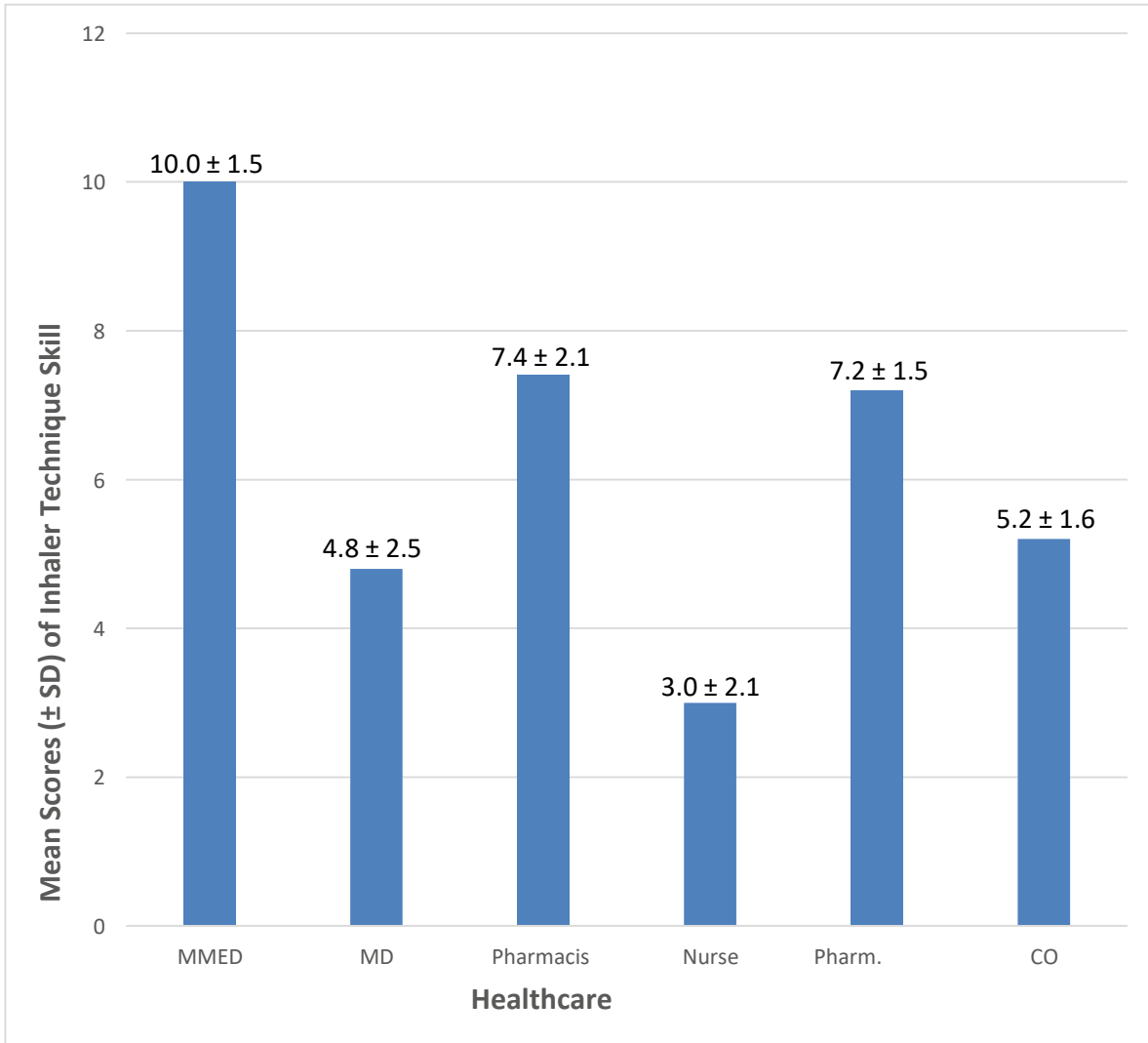


Figure 7: Comparison of inhaler use mean scores among healthcare professionals

There was a statistically significant difference in mean scores for inhaler technique between HCPS cadres as determined by one-way ANOVA ($F(5) = 11.5$, $p < 0.0001$). In the post hoc analysis with medical specialists as the comparator, it was shown that Medical specialists' mean scores for inhaler technique was significantly higher than that for medical doctors ($p < 0.001$), and that of the nurses ($p < 0.001$). Comparisons with other cadres as comparator did not show any significant difference.

CHAPTER FIVE

5.0 DISCUSSION

This study found that 75.4% of HCPS in health centers and regional referral hospital in Dar es Salaam had inadequate knowledge on asthma. Among all HCPS, Medical specialists were more knowledgeable to asthma with mean scores of 14.5. HCPS with age above 40 years were significantly knowledgeable to asthma. Medical specialists also had the highest mean score (10) for inhaler technique. Only around 5% of the participants could perform all the steps on inhaler technique correctly. Participants with adequate knowledge on asthma significantly presented with a higher median score for inhaler techniques than were participants with inadequate asthma knowledge.

5.1 Knowledge on asthma

In the present study, only a quarter of participants (24.6%) had adequate knowledge on asthma. This finding is partly explained by lack of training on asthma as more than half of the participants (53.5%) reported to having not received any training on asthma and inhaler technique. In the present study, HCPS in the age group of 21-30, which covers most of the new employees in the health care field had the least proportion (16%) of members with asthma knowledge, implying that either the training in medical schools were inadequate or years of experience in service do matter. Poor asthma knowledge was also reported in Ghana amongst newly qualified doctors. In the Ghana study too, the medical specialists had the best performance as was the case for the present study (25). Best scores among medical specialists can be attributed to the fact that the medical specialists had received additional training while doing their post graduate programmes. In the present study nurses performed poorly in terms of asthma knowledge and inhaler technique. This poor performance among nurses is alarming as most doctors rely on nurses for provision of health education to patients.

Much as it is understood that nurses might have not received training in nursing school, one would expect a nurse caring for asthma patients on daily basis be well informed of asthma and its management. It has been reported that understaffing might lead to involvement of nurses to many other tasks that are not directly based on patients' management thus leading to lack of knowledge and skills (26). Similar findings were reported in Jordan whereby medical specialists had the best performance amongst all cadres, while the nurses recorded poor performance (27). Nurse knowledge on asthma and its management is very important as patients derive most of their self-care knowledge from nurses. (28)

5.2 Inhaler technique

In the present study only about 5% of participants had good inhaler technique. Medical specialists scored the highest and nurse the lowest. A study done in Nepal(19) reported none of the HCPS could perform all the steps correctly. In the Jordanian study(13), it was reported that only 22.5% of all the HCPS did all the steps of inhaler technique correctly .Better performance was seen among specialists (50%) of those who did all the steps correctly, and their inhaler technique mean scores was highest than all cadres. This has been attributed to having more experience and having received extra education during master's program. Nurses' poor performance (lowest mean score of 3) as seen in our study has been reported in other studies as well. In the Nepal study done among HCPS, to check the inhaler technique, nurses had the least performance score. Another study done in India to check knowledge, attitude and use of MDI among nurses only reported unsatisfactory results (29). This poor performance among nurses has been attributed to having more work load and a high patient to nurse ratio in most facilities (30), other reasons given include lack of training and regarding management of asthma to be a doctor's role. Knowledge of nurses in this regard is very vital as they attend to patients once admitted and they have the most exposure time with them.

For proper delivery of the medication to the lower respiratory systems, all the steps have to be performed correctly. Steps 6-8 need hand mouth coordination and are mostly missed. In the present study, it was noted that only 7.9% of the participants performed the step that requires breathing in slowly then actuating the canister once. The Indian study had similar findings

with the step that requires to breath in slowly then actuate as the most poorly performed step(19) while a study done in Turkey found the step of holding breath for 10 seconds was improperly performed by majority(31). The use of spacers especially in children and elderly had reduced these errors which require coordination.(31) Commercially available spacers are expensive and in a developing country like Tanzania, use of improvised spacers could be advised.

5.3 Training impact

In the present study than half (53.5%) of the participants had never received any training on asthma yet they were caring for asthma patients daily. Among those who received training, 60.4% reported having received training recently within the past 1 year. Although in the present study all the participants were trained on inhaler use technique, they were not followed up for assessment of training retention; Training has been found to be beneficial in other settings. In the study done in Nepal where none of the HCPS performed all the steps correctly, one week post intervention, 1 doctor, 4 intern doctors and 8 nurses out of the 101 participants could perform all steps correctly (19). Also the mean scores improved post intervention (pre-intervention was 4.44 and post intervention was 7.68). In the Jordanian study,(27) post training assessment and 4 months post training follow up noted that those who attended the workshop performed better with scores of 7.65 compared to those who did not attend the workshop training with scores of 5.99 at 4 months. Rebuck et. al, wanted to find out if structured education versus none was sufficient to teach postgraduate physicians on inhaler skills and if this would be sustained over a long period. At 8 months follow up, improvement from baseline of 42% to a score of 59% was noted in the questionnaire score. The mean demonstration score was significantly higher in the intervention group at follow up with score of 68% compared to a score of 39% at baseline and a score of 44% in the control group (32). This is to assume that the HCPS would perform better after the training given but this would require a follow up study in the future.

5.4 Demonstration to patients

Demonstrating the inhaler use technique to asthma patients is part of long term management of these patients. HCPs should abide to this practice. In the present study, 58% of the HCPS reported to be demonstrating inhaler technique to the patients. Those who demonstrated the technique had better inhaler mean scores of 6.71 compared to those who did not demonstrate who had a mean score of 2.97. This could mean that those who had the skills were confident enough to demonstrate to their patients and those who had no skills shy away from demonstrating. This also means that regular practice makes the art perfect. In the South African study, only 40% of the study participants demonstrated to their patients (20) while a survey done in Japan showed only 17.1% of patients reported to receive demonstration guidance from the physician (33).

5.5 Role of educating patients on asthma and inhaler technique

It is not certain whose role is to educate the patient on inhaler technique. Is it a clinician's responsibility or nurse's or pharmacist's? In the present study only 21% of the HCPS felt it is the responsibility of all HCPS dealing with asthma patients to educate them on asthma and inhaler technique while 35% felt it's the attending doctors' responsibility to teach them and 22% felt it's the pharmacists' responsibility. Similar findings were noted in the South African study, where 45% felt it was the treating doctor alone while 22% felt it was the nurses' responsibility (20).

It is the responsibility of all HCPS who come into contact with asthma patients to offer education on inhaler technique. However, there should be a clear task allocation among these healthcare worker cadres as to who will teach what or else there will be no training at all as everyone will assume the other has done it.

5.6 Study Strength

First study in Tanzania to assess knowledge on asthma and inhaler use amongst healthcare practitioners of different cadres.

This study was conducted at multiple sites, different healthcare facilities to acquire a more general outlook on the findings in Tanzania.

5.7 Study limitation

This study was conducted in public health facilities only thus limits its generalizability to private facilities.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Knowledge on asthma is generally poor among HCPS in Dar es Salaam. Factors such as age of more than 40 years and advanced professional cadre, was positively associated with adequate knowledge. Only about five percent of HCPS could perform all the steps of inhaler technique correctly. None of the health facilities had placebo inhalers for patients' training on inhaler technique.

6.2 Recommendations

It is recommended that

- i. Asthma and inhaler use should be taught to all cadres of HCPs in schools in detail including practical demonstration on the inhaler use.
- ii. Hospitals should conduct frequent continuous medical education (CMEs) which will include practical demonstrations to all HCPS in all cadres dealing with asthma patients.
- iii. Provision of placebo inhalers to HCPS for practice amongst them and for demonstration to their patients

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APPENDICES

Appendix I: Informed Consent Form

CONSENT TO PARTICIPATE IN THE STUDY ON ASSESMENT OF ASTHMA KNOWLEDGE AND METERED-DOSE INHALERS AMONG HEALTHCARE PROFESSIONALS HEALTHCENTRES AND REGIONAL REFERRAL HOSPITALS IN DAR ES SALAAM.

NAME _____

CONTACT _____

AGE _____

Dear Sir/Madam,

My Name is Dr. _____, Me and Dr. Aisha Ahmed, a resident doctor in the department of Internal Medicine at Muhimbili University of Health and Allied Sciences (MUHAS) conducting the above study as a requirement for partial fulfillment of Dr. Aisha Ahmed's postgraduate programme.

Purpose of the study:

This study aims to determine the level of asthma knowledge and use of metered-dose inhalers among healthcare workers.

How to participate:

Participants who are willing will fill given questionnaires and demonstrate inhaler use technique using placebo inhalers.

Confidentiality:

Your name is not going to appear anywhere in the questionnaires. Information shall not be shared with any other party; data will be presented as anonymous.

Costs:

There is no any form of enumeration for your participation in this study. .

Voluntary participation and the right to withdraw from the study:

Your participation is voluntary and you have the right to withdraw from participating in this study at any time without any consequences...

Risks involved with participation: None.

Benefits:

Your participation will help us understand the level of asthma knowledge and skills among healthcare providers and suggest remedial measures to the government. You will also get an opportunity to refresh your knowledge on inhaler use technique as we will provide training on individual basis upon completion of the interview. .

I will be delighted if you agree to participate in this study.

Investigator’s Statement

I, Dr.....
..... the investigator have educated the

research participant on the purpose and applications of this study. Sign _____

Date _____

Participant’s statement

I willingly agree to take part in this study. I do this with full understanding of the purposes of the study and the procedures involved all of which have been explained to me by Dr.

_____.

Signature of Health care provider _____

Signature of witness _____

Date _____

If you have questions during the course of the study, you may contact the following:

Dr. Aisha Ahmed.

Principal Investigator

Muhimbili University of Health and Allied Sciences (MUHAS) Department of Internal
Medicine

P.O. Box 65001 Dar es Salaam.

Mobile phone: 0745302536.

Dr. Grace Shayo

Supervisor for this research.

Muhimbili University of Health and Allied Sciences (MUHAS) Department of Internal
Medicine

P.O. Box 65001 Dar es Salaam.

**In case of any information about your rights as a participant in this study please
contact:**

The Chairperson of Research and Publication Committee Muhimbili University of Health and
Allied Sciences (MUHAS)

P.O. Box 65001 Dar es Salaam Tel. 022-2152489

Appendix II: Clinical Research Form

Study number _____ Participant's initials: _____ Age: _

Study date _____ Facility level _

Sex: Male () Female ()

Profession: (MD, MMED, Nurse, pharmaceutical technician, pharmacist
etc)

Years of experience: _____

Received previous education on inhaler demonstration skills:

1. Yes _____ 2. No _____

Date since last education on inhaler demonstration skills: _____

Demonstrates inhaler use to patients on day to day basis: 1. Yes _____ 2. No _____

Who is tasked with teaching the patients on inhaler use? _____

Are placebos available for demonstration? 1. YES 2. NO

Health Care Professional Asthma knowledge Questionnaire (HQ). Kindly fill the dash after each sentence as T(true) or F (false).

1. Asthma results from complex interactions among inflammatory cells, mediators, and other tissues in the airways __
2. Asthma can be triggered by aspirin or other non-steroidal anti-inflammatory Drugs (NSAIDs) such as IBUPROFEN and Diclofenac _____
3. After the patient has recovered from a severe asthma attack, he/she should be maintained on the same dose of oral corticosteroid permanently to control his/ her condition
4. The aim of asthma management is to empower health care professionals to take control of patient's disease _____

5. Asthma episodes are associated with variable airflow obstruction that is often reversible with treatment _
6. All people with asthma should have a long acting beta2 agonist for symptoms relief _____
7. The inflammatory process in asthma doesn't cause permanent changes in the airways
8. Multiple actuations of aerosol devices before inhaling from a spacer will result in more effective medication delivery __
9. The most common problem with Dry Powder inhaler use is incorrectly coordinating drug release and inhalation
10. It's a good idea to give cough syrups during an asthma attack to treat asthma related cough
11. The genetic predisposition for the Development of IgE mediated response to common aeroallergens isn't a predisposing factor for developing asthma _____
12. An asthma 3 +visit plan is a plan in which GPs treat an acute asthma exacerbation over 3 visits.
13. Inhaled non-steroidal anti-inflammatory such as sodium cromoglycate (Intal) are recommended as initial preventative therapy for children with frequent episodic to mild persistent asthma__
14. In some people with asthma, exercise induced symptoms may be the only manifestation of asthma _____
15. When oral corticosteroids are initiated in an acute asthma attack, inhaled corticosteroids should be ceased to avoid any complications _____
16. Dry Powder Inhalers require higher inspiratory flow rates than metered dose inhalers.
17. Only nebulizers can be used in children less than 2 years old who have asthma _____
18. Unlike short acting bronchodilators, formoterol effects usually last for 2 days _____

CHECKLIST OF STEPS IN USING METERED-DOSE INHALER DEVICE:

Step	Correctly performed (1)	Non performed or incorrectly performed (0)	Comment /Type of error
1. Shake the contents well			
2. Remove the cap			
3. Hold the inhaler upright			
4. Tilt the head back slightly			
5. Breath out slowly			
6. Put the inhaler in the mouth with the lips tightly sealed around it.			
7. Begin breath in slowly and deeply through the mouth and actuate the canister once.			
8. Hold breath for 10–20 sec			
9. Exhale & wait one minute before the second dose.			
10. Begin breath in slowly and deeply through the mouth and actuate the canister once			
11. Shake again before the second dose			
12. After use, replace the mouth piece cover			