

St Paul Hospital Millennium Medical College
Respiratory Care Practitioner Program



**The Skill of Meter Dose Inhaler Technique and its associated factor among
Pharmacy Professionals in Addis Ababa Governmental Hospitals in 2021-2022.**

BY

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Addis Ababa, Ethiopia

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Department of Emergency and Critical Care Nursing

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By

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A Research thesis submitted to Nursing School, Department of Emergency and Critical Care Nursing for the partial fulfilment of the requirements for the degree of Masters in Respiratory Care Practitioner; St. Paul Hospital, Millennium Medical College.

Addis Ababa, Ethiopia

February, 2022

Name of investigator	Simachew Abebaw
The full title of research project	The Skill of MDI technique and its associated factor among pharmacy professionals in Addis Ababa governmental hospitals.
Duration of the research	From September 2021 -February 2022.
Study Area	Saint Paul's Hospital Millennium Medical College, Tikur Anbessa Specialized Hospital, Yekatit 12 hospital, Zewditu memorial hospital and Ras Desta Damtew memorial hospital.
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Summary

Background:

A Meter dose inhaler is one of the most commonly used devices in the management of asthma. Good meter dose inhaler technique is vital for a drug to be effective and given the wide range of drugs used for treatment of respiratory conditions, cost of misuse can be significant. If patients are not using their inhalers correctly the need for increased dosages, systemic steroids and irregular visits to the doctor may increase. However, in most studies conducted around the globe, pharmacists have suboptimal knowledge and skill on meter dose inhaler technique.

Objective:

To assess the skill of meter dose inhaler technique among pharmacy professionals in Addis Ababa selected governmental hospital, from September 2021 to February 2022.

Methods:

An institutional-based cross-sectional study was conducted to assess the skill of the meter dose inhaler technique among pharmacy professionals working in five selected governmental hospitals in Addis Ababa, Ethiopia. Simple random sampling was conducted to recruit 310 pharmacy professionals from the study subjects. Data was collected by means of pretested and structured checklists. Data was entered and analyzed using SPSS version 25. To ascertain the association between dependent and independent variables, an odds ratio with a 95% confidence interval was calculated, and the p value was considered significant at the level of <0.05 . Finally, the study findings were presented using diagrams, tables, and figures.

Result: A total of 310 pharmacy professionals were included in the study. Overall response rate was 305 (98%). From the respondents only 38 (12.5%) have optimal skills. Pharmacy professionals with training on MDI technique were, found to have optimal MDI skills than who do not have one. Training is significantly associated with the pharmacy professional's skill of MDI administration technique ($p=0.00$).

Conclusion: Our study observed that most of the governmental pharmacy professionals' skill of MDI technique was suboptimal. These findings point to the need for skill of MDI technique training programs to be implemented on a regular basis.

Key Word: MDI, pharmacist, skill

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Acronym

COPD	chronic pulmonary disease
ETB	Ethiopian birr
DPI	dry powder inhaler
HCP	health care provider
IT	inhaler technique
MDI	meter dose inhaler
NAEPP	national asthma education and prevention program of America
NRAD	national review of asthma death
PMDI	pressure meter dose inhaler
RDMH	Ras Desta Damtaw memorial hospital
TASH	Tikur Anbesa specialized hospital
WHO	world health organization
ZMH	Zewditu memorial hospital
MOH	Ministry of health

1. Introduction

1.1 Background

The pressure meter dose is a compact, self-contained medication device that delivers several doses according to a metered value. Holding chambers and spacers are frequently utilized as supplementary devices with pressure meter dose inhalers due to substantial medicine loss in the oropharynx and hand-held coordination difficulties with pressure meter dose. The pMDI has been the most commonly prescribed aerosol generator for patients with asthma and COPD since its invention by Dr. George Maisson in 1955. This is due to the fact that it is small, portable, and offers multi-dose convenience in one device (1).

The most widely prescribed mode of aerosol delivery in the United States is the pressurized metered-dose inhaler (pMDI). Multidose convenience is provided by pMDIs, which are portable, compact, and relatively straightforward to use. Within a fraction of a second of actuation, a uniform amount of medicine is delivered, and the doses are repeatable throughout the canister's lifetime. Each pMDI and actuator is customized to the drug composition and dose volume being given. While the pMDI appears to be simple, patients frequently misuse it despite how simple it is to use (2).

Study done in turkey shows only 31.1% of the patients correctly used the pMDI before training and post training was 45.2%. Training resulted in a substantial increase of correct use among the patients using pMDI; however, the error rate was still high (3). Community pharmacists are particularly situated to regularly check inhaler technique when patients drop of new inhaler prescriptions or pick up refills. Pharmacist interventions can help to improve the inhaler technique of asthma and COPD patients (4).

The correct inhaler technique is required to ensure optimal clinical outcomes and improve the quality of life. Community pharmacists are responsible for counseling patients and their knowledge and skills of inhalers (5). Another study which was done in Oman among health care providers Only 22/150 (15%) participants performed all steps correctly. When only essential steps were considered, the overall performance increased to 28/150 (19%) (6).

The medications normally used in asthma are bronchodilators and anti-inflammatory agents. Systemic administrations of these agents produce considerable side effects. Hence, to overcome this problem as well as have a quicker onset of action and for better efficacy, inhaled medications are preferred (7). The level of Asthma control is below recommended standards in Africa and it ranges from clinically manifested Asthma, to significantly decreased or removed symptoms by treatment (8).

Good inhaler technique is vital for a drug to be effective and bearing in mind the wide range of drugs used for treatment of respiratory conditions cost of misuse can be significant. If patients are not using their inhalers correctly the need for increased dosages, systemic steroids and irregular visits to the doctor may increase. Only 79% of patients tested could use the MDI efficiently even after instruction. Patient education should play an important part in the provision of inhaler devices. The technique should be assessed by direct observation after expert instruction (9).

A large number of asthma patients do not use their inhaler devices correctly (10). Studies described that around 90% of asthma and COPD victims- miss use their inhalers. Therefore, patients prescribed with MDI should be appropriately educated by experts about inhaler technique as it will lead to improved adherence and management of the disease (11). Community pharmacists are an indispensable part of the healthcare taskforce in patient counselling. However, in most studies conducted around the globe, pharmacists have suboptimal knowledge and skill on MDI techniques. A recent published article emphasized that merely 7% of healthcare providers possibly well demonstrate all the proper steps of MDI use (12).

The National Review of Asthma Deaths (NRAD) pointed out that a low level of understanding and incorrect use of inhalers was assumed to have contributed to a huge figure of the 195 asthma deaths (13). The importance of the critical steps about MDI usage is justified as they are key in ensuring an adequate amount of the drug has reached the intended site (5).

In our country as well as specifically in this study setting there is no research published previously to assess MDI technique and its associated factor however high use of MDI devices.

1.2 Statement of the problem

The optimum distribution of medication is jeopardized by ineffective inhaler technique (IT).

However, health care professionals (HCPs) IT skill has gotten little attention (14).

Inhaled medicines are essential in the treatment of respiratory disorders such as asthma and chronic obstructive pulmonary disease (COPD). Unfortunately, up to 92% of patients make at least one crucial error when using an inhaler, which can reduce the inhaled drug effectiveness (15).

Uncontrolled asthma and increased incidence of severe COPD exacerbations have both been linked to inhaler technique errors. Healthcare providers should teach patients how to utilize MDIs correctly in to improve MDI utilization. Only 4.8% of pharmacy professionals a study conducted in Gonder, Ethiopia was capable of successfully demonstrating the necessary steps (16).

Studies from Nepal have demonstrated the usefulness of counseling by pharmacists in using MDIs.

To correctly teach MDI use, healthcare professionals like doctors, pharmacists and nurses should have adequate knowledge about the use of MDIs. Inhaler therapy is a first-line controller therapy for asthma self-management. Despite its effectiveness, misuse of inhaled medications is common, which results in compromised treatment outcomes and excess health care costs. Even though treatment outcomes of asthma were assessed and the majority of patients were not controlled (17)

A study conducted in California shows Participants who received pharmacist consultation were more likely to demonstrate correct technique (18). Studies from around the world have shown that community pharmacies present a suitable facility for assessing and educating patients on inhaler techniques (19). Pharmacists are considered the most accessible health care provider and are ranked amongst the top three most trusted professions in honesty and ethical standards (20).

As far as my knowledge and extensive literature review, no research on the MDI technique has been published in Addis Ababa, Ethiopia. Therefore, the aim of this study was to assess the skill and factor associated with meter dose inhaler techniques among pharmacy professionals working in governmental pharmacy during the study period in, Addis Ababa, Ethiopia.

1.3 Significance of the study

Following the completion of this investigation, the findings will be contributed to:

For Hospitals: This study, would provide useful information regarding the skill of MDI technique and associated factors among pharmacy professionals, allowing for a training program on MDI technique and the planning of evaluating patient inhalation technique at each visit and providing timely necessary assistance.

For Clinicians: This will be beneficial to clinicians in terms of improving their skills and providing ongoing education regarding MDI techniques.

For Researchers: It will be utilized as a resource for other researchers who are interested in conducting more research on the subject.

For customers and the community's: This would enhance asthma and COPD control by boosting drug effectiveness, which in turn improves overall health.

2. Literature review

2.1 Magnitude of MDI technique error

A study was done in Mexico all HCW surveyed, it was observed that 79 (32.4%) performed a bad technique, 126 (51.6%) a regular technique, while only 33 (13.5%) and 6 (2.5%) of all surveyed performed a good or very good technique, respectively (15).

A study done in Saud Arabia to investigate community pharmacy knowledge, When the assessment criterion was applied, it was seen that only four steps were demonstrated commonly by the majority of 57–75% of the pharmacists. These steps are; breathe the air slowly out of the lungs, tilt back your head slightly, place the inhaler mouthpiece in the upright position and close the lips and breathe in slowly for 3–5 s. Scoring of the responses revealed that nearly all possess a moderate level of knowledge about the appropriate use of inhalers (21).

A study done in Iran to evaluate the meter dose inhaler technique, Except for step 2 (breath out slowly and completely) and step 9 (wait for 20-30 seconds before starting the second puff), the frequency of correct technique was high (70.2-97.2%). The frequencies of participants who made an error in only essential steps and any steps were 33.3% and 92.6%, respectively. Of the essential steps, depressing the canister once (step 5) had the highest frequency of error (25.6%), while among non-essential (preferred) steps, highest frequency of errors was observed in breathing out slowly and completely and waiting for 20-30 seconds before starting the second puff (steps 2 and 9, 75.6% and 79%, respectively) (22).

Fifty-seven percent of research participants admitted that they did not watch patients' MDI technique at every hospital-related visit, according to a study conducted in South Africa to assess medical professionals' and students' understanding and proper use of the meter dosage inhaler. In the study, 40% of participants admitted to never presenting the MDI technique to their patients. Even though 50% of research participants said they routinely demonstrated inhaler technique to patients, the current study revealed that HCPs have poor MDI method knowledge, resulting in erroneous MDI technique being taught to patients (23).

A study was conducted at a Sudanese community pharmacy, according to the findings, 59 percent (62/105) of pharmacists approached with a metered-dose inhaler did not know how to use it properly, 36.2% (38/105) had poor technique, 3.8% (4/105) had "adequate technique," one pharmacist only had "optimal technique" (0.9%), and none were "totally unfamiliar" with the inhaler (24).

In research conducted in Nigeria, just half of the pharmacists displayed steps 2, 6, 7, and 8. Step 7, which consisted of inhaling slowly and deeply via the mouth before depressing the canister once, was primarily demonstrated by experienced pharmacists (90.2%). Step 6 (75.6 percent) and step 2 (75.6 percent) were also successfully demonstrated by pharmacists (63.4%). However, more than half of practicing pharmacists failed to accurately demonstrate all other stages. Only steps 6, 7, and 8 were exhibited by more than half of the surveyed pharmacists, whereas only a small number of pharmacists correctly performed the five crucial processes outlined in the 11-step instructions demonstrated steps 1 and 5 (25).

Another study was carried out in Nigeria Sixty-seven percent of pharmacists said they had never put any of their relatives on inhalation asthma medication. Seventy-eight pharmacists (91.8%) had never used an inhalation asthmatic medicine. Thirty-four pharmacists (40.0%) said they have previously received training on how to use an asthma inhalation device: 24 (70.6%) were pharmacists, 6 (17.5%) were physicians, 3 (8.82%) were family members, and 1 (2.94%) was a nurse (26).

According to the findings of a study conducted in Pakistan, 71 percent of nurses could exhibit proper inhaler technique before the training session, which improved to 97 percent after the instruction. Furthermore, there was a significant improvement in performing key tasks while utilizing proper inhaler technique, which improved from 63% to 99% (27).

A study conducted in Nepal on the proper use of a meter dosage inhaler by health care workers, the mean score received by the experts was determined according to their specialty. Nurses' pre-intervention and post-intervention scores were 3.99 and 8.14, respectively; doctors' scores were 5.96 and 7.18, pharmacists' scores were 5.8 and 7.1, and interns' scores were 4.72 and 7.12. During the pre-intervention period, none of the experts in this study could show all 10 processes necessary in the proper usage of MDI. After the intervention, one doctor, four interns, and eight nurses demonstrated that all of the steps were followed appropriately. (28).

Study done in Palestine indicated that correct handling of inhaler devices is uncommon among the study patients. Furthermore, MDI devices had significantly lower scores of correct handlings compared to DPI devices. Correct handling of inhaler devices was significantly related to educational level and ICS use (29).

A study was conducted in Mekelle, Ethiopia, the competency of pharmacists and druggists in applying proper inhaler technique was found to be horrible, Of the essential steps, only 25 (23.6%) and 16 (15.1%) participants breathed in and actuating the canister together according to evaluators I and II respectively. Step 7 (Begin breathing in gently and trigger the canister once) was the least properly answered of the important steps. Step two, 'Remove the cap,' was the most properly shown important step (88.7%), followed by step one, 'Shake the content well (64.2%)

The results of both evaluators revealed inadequate demonstration techniques (30).

2.2 Factor associated with skill of MDI technique

In a study of Saudi pharmacists aged 30–35 years, it was discovered that they had considerably higher knowledge regarding the proper use of inhalers (5.52 ± 2.14, $t = 2.851$, $p = 0.009^*$). Furthermore, job experience (3–4 years) was found to be significantly ($p = 0.003^*$) related to a greater understanding of how to use inhalers correctly. Similarly, pharmacists employed by chain pharmacies were shown to be more knowledgeable than those employed by small pharmacies (21). Another study in Nigeria found that the total score of pharmacists before education was not significantly affected by years of qualification ($P=0.162$) or gender ($P=0.980$) and that there was no difference in the pharmacists' knowledge scores regardless of whether they had recently received asthma training or not. $P=0.492$. $P = 0.03$ showed that pharmacists with a second Pharm D degree scored higher than others (31). A study done in Saudi shows there was a significant difference between community pharmacists with an experience more than five years and pharmacists with five years 'experience or less' p -value (0.013). (32)

Another study done in Gonder Ethiopia Out of 62 participants, only 5 got training on MDI use. In this study, only three (4.8%) respondents were competent enough to demonstrate the essential steps correctly. Respondents were evaluated on their competence of MDI technique. Accordingly, step 2 (removing the cap) was the most frequently demonstrated (80.6%) step followed by step 1 (shake the content well) (72.6%). On the other hand, step 4 (tilt the head back slightly) and step 7 (begin breath in slowly and deeply through the mouth and actuate the canister once) were among the least demonstrated steps (9.7% and 22.6%, respectively). This study revealed that only 13 participants got score seven or above, but most of them missed the pertinent steps which included steps 1, 2, 5, 6, 7 and 8. Fishers exact test revealed that there was a significant difference ($P = 0.015$) in competency of demonstrating adequate inhalational technique among respondents who took training on basic inhalational techniques and who did not. Unlike training, other variables such as educational status, work experience, the working sector had no significant association with the competency of delivering sufficient inhalational techniques (16).

2.3 Conceptual framework

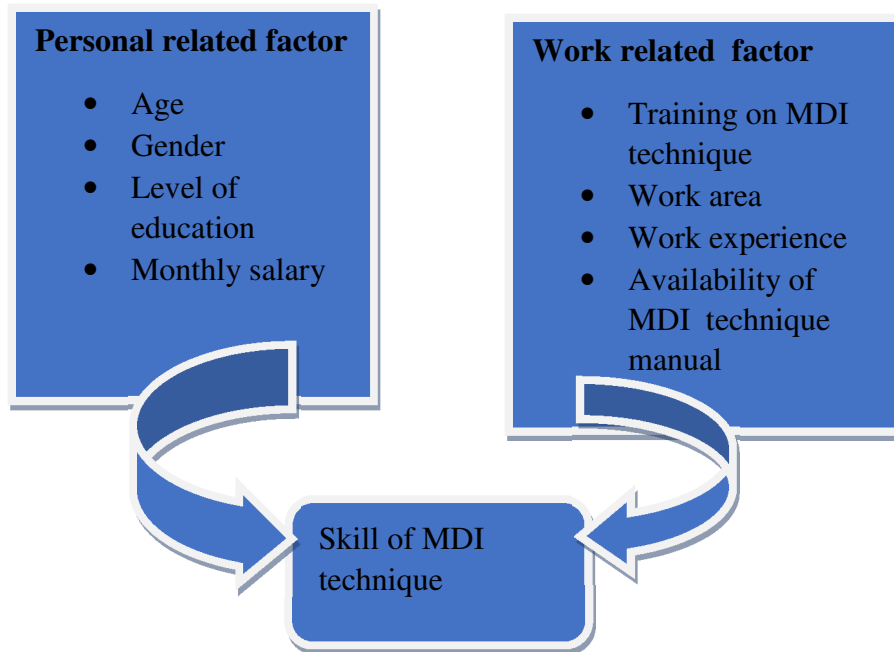


Figure 1:The concept of this framework is to show, the relationship of associated factors and skill of meter dose inhaler technique (16).

3. Objectives

3.1 General objective

To assess the skill of pharmacy professionals in meter dose inhaler administration technique and associated factors in selected governmental hospitals in Addis Ababa, Ethiopia, 2021–2022.

3.2 Specific objective

- ❖ To assess the skill of meter dose inhaler technique among pharmacy professionals in a selected governmental hospital in Addis Ababa, Ethiopia 2021–2022.
- ❖ To identify factors associated with the skill of meter dose inhaler technique among pharmacy professionals in selected governmental hospitals in Addis Ababa, Ethiopia 2021–2022.

4. Methods and materials

4.1 Study area and period

This study was conducted in Addis Ababa Ethiopia which is the capital city of Ethiopia and the seat of the Africa Union. In Addis Ababa 14 governmental hospitals all have a pharmacy. Data was collected from five governmental hospitals, namely St Paul's hospital millennium medical college, Tikur Anbesa specialized hospital, Ras Desta Damtaw hospital, Zewditu memorial hospital and Yekatit 12 hospital.

St Paul's millennium medical college is one of the famous federal hospitals. There are 84 pharmacies professional and provide service for a population of 650 per day.

Tikur Anbesa specialized hospital is also the largest referral hospital in the country and currently the main teaching hospital for both clinical and preclinical training of most disciplines, the pharmacy has 86 pharmacy profession and provide service for a population of 740 people per day. Yekatit 12 hospital is one of the Addis Ababa city administration's health bureau's hospitals that provides routine pharmacy services in Addis Ababa, Ethiopia. On a daily basis, the pharmacy serves a population of 500 individuals. The pharmacy employs a total of 60 pharmacists.

Ras Desta Damtaw memorial hospital, which is run by the Addis Ababa city administration's health bureau, has a pharmacy that serves a daily population of 450 individuals. There are 66 professions in pharmacy.

Zewditu memorial hospital is under Addis Ababa health bureau and the pharmacy provides service for a population of approximately 430 people per days and have 54 pharmacy professionals under the department.

This study was conducted from September 2021-February 2022.

4.2 Study design

An institutional-based cross-sectional study was conducted for this study.

4.3 Population

4.3.1 Source population

All pharmacy professionals who work in Addis Ababa governmental hospitals were taken as the source population.

4.3.2 Study population

All pharmacy professionals who work in Addis Ababa's selected governmental hospitals were taken as the study population.

4.4 Eligibility criteria

4.4.1 Inclusion criteria

Pharmacy professionals who work in five selected governmental hospitals during the study period and who are willing to take part in the study were enrolled in the study.

4.4.2 Exclusion criteria

A pharmacy professional who works for 6 months was excluded from the study.

Free service and pharmacy students were excluded from the study.

4.5 Sample size determination

The actual sample size for the study was determined by using single population proportion formula. For single proportion population, $n = \frac{(Z_{\alpha/2})^2 p(1-p)}{(d)^2}$

Where: n= Estimated sample size

d= is the desired level of precision (i.e., the margin of error),

p= is the (estimated) proportion of the population that has the attribute in question

Z = Confidence level (alpha, α)

The competence of MDI technique 24, since a study was done in Mekelle to assess MDI technique among pharmacy profession (30). The level of confidence is 95%, ($Z_{\alpha/2} = 1.96$), the margin of error between the sample and the population is 5%. The nonresponse rate of 10%, The final calculated sample size is 310.

4.6 Sampling Procedure

A simple random sampling method was used to select five study areas from among 14 governmental hospitals in Addis Ababa, Ethiopia. The five selected governmental hospitals are SPHMMC, TASH, Yekatit 12 hospital, Zewditu memorial hospital, and Ras Desta Damtaw memorial hospital.

Then the actual sample (n) were taken from each selected hospital using the Proportional to size

allocation formula: $n = \frac{n_f \times n_i}{N}$

Where: n_i = number of pharmacists in each selected governmental hospital.

n = samples taken from each selected hospital among the total pharmacist.

n_f = final sample of the study.

N = total number of pharmacists in all selected governmental hospitals, which was 350

$$\text{SPHMMC} = \frac{310 \times 84}{350} = 75$$

$$\text{TASH} = \frac{310 \times 86}{350} = 76$$

$$\text{ZMH} = \frac{310 \times 54}{350} = 48$$

$$\text{Yekatit 12} = \frac{310 \times 60}{350} = 53$$

$$\text{RDMH} = \frac{310 \times 66}{350} = 58$$

$$\text{Total} = 310$$

Finally simple random sampling technique was implemented to take sampled cases from each selected governmental hospital.

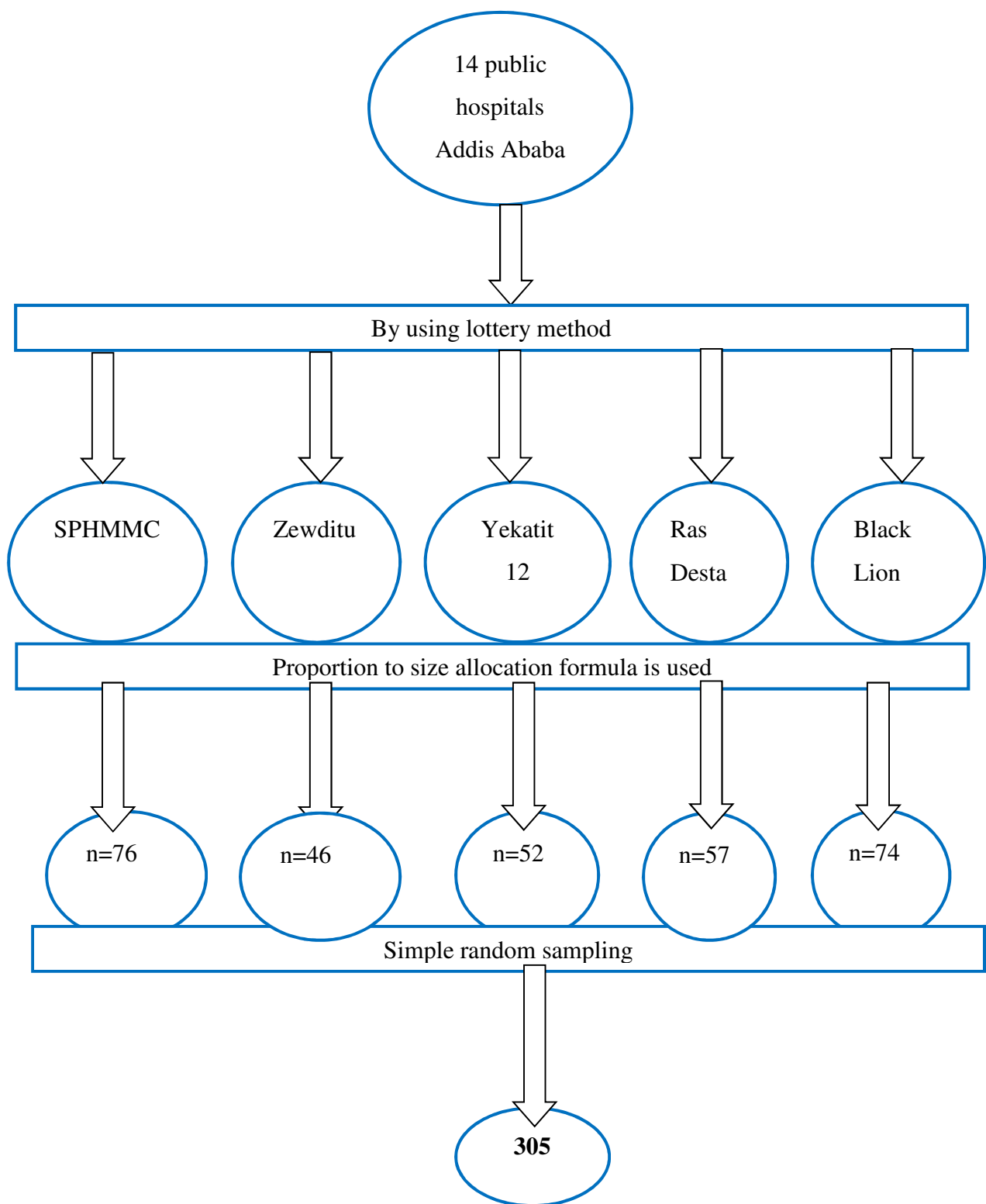


Figure 2:Schematic Presentation of Sampling Procedure, governmental Hospitals of Addis Ababa, Ethiopia

4.7 Variables

4.7.1 Dependent variable

The skill of MDI technique

4.7.2 Independent variables

Age

Educational level

Gender

Work experience

Training on MDI technique

Monthly salary

Working area

Availability of manual in the working area.

4.8 Data collection Tool and management

The evaluation (data collection) tool was based on the National Asthma Education and Prevention Programs of America (NAEPP) step criteria for MDI demonstration to rate the skill of MDIs by pharmacy professionals (33) and the demographic tools were based on prior literature (16). The MDI was performed using an observational checklist and self-administrative questioners to collect demographic data. Each participant was instructed to take two puffs from an empty MDI device to demonstrate the MDI technique. The correctness of each participant's approach was rated by three trained observers utilizing an eleven-step checklist. When there was a performance difference between the two puff demonstrations, the data collectors took the one with less performance.

4.9 Data quality assurance

A pre-test was conducted before actual data collection in order to check if there were missed variables and the difficulty of understanding of questionnaires. Data was collected by three pharmacists; the data collector was trained for two days on demonstration of inhalation techniques and techniques of data collection. The principal investigator was supervising the data collection process and a review. The principal investigator also facilitates a meeting whenever necessary with the data collector so that any ambiguity is cleared by discussion. During actual data collection, the data was revised for completeness, clarity, and consistency by the principal investigators.

4.10 Data management and analysis

Responses in each frequency distribution were computed to describe the study variables. A binary regression model was fitted to identify the association between independent and outcome variables. The checklist was coded for simplicity of data entry. Then the coded data was entered into Epi Data 3.1 and exported to SPSS Version 25 statistical software for data analysis. Data entry errors and any missing values were checked and corrected before conducting the data analysis. In the first steps, descriptive analysis, such as percentages and frequency, was done. All independent variables that were associated with the outcome variable at a p-value of 0.25 or less in the bivariable analysis were entered into multivariate logistic regression models to identify independent predictors of the skill of the MDI technique. Then the p 0.05 cutoff point was as significant for all the independent variables before fitting the model. Crude and adjusted odds ratios were computed with their corresponding 95% confidence intervals. Then the result was presented with text, graphs, figures, and tables.

4.11 Ethical considerations

The study was ethically approved by the Institutional Review Committee of St. Paul's hospital Millenium Medical College. The data collected was kept anonymous and recorded in such a way that the involved pharmacy professionals could not be known.

4.12. Term and operational definition

Training on MDI technique: a pharmacy professional who claimed to have received on job MDI training during the previous five years.

Availability of MDI technique manual: can be protocols or wall charts that can be used as a reference while teaching patients about the MDI technique and this might be available in the work place.

Work area: is a site where pharmacy professional works in either dispensary or in a store.

Optimal skill: a pharmacy professional who accurately shows 7 or more of the 11 steps of the MDI technique including all essential steps in the right order.

Suboptimal skill: a pharmacy professional who demonstrates < 7 from 11 steps MDI technique or missing any one of the essential steps.

4.13. Dissemination of the result

The study findings will be presented at the Millennium Medical College at Saint Paul's Hospital. TASH, Yekatit 12 hospital, Zewditu memorial hospital, and Ras Desta Damtaw memorial hospital will also be submitting it. Finally, the findings will be published in national and international journals to be used in future research.

5. Result

A total of 310 pharmacy professions were included in the study. The overall response rate was 305 (98%), with five pharmacy professionals declining to participate for various reasons, including being too busy and refusing to respond, of which 168 (55%) were males. Most of the pharmacy professionals is in the age group of 20–29 years. About 231 (75%) of the pharmacy profession were degree holders. The majority of respondents (193) (63%) had work experience of > 5 years. Most pharmacy professionals' gross salaries are > 6000 birr per month. Out of 305 participants, only 30 (10%) got training on the MDI technique. According to the findings, there is no documented MDI manual in 305 (100%) of the cases.

Table 1 Socio-demographic characteristics of the respondents, A.A, 2022 (N = 305).

Variable	Category	Frequency	Percent (%)
Age	20-29	148	48
	30-39	139	46
	>40	18	6
Gender	Male	167	55
	Female	138	45
Educational level	Diploma	34	11
	Degree	230	75
	Masters	41	14
Work experience	<5 years	113	37
	>5years	192	63
Gross salary per month	<4000	19	6
	4000-600	125	41
	>6000	161	53
Work unit	Dispensary	272	89
	Main store	33	11
Training on MDI	Yes	30	10
	No	275	90
Availability of MDI manual	Yes	0	0
	No	305	100
	Total	305	100

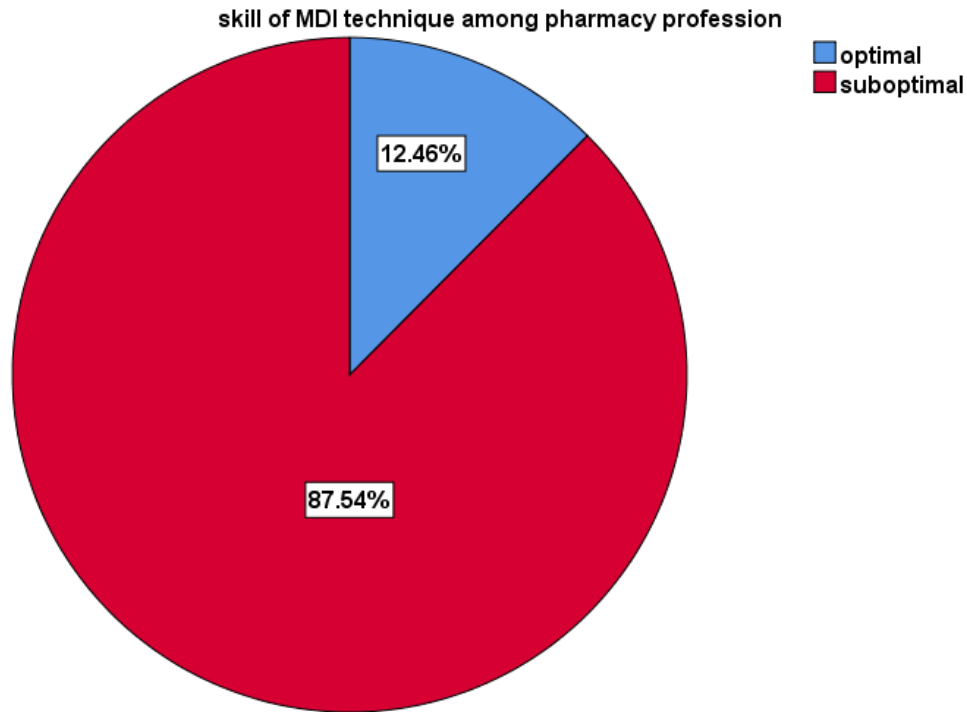
5.1 Skills of meter dose inhaler Technique

Respondents were evaluated on their skill of MDI technique; Accordingly, step 2 (removing the cap) was the most frequently demonstrated 300 (98%) followed by step 11 (after use replace the mouth piece cover) (96.1%). On the other hand, step 4(tilt the head back slightly) and step 8 (Hold breath for 10-20 seconds) were among the least demonstrated steps (18% and 26.6%, respectively). Of the respondents only 38 (12.5%) have optimal skills and 267 (87.5%) suboptimal skills. The details of the frequency of respondents to demonstrate each MDI technique steps were described below at table 2.

Table 2 Skills of MDI technique of the respondents; A.A, 2022 (N=305)

Variables	Correct (%)	Incorrect (%)	Skipped (%)
1* Shake the content well	194 (65)	8 (2)	100 (33)
2* Remove the cap	300(98)	2(0.7)	3 (0.8)
3 Hold the inhaler upright	112 (36.7)	183 (60)	10 (3)
4 Tilt the head back slightly	55 (18)	53 (17)	197 (65)
5* Breath out slowly	120 (39)	109 (36)	76 (25)
6* Open mouth with inhaler 1 to 2 inches away or in the mouth with the lips tightly sealed around it	131 (43)	173 (57)	1 (0.3)
7* Begin breath in slowly and deeply through the mouth and actuate the canister once	83 (27)	221 (72)	1(0.3)
8* Hold breath for 10-20 seconds	81 (26.6)	70 (23)	154 (50.4)
9 Exhale and wait one minute before the second dose	83 (27.2)	200 (65.6)	22 (7.2)
10 shake again before the second dose	86 (28.2)	19 (6.2)	200 65.6)
11 after use replace the mouth piece cover	293 (96.1)	1 (0.3)	11 (3.6)

Figure 3 the skill of MDI technique among pharmacy professional, A.A, N=305.



5.2 Factors associated with skill of meter dose inhaler technique

Bivariate logistic regression was done to identify significant independent predictors. Training, educational level, and monthly salary were significant predictors, whereas age, gender, work area, and work experience were not significant predictors. Variables that had $p < 0.25$ at bivariate analysis were further entered into a multivariate model to identify the independent factors of the outcome variables.

Table 3 Bivariate analysis with skill of meter dose inhaler technique among respondents; A.A, N=305.

Variables	Category	Outcome variable		COR (95% CI)	P-value
		Optimal	suboptimal		
Age	20-29	18	131	1.00	0.13
	30-40	16	122	1.048(0.511-2.146)	
	>40	4	14	0.481(0.143-1.622)	
Gender	Male	25	145	1.00	0.159
	Female	13	124	1.668(0.818-3.399)	
Education level	Diploma	4	30	1.00	0.016
	Degree	23	207	1.200(0.388-3.710) *	
	Masters	11	30	0.364(0.104-1.271)	
Work experience	<5 years	10	103	1.00	0.147
	>5 years	28	164	0.569(0.265-1.220)	
Gross Salary per month	<4000	2	17	1.00	0.026
	4000-6000	8	117	1.721(1.337-8.789) *	
	>6000	28	137	0.559(1.122-2.557)	
Training	Yes	16	14	13.143(5.678-30.420) **	0.000
	No	22	253	1.00	
work unit	Dispensaries	35	239	1.293(1.467-3.582) *	0.021
	Main store	5	28	1.00	

In adjusted analysis, pharmacy professionals who had training were 13.331 times more likely to have optimal skill in MDI technique than those who had no training. AOR: 13.331; 95% CI (13.331 (5.420–32.793, $p < 0.000$). Those who have a degree and a master's were 2.642 and 3.744 times more likely to have good MDI technique skills than those who have a diploma. AOR: 2.644 and 3.744, 95% CI (0.107-3.859), (0.603-4.485) $P < 0.04$ as shown in table 4

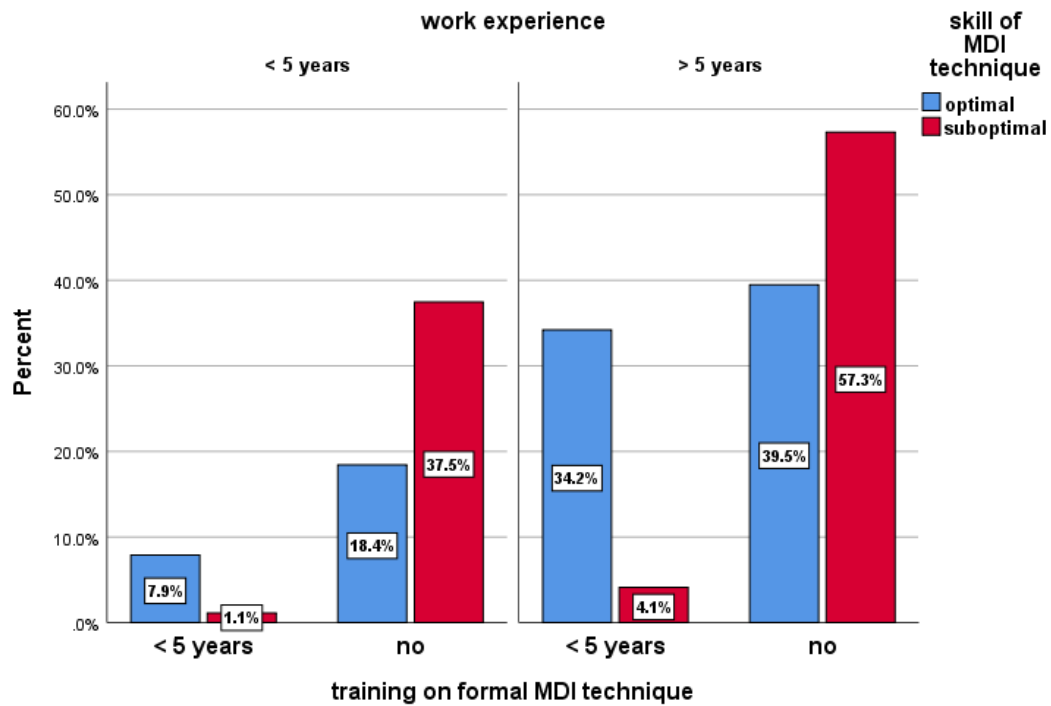
Table 4 Multivariate analysis with skill of meter dose inhaler techniques among respondent; A.A, N=305.

Variables	Catatagory	Outcome variable		COR(CI)	AOR (CI)	P – value
		optimal	suboptimal			
Age	20-29	18	131	1.00	1.00	0.213
	30-40	16	122	1.048(0.511-2.146)	0.36(0.216-4.058)	
	>40	4	14	0.481(0.143-1.622)	0.866(0.208-3.612)	
Gender	Male	25	145	1.00	1.00	0.159
	Female	13	124	1.668(0.818-3.399)	0.508(0.221-1.169)	
Educational level	Diploma	4	30	1.00	1.00	0.04
	Degree	23	207	1.200(0.388-3.710)	2.642(1.107-3.859)**	
	Masters	11	30	1.364(0.104-2.271)	3.744(1.603-4.485)**	
Work experience	<5 years	10	103	1.00	1.00	0.143
	>5 years	28	164	0.569(0.265-1.220)	0.529(0.158-1.771)	
Gross salary per month	< 4000	2	17	1.00	1.00	0.003
	4000-6000	8	117	1.721(0.337-8.789)	5.686(2.603-53.629)**	
	>6000	28	137	0.559(0.122-2.557)	4.085(1.135-14.697)**	
Training	Yes	16	14	13.215 (5.488-33.463)	13.331(5.420-32.793)**	0.000
	No	22	253	1.00	1.00	
Work unit	Dispensery	35	239	1.293(0.467-3.582)	0.855(0.242-3.019)	0.874
	Main store	5	28	1.00	1.00	

NB: -significant association with 95% confidence interval.**

COR- crude odds ratio AOR- adjussted odds ratio

Figure 4 Relationship of training and work experience with skill of MDI technique.



As the graph shows more experience without training is not a protective factor for their suboptimal performance.

6. Discussion

Many studies have focused on the assessment of patients' mishandling of asthma inhaler devices and their clinical consequences in terms of disease control or unscheduled hospital admissions (24). But this study aims to assess the skill of the MDI technique on pharmacy professionals. In this study, the pharmacy professional's skill in MDI technique was suboptimal.

In this study, it was found that 87.5% of pharmacy professionals have suboptimal MDI technique skills. Our finding was similar to a previous study that was done in Gonder, Ethiopia, where 90% of the pharmacy professionals were incompetent (16). As to the finding of this study, only 12.5 pharmacy professionals had optimal MDI technique skills. This result is similar to research done in Mexico, where 13.5% (15). The problem with effective demonstration skill could be because higher education's focus more on knowledge development rather than pressing on skills. In other study done in Nigeria only 2.4% of the participant correctly demonstrate MDI technique (26) this discrepancy may be due to the previous study's use of a small sample size as compared to the present study. In this study, most steps of the MDI technique correctly demonstrate 65–98% (steps 2, 11, and 1). This result is not similar to that of a study done in Saudi Arabia (21). This discrepancy may be due to using different tools; this study uses a check list, but the previous study uses self-administrative questioners. The list correctly demonstrated skills of MDI technique was step-4 (Tilt the head back slightly). This result is comparable to previous study done in Nigeria (25).

The most skipped steps of MDI technique were step 9 (shake again before the second dose) this result was in agreement with previous study done in Mekelle Ethiopia (30). The list skipped step of this study was step 6 and 7 of the MDI technique 0.3%, but most of the participant demonstrates incorrectly. Of the essential steps, the greatest number of errors occurred in steps 7 (Begin breath in slowly and deeply through the mouth and actuate the canister once), whereas inadequate breath out and waiting before a second puff (steps 2 and 9) were the non-essential steps with highest frequency of error. This result was in analogous with study done in Iran. (22)

A study from Nepal, conducted amongst pharmacy professions, had demonstrated a significant improvement in MDI use after a training program (28). The authors also suggested a training program for pharmacy profession, and recommended repeat programs for better outcomes. The findings of our study also recommend training programs for the professionals to improve their

skills of MDI technique. As the finding of this study gender was not predictor of outcome variables ($p < 0.159$). This finding is inline with study done in Nigeria with ($p < 0.980$) (31).

In this study, work experience was not associated with the skill of the MDI technique ($p = 0.143$), but in the previous study done in Saudi Arabia, work experience was significantly associated with the skill of the MDI technique ($p = 0.013$) (32). The discrepancy in this result may be explained by the fact that, in contrast to the previous study, there was no proper MDI technique practice in our study area. In our study, monthly salary was associated with the skill of MDI technique at a significant level ($p < 0.003$). This significance may be due to increased work satisfaction, but previous studies were done in Gonder City, where there was no association between monthly salary and the skill of MDI technique (16). This discrepancy may be because the present study uses an adequate sample size compared to the previous study and also study design difference.

According to the findings of a study conducted in Pakistan, 71 percent of nurses could exhibit proper inhaler technique before the training session, which improved to 97 percent after the instruction. Furthermore, there was a significant improvement in performing key tasks while utilizing proper inhaler technique, which improved from 63% to 99% (27). Our study also recommended training may improve professionals' skills in MDI technique. Educational level was significantly associated with the skill of MDI technique with $p = 0.04$. This result is inline with a study done in Nigeria that showed that pharmacists with a second Pharm D degree scored higher than others ($P = 0.03$) (21).

6.1. Strength and limitation

This survey highlights an area of governmental pharmacy skills where there is limited literature in Ethiopia. As far as my knowledge and extensive literature review, this was the first time in Addis Ababa that the MDI technique of the pharmacy professionals was tested in a practical demonstration.

This study also has some limitations:

- ❖ Only one time evaluation
- ❖ As the study was a cross-sectional survey conducted in Addis Ababa town, caution should be exercised when generalizing to other cities and regions in Ethiopia.
- ❖ Our direct visit of governmental pharmacy professionals at their work places could affect the responses as it may be subjected to respondent bias.
- ❖ Willingness to participate is prone to have internal bias in selecting a more confident participant.

7. conclusion

Our study observes that most governmental pharmacy professionals' skills in MDI technique were suboptimal. These findings point to need for skill-based MDI technique training programs to be implemented on a regular basis. Special attention should be given to correcting the errors in the essential steps of the inhaler technique. Associations, higher education, and governmental and non-governmental organizations should take part in resolving the problem. According to our findings, including MDI administration technique skill development sessions during academic training, particularly for diploma students, is beneficial.

8. Recommendation

For hospitals

- Establish asthma training center and certified respiratory educators such as nurses, respiratory therapists and pharmacists and so that continuous evaluation of inhaler technique should be integral part of asthma treatment.
- Prepare skill of MDI technique manual and other job aids to be displayed or accessed in the pharmacy dispensaries of hospitals.

For researchers

- More studies should be needed with patient simulation rather than assessing the pharmacy professionals' skill on MDI administration.

For MOH

- MDI technique skills should be included in competency exams for pharmacy professionals.
- The MDI technique should be included in the Ethiopia Treatment guidelines for use by health care professionals in the management of asthma and COPD patients.

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10. Annex

Annex I: Consent and information sheet

An English questionnaire will be prepared to assess **skill of MDI technique among pharmacy professional work in Addis Ababa governmental hospital.**

Dear....!

My name is_____ I am currently a member of a data collection team for a study being conducted by a Respiratory Care Practitioner student at Millennium Medical College at St Paul's Hospital. The goal of this study is to evaluate the skill of MDI technique among pharmacy professionals working in government hospitals in Addis Ababa. You have been chosen to take part in this research. I received approval letter from college with permission of research committee and the questioner includes socio- demographic factor, I will not write your name on the questionnaire and your individual responses will not be reported.

I'd also like to reassure you that your information will be kept private by being locked with a key until it is typed into a computer with a password, after which the questionnaire paper will be burnt. In addition, the data will be used solely for this study. The study has no negative consequences other than taking a few minutes of your time to answer the questions. As a result, you will gladly support this initiative in the event of any issues.

Name of investigator: Simachew Abebaw

Address of investigator: phone no- +251921936090

Email: simachewabebaw56@gmail.com

Thank you!!!

Annex II: data collection tools

Part I: general information

Date of data collection _____ Identification number _____

S. N	QUESTIONS	RESPONSE
1	Age	_____
2	Gender	I-Male ☐ II-Female ☐
3	Name of hospital	I-SPHMMC ☐ IV- Yekatit 12 ☐ II-TSH ☐ V- Ras Desta ☐ III-Zewditu ☐
4	Educational level	I-diploma ☐ II-degree ☐ III-masters ☐ IV-others ☐
5	Work experience	I < 5 years ☐ II - > 5years ☐
6	Gross Salary per month	I - < 4000 ☐ II -4000-6000 ☐ III- > 6000 ☐
7	Work unit	I-Dispensaries ☐ II- main Store ☐
8	Training on formal MDI technique	I-Yes ☐ II- No ☐
9	Availability of documented MDI manual	I- Yes ☐ II- No ☐

Part II MDI technique checklist

S. N	QUATIONS	RESPONSES
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1*	Shake the contents well	I- correct ☐ II-incorrect ☐ _ III-skipped ☐
2*	Remove the cap	I- correct ☐ II-incorrect ☐ III-skipped ☐ _
3	Hold the inhaler upright	I- correct ☐ II-incorrect ☐ III-skipped ☐
4	Tilt the head back slightly	I- correct ☐ II-incorrect ☐ III-skipped ☐
5*	Breath out slowly	I- correct ☐ II-incorrect ☐ III-skipped ☐
6*	Open mouth with inhaler 1to 2 inches away or in the mouth with the lips tightly sealed around it	I- correct ☐ II-incorrect ☐ III-skipped ☐
7*	Begin breath in slowly and deeply through the mouth and actuate the canister once	I- correct ☐ II-incorrect ☐ III-skipped ☐
8*	Hold breath for 10- 20 seconds	I- correct ☐ II-incorrect ☐ III-skipped ☐
9	Exhale and wait one minute before next dose	I- correct ☐ II-incorrect ☐ III-skipped ☐
10	Shake again before the second dose	I- correct ☐ II-incorrect ☐ III-skipped ☐
11	After use replace the mouth piece cover	I- correct ☐ II-incorrect ☐ III-skipped ☐

*-essential steps according to NAEPP.

Annex III. Assurance of Principal Investigator

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisor and seek the necessary advice and approval from my primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the student: _____

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: _____

Signature: _____

Date: _____

Approval of the Co-Advisor

Name of the co- advisor: _____

Signature: _____

Date: _____

Approval of the examiner

Name of the examiner_____

Signature_____

Date_____