Addis Ababa University, College of Health Sciences, School of Medicine

Addis Ababa , Ethiopia

Using face-to-face training and multi-media demonstrations for improvement of MDI and DPI inhaler technique among Asthmatic patients in the Chest Referral Clinic of Tikur Anbessa Specialized Hospital

A Quality Improvement Project Proposal Submitted to Department of Internal Medicine, AAU, Post Graduate Program, in Partial Fulfillment of Specialty Certificate in Internal Medicine

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Full Title Of The Research Project	Using face-to-face training and multimedia demonstrations for improvement of MDI and DPI inhaler technique among Asthmatic patients in the Chest Referral Clinic of Tikur Anbessa Specialized Hospital: A Quality Improvement Project
Duration Of The Project	From June 2023 up to Febuary 2024
Study Area	Tikur Anbessa Specialized Hospital (TASH)
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ACRONYMS / ABBREVIATIONS

AAU	Addis Ababa University
ACT	Asthma Control Test
CHF	Congestive Heart Failure
COPD	Chronic Obstructive Pulmonary Disease
DPI	Dry Powder Inhalers
ED	Emergency Department
ICS	Inhaled Corticosteroid
iHARP	International-Helping-Asthma-in-Real-Life-Patients
IHD	Ischemic Heart Disease
IT	Inhaler Technique
GBD	Global Burden of Disease
GINA	Global Initiative For Asthma

JUMC	Jimma University Medical Centre
LABA	Long Beta-Agonist Agonist
NAEPP	National Asthma Education and Prevention Program
NCD	Non-Communicable Disease
pMDI	Pressurized Metered-Dose Inhalers
SABA	Short-Acting Beta Agonist
SMI	Soft-Mist Inhalers
SPSS	Statistical Package for The Social Sciences
TASH	Tikur Anbessa Specialized Hospital

2. Abstract

Background: Asthma is the most common chronic respiratory illnesses in the world causing cumbersome morbidity and mortality. Control of asthma symptoms has been suboptimal worldwide and multiple studies have documented that asthma control in Ethiopia has been as low as 24%. Poor inhaler techniques are one of the most important contributing factors to poor asthma control. Although multiple studies have documented the prevalence of poor inhaler techniques in Ethiopia, there have not been quality improvement projects done with in the country to provide evidence and outcome-based guidance for the health system in improving our asthmatic patients' inhaler techniques and thus, their asthma control.

Objectives: This quality improvement project aims to assess the impact of face-to-face demonstrations and multimedia demonstrations in improving the MDI and DPI inhaler techniques of asthmatic patients in the chest referral clinic of TASH.

Method: 30 asthmatic participants from the Chest Clinic of Tikur Anbesssa Specialized hospital who were taking either DPI and/or MDI inhalers had been recruited after assessing for baseline characteristic and baseline inhaler technique by using an adopted checklist from previous studies. Baseline asthma symptom control was assessed using ACT tools.

Recruited participants were given face-to-face demonstrations by trained health care professionals. These face-to-face demonstrations were aided by easy-to-use pamphlet pictograms and adopted videos. Inhaler techniques and asthma control were reassessed by adopted checklists and ACT tool respectively at 4 weeks after demonstrations and trainings had been given. Eventually the preintervention and postintervention results were analyzed and compared to quantify the impacts brought about by the implemented trainings.

Results This study has proved to show that face-to-face demonstrations aided with pamphlet pictograms had brought about a tangible improvement in the total score of proper inhaler technique steps used by the participants. There has been a significant improvement in 5 steps of MDI inhaler technique steps with an increment in total correct steps ($P<0.001$) and 6 out of 9 steps of DPI inhaler technique with an increment in total correct steps ($P <0.001$). There was an improvement of proper inhaler technique among participants increasing from 10.5% to 52.6% for participants using DPI inhalers ($P=0.007$)and from 7.1% to 35.7% ($P=0.011$) for those using MDI inhalers.

Conclusion- Face-to-Face demonstrations of MDI and DPI techniques among groups of patient w aided with pictogram pamphlet has significantly increased correct inhaler technique among asthmatic patients. Patients have also approved of using the pamphlets used as easy to understand and helpful in improving their inhaler technique.

Keywords: Asthma, Inhaler Technique, TASH, Ethiopia, Asthma Control

Introduction

3. Background

According to GINA, asthma is a heterogeneous disease that is often characterised by persistent inflammation of the airways, which leads to a history of respiratory symptoms that change over time and in intensity and are accompanied by varying limitation of expiratory airflow. [1].

Globally, asthma ranks as the 24th leading cause of years lost due to disability and the 34th leading cause of disease burden.[2]

Asthma was predicted to impact 262 million people worldwide in 2019, translating to an age-standardized rate of 3416 cases per 100,000 people, according to the Global Burden of Disease Study (GBD). The study also estimated that in 2019, 461,000 people in the world died from asthma – more than 1000 per day.[2]

In Africa, asthma continues to be the most prevalent non-communicable disease (NCD) in children and adolescents**.** In Ethiopia more than 10 million people, representing 8.7% of the population, are believed to have asthma with the rate of poor asthma control among them being as high as 78%. [3]

Inhalers are the most common way to take asthma medication, with Metered Dose Inhalers, Dry Powder Inhaler and Soft Mist Inhalers being the three main types of inhalers. Improper use will result in reduced effectiveness substantiating that improper asthma inhaler device use is one of the major causes associated with uncontrolled asthma and frequent ED visits. [3-5]

In a cross-sectional study done in TASH , 87.4% had poor inhaler technique even though 79.3% of the participants had received instructions on how to receive them.[6] Moreover a small scale cross-sectional study among pharmacy professionals in Addis Ababa showed that 94% of the professionals demonstrated a poor technique.[7]

This has showed a gap in the understanding and practicability of the demonstration of inhaler techniques to patients among healthcare provider.

Practice guidelines recommend patient technique be demonstrated and assessed at every encounter using a checklist of critical steps with repetition until competency is achieved. [1] However, there is a wide gap between guideline directed practice and actual practice.

Studies have showed that, education in inhaler technique which were consistent showed reductions in ER visits and exacerbations. [8] Trainings that proved to be most effective where person to person training and multimedia training. [9]Trainings delivered by projects to improve inhaler techniques were well received by the patients and following trainings, health care professionals were able to deal effectively with patient's concerns. By the end of the projects, significant increments in proper uses of inhaler techniques as well as asthma symptoms control were achieved. [8-10]

4. Statement of the problem and Rationale of the study

According to several studies done in our set up, it has been proven that the majority of asthmatic patients have poor inhaler techniques with the most commonly used inhaler device being the MDI inhaler contributing to poor asthma control in such patient. [6, 11, 12]

Even though, most of the patients received instructions from health professionals in previous studies, a statistically significant improvement in the techniques of the patients has not occurred, probably owing to the fact that the education delivered by the health care professionals is suboptimal.[6, 7, 13]

Furthermore, Practice guidelines recommend patient technique be demonstrated and assessed at every encounter using a checklist of critical steps with repetition until competency is achieved. However, there is a wide gap between guideline recommendations and actual practice in TASH as most patients do not have documentation of their inhaler techniques on their electronic medical recordings at every visit.

Therefore, in this quality improvement project, we implement person to person as well as multimedia training to asthmatic patients in the Chest Referral Clinic of TASH intended to improve the rampant prevalence of poor inhaler techniques owing to poor asthma control in our patients. It will also bridge the gaps between knowledge and practice among health care

professionals in providing trainings for patients and proper documentation for future use and improvement.

This could be a pilot project study for the extension of this kind of quality improving service to other hospitals in service of asthmatic patients and will help eventually in the development of nationwide strategies for improving inhaler techniques among asthmatic patients throughout the country.

5. Literature Review

Prevalence of poor Asthma control in Ethiopia

In a systematic review and metanalysis done by Jimma University and AAU published in 2022 , from 1,388 patients, based on the Global Initiative for Asthma (GINA) symptom control, the rate of the uncontrolled asthma was 45.0%. [3] In this study, the rate of well-controlled asthma was 19% at the national level, 14% in Jimma and 25% in Addis Ababa. [3]

In another study conducted in Addis Ababa, 75.8% of asthmatic patients had uncontrolled asthma. [4] Incorrect inhalation technique is one of the most important contributing factors for poor asthma control.[3, 4]

Prevalence of poor inhaler technique

A systematic review of 144 articles done over 40 years (from 1975-2014), included studies performed in 31 countries and reported on a total number of 54 354 subjects. This review found that the overall prevalence of correct inhaler technique was only 31%.[14]

The CRITIKAL study evaluated the inhaler technique type, frequency, and correlation with asthma outcomes through a cross-sectional, observational analysis utilizing data gathered for the iHARP asthma review. 3660 patients' worth of data are included in this study. Only 19.5% and 13.4% of patients using turbohaler and MPI, respectively, were found to have had correct techniques.[15]

Data were gathered from 55 studies that involved 6,304 HCPs taking 9,996 assessments to gauge their IT proficiency. In 15.5% of cases, the IT was thought to be accurate overall. HCPs showed a lack of understanding on how to utilize inhalers correctly. These professionals may be unable to

properly assess patients and instruct proper inhalation techniques to them due to a lack of awareness on how to utilize these devices correctly.[16]

In Jimma University Medical Centre (JUMC), a prospective observational study conducted in 2018 evaluated relationship between MDI use technique and asthma control among adult asthmatic patients who attended the respiratory clinic. Regarding their inhaler technique, 130 (92.85%) patients had errors in one or more steps. Only about 26% patients were efficient, and the rest were not efficiently using their inhalers. A significant association was seen between asthma control status and inhalation technique.[17]

Another cross-sectional study, on the level of asthma control and risk factors for poor asthma control among clinic patients seen at a referral Hospital in Addis Ababa was conducted on 182 between July and December 2015. The study assessed improper inhaler technique as one of the variables for poor asthma control and found that 34.6% of patients had improper inhaler technique.[4]

Cross-sectional study that has been submitted for publication in TASH found that the prevalence of poor inhaler technique in asthmatic patients on regular follow up at the chest clinic in 2022 at TASH is 87.4% and that education level is causally associated with missed essential inhalation steps Majority of the patients who had poor inhaler technique were MDI users, 82 (69.5%), and the rest were using both types of inhalers 24 (20.3%) or DPI 12 (10.2 %). [6]

Interventions and Quality Improvement Projects done on improving inhaler techniques

In a Cochrane systematic review that included 29 parallel RCTs and 2210 asthmatic patients, with a follow up ranging from 2 – 26 weeks, it was shown that enhanced inhaler technique education and multimedia training including DVD, computer app or games, showed improved technique in most studies immediately after the intervention and at follow up even though most evidence was considered to be of moderate evidence quality due to biases.[9]

From this systematic review, 3 studies 258 participants showed 31 per 100 participants with correct technique in control group compared with 69 per 100 in the education group (95% CI 45 to 86). These also showed 30/100 in control group with correct technique compared with 47/100 with correct technique in the multimedia group 7 (95% CI 26 to 70). [9]

A retrospective open cohort study was conducted in a single hospital in Baltimore including 525 cases of BA and COPD with participants mean age of 71 years to asses effect of inhalational technique guidance and procedure improvement. Continuous repeated guidance steadily and significantly decreased errors with all devices (for DPI, pMDI, and soft mist inhaler) ($P < .001$ for DPI, pMDI, and soft mist inhaler). Elderly cases (>70 years of age) should undergo continuous repeated guidance to reduce inhalation errors like inhalation speed and gargling errors.[18]

In a quality improvement project done in a hospital in New York City, 25 patients with a diagnosis of COPD and asthma were prospectively followed for 7 month and during each visit, they were educated on inhaler techniques. Inhaler technique intervention had an overall positive outcome in 84% of the subjects and no outcome in 16%,with a 91% reduction of ER visits among the asthmatic patients postintervention. [8]

In another project done among the admitted pediatric age group with 138 people, 100% of the patients/caregivers were able to demonstrate competency in every critical step in medication administration prior to discharge from Pediatric Emergency Department after receiving checklist driven training from trained nurses in the ED.[19]

In a single center QI project done among 30 COPD patients, it was shown the simple, rapid and structured educational intervention such as a teaching session complemented a flyer resulted in good overall inhaler application (80% of COPD patients used the inhaler correctly) and patients acquired ability was maintained for up to 14 days (83.0% , p value>0.99).[20]

In a rural primary health care clinic in the Eastern Cape, South Africa, fifty-five rural asthma patients were recruited for a pre-post design educational intervention study by using leaflets as intervention. Metered dose inhaler technique was assessed using a checklist, and patients were

then educated using a study leaflet. The number of correct steps increased significantly post intervention from 4.6 ± 2.2 at baseline to 7.9 ± 2.7 at follow-up ($p < 0.05$). Statistically significant improvement of correct technique was established for 10 of the 12 steps.[21]

6. Objectives of the Project

General Objective

- To assess the impact of inhaler technique demonstrations (both multimedia and face to face demonstrations) in the improvement of MDI and DPI inhaler techniques among asthmatic patients

- To asses the impact of inhaler technique demonstrations on symptom control of the participants by using the ACT tool.

Specific Objective

- To measure asthma inhaler technique among participants 4 weeks after face-to-face training aided with a pamphlet pictogram and a video demonstration
- To compare and quantify impact of face to face and multimedia demonstration on improvement of patients' MDI and DPI inhaler techniques pre and post intervention
- To evaluate and measure the extent of asthma control in patients that have received stated intervention using the ACT tool score and compare it with the ACT score preintervention

7. METHODS AND MATERIALS

7.1 Study Area

The study was conducted at chest clinic of TASH in Addis Ababa, the capital city of Ethiopia. TASH is the largest tertiary hospital in Ethiopia, offering diagnosis and treatment for approximately 370,000–400,000 patients per year. There are 16 outpatient clinics located within the hospital. The chest clinic has over 500 visits/month. [4] The clinic runs three times per week, and it has a spirometry unit with trained staff, which has increased its capacity for diagnosing

asthma. Medical residents, pulmonary/critical care medicine fellows and attendings care for the patients in the clinic.

7.2Population

7.2.1Source Population

All Asthmatic patients that were seen in the adult chest referral clinic during the study period.

7.2.2Study Population

Selected adult patients with physician diagnosed asthma on follow up at chest clinic of TASH for at least 3 months, and came for follow-up visits during the study period.

7.2.3 Inclusion and Exclusion Criteria

- **Inclusion Criteria**

  - All adult patients with physician diagnosed asthma on follow up at chest clinic of TASH for at least 3 months
  - Age ≥ 18 years
  - Agree to consent and participate
  - All patients who brought their inhaler to follow-up.
  - Patients on inhalers for at least 3 months
  - Patients who are willing to come for follow up in a short appointment for postintervention assessment

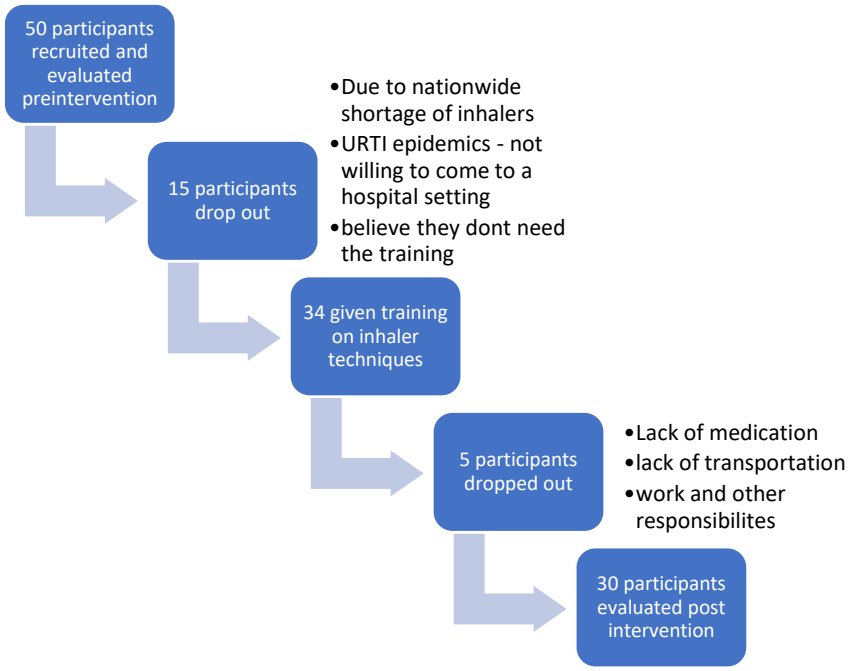
- **Exclusion Criteria:**

  - Individuals on follow-up for less than 3 months
  - Asthma patients who are not on inhalers
  - All asthmatic patients who are seriously ill during the data collection period
  - Subjects who refuse consent.
  - Non-asthmatic indications of inhaler mediction (COPD, post TB lung disease etc)

7.3 Sample Size and Design

This is a quality improvement project, where were assessed and data collected before and after intervention and comparisons made to quantify impact of intervention among study population.

- As most literatures and quality improvement projects which served as pilot worldwide incorporated 25 – 35 patients, we enrolled 30 asthmatic patients with poor asthma inhaler techniques in to this quality improvement project. [8, 10, 22]
- Even though target sample size was 30 participants, 50 patients were recruited considering 50% nonresponse rate due to the nationwide shortage of inhaler medications
- Figure 1- Study Participant enrollment



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7.3.1 Period of Study

Study had been conducted between the time period of August 13, 2023 – January 28, 2024

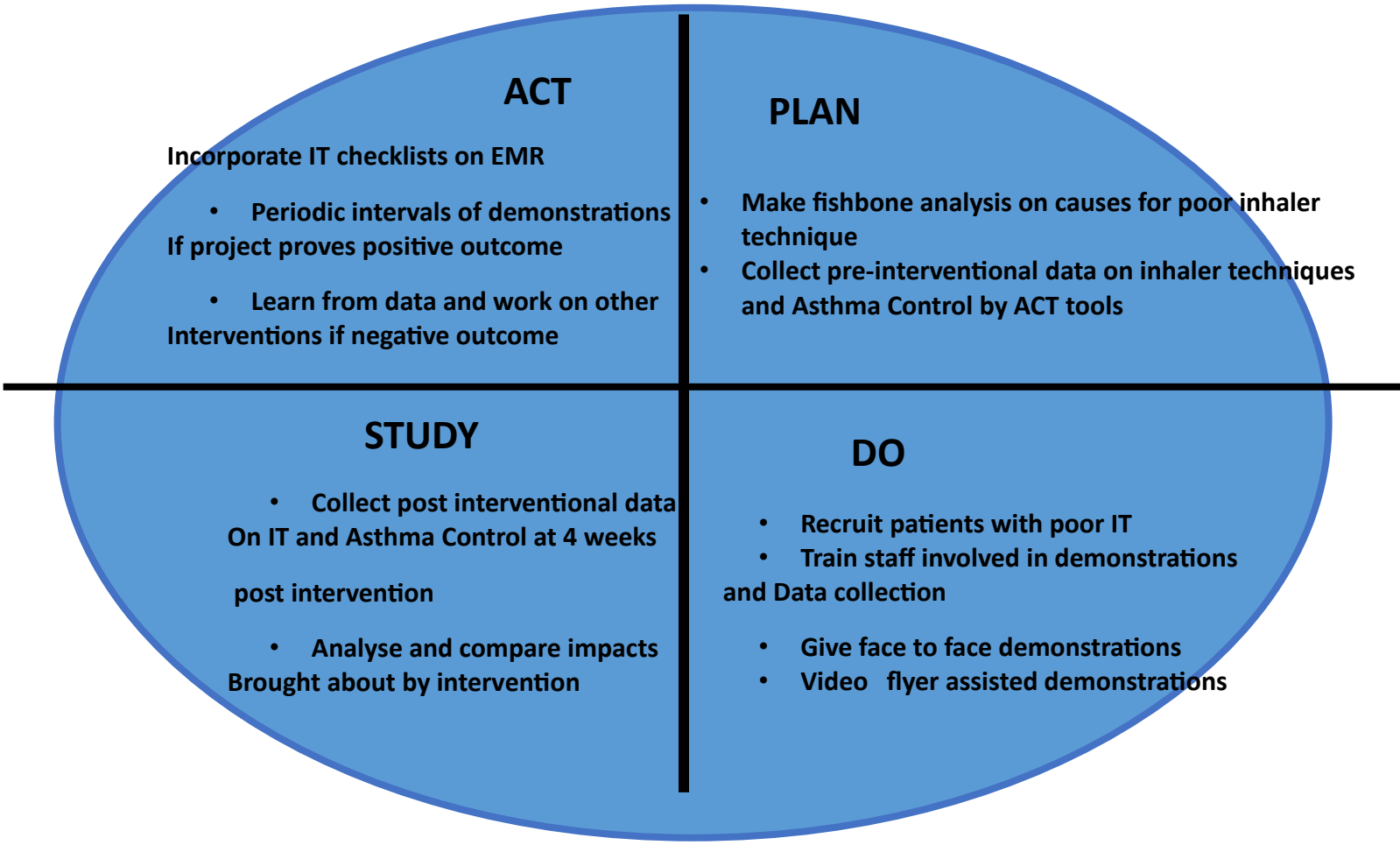
7.4 Procedures

- The first case of bronchial asthma patient who came for follow-up at TASH's chest clinic at the beginning of the study period on August 13 was recruited and all consecutive patients were included until a sample size of 50 was reached.
- Inhaler techniques of each patient was assessed using the checklist adopted from previous studies by a trained General practitioner and the project lead in the OPD along with filling out Asthma Control Test (ACTs) tool to assess baseline asthma control for later comparison.
- This was followed by face-to-face demonstration of guideline directed MDI and DPI inhalational technique which was given by the trained general practitioner and /or the primary investigator (Internal Medicine final year resident).
- The face-to-face demonstrations comprised of groups of 5 – 15 participants per session. Demonstrations were given by the health care professionals followed by a teach back method where participants practiced until 100% competency and asked questions.
- One session lasted from 1 hour to 3 hours depending on the number of participants per group.
- The face-to-face demonstrations were aided by pictogram pamphlet that has been adopted from a previous study done in South Africa. This pamphlet that has been designed by specialists to allow fitness for population with low literacy rate and older age group was explained and distributed among all the training participants.
- Online Videos were designed and adopted in Amharic and distributed among participants that had access to smart phones and social media.
- The asthmatic patients were then evaluated 4 weeks after demonstrations have been given.
- Inhaler techniques were assessed at follow up visit with corrections given. Asthma control Test questionnaires were also assed at follow up visit.
- Questionnaires that have been adopted from previous studies on applicability and usage of video/leaflets that have been distributed were assessed at 4 weeks postintervention.

7.5 Design-To-Action Plan

The project was based on the Institute for Healthcare Improvement model of the Plan-Do-Study-Act (PDSA) cycle to implement change

Fig 2- PDSA cycle of QI project



The "Plan" phase included fishbone analysis and literature search on interventions to improve MDI and DPI inhaler technique. The most practical one being providing face-to-face

demonstrations and trainings to patients, as well as promoting proper documentation of MDI and DPI inhaler techniques at each visit as recommended by the GINA guidelines.

The “Do” phase is training sessions and demonstrations followed by assessment of inhaler techniques and asthma symptom control 4 weeks after intervention.

The “Study” phase has involved measuring and analyzing impacts brought about by the intervention with regards to asthma symptom control and proper inhaler techniques and identifying barriers for proper patient education.

The “Act” phase will involve implementing strategies like periodic interval inhalational technique demonstrations and trainings for patients and healthcare providers and incorporating proper documentation of inhaler techniques of all asthmatic patients during each OPD visits using guideline recommended checklists in the Electronic Medical Records.

8.Data Collection

For data collection, a structured questionnaire (Annex 2) to assess baseline characteristics and comorbidities that have been obtained from previous studies were filled out by trained general practitioner once written consent were obtained. Then data was collected from the sample population before and after the project implementation by using a checklist to check MDI and DPI inhaler techniques (Annex 1) adopted from previous studies. Patients who missed any of the “essential” steps will be categorized as poor inhaler technique.

Asthma Control Test Tool (Annex 3) was also filled out before and after intervention for evaluation of asthma symptom control based on GINA guidelines. ACT has four symptom/reliever questions plus patient self-assessed control. The minimum clinically important difference is 3 points. Taking ACT for evaluating asthma control in patients is based on previous studies. [23]

Eventually videos from online materials and pictogram pamphlets that have been adopted from previous studies were distributed and questionnaires adopted from previous studies on the convenience and feasibility of these methods were filled out.

8.1 Operational Definitions

- Asthma -Diagnosed by physician or confirmed by spirometry.
- Inhaler technique – steps used to deliver inhalational drugs to the lungs.
    - Proper Inhaler Technique: incorporating all of the essential steps as depicted in Annex I
    - Poor Inhaler Technique – missing any of the essential steps
    - Essential Steps: Steps without which inhalational drugs would not adequately reach the airways and thus results in much decreased efficacy.

- Asthma Control Test Tool- Questionnaire tool used to assess symptom control of asthma in the past 1 month. Score ranges from 5 – 25 (Annex III)
    - Well-Controlled Asthma - Scores of 20 – 25 using the ACT tool.
    - Not-well controlled Asthma - scores 16 – 19 using the ACT tool
    - Poorly controlled Asthma - scores 5 – 15 using the ACT tool.

- Monthly income: - is the total amount of money (Ethiopian birr) a responder could get per month which is categorized according to 2020 WHO report:
    - Low (<3100birr),
    - Low moderate (3100-12100 birr),
    - Moderate (12101-37600 birr) and
    - High (>37600 birr)

- Trained patients---- those that have received face to face demonstrations at Bronchoscopy room of Tikur Anbessa by either the project lead, residents or other GPs exclusively done for asthmatic patients.

- Patients with multimedia assistance ---- those patients who have used either the pamphlet or the videos that have been distributed when using inhaler with the aim of being assisted on their inhaler techniques

8.2 Study Variables

Dependent variable:

- Prope use of inhaler technique post intervention
- Asthma control using ACT tool post intervention

Independent variables:

- Sociodemographic characteristics (Age, sex, residency, level of education, financial status etc.)
- Duration of asthma
- Co-morbidity
- Previous Asthma Education (on how to use their inhaler devices)
- Asthma inhaler technique preintervention
- Asthma control using ACT tool preintervention

9. Data Analysis

The collected data has been checked, compiled labeled and cleaned before entry in to the computer using EPI software, and then all the statistical tests were performed using SPSS version 26.

Descriptive analysis was done using mean, median frequency and percentages. After testing for basic assumptions and normality distribution using Shapiro Wilk test, comparison of mean and/or median between total scores of inhaler technique steps preintervention and postintervention score as well as ACT scores has been made by Wilcoxon rank test.

The influence of age, gender, education and sociodemographic data on improvement of inhaler techniques has been made using nonparametric tests. The categorical data have been compared with continuous data using Mann Whitney test and Kruskal Wallis test based on number of subgroups in each category.

The results are reported in tables and graphs. A P-value less than 0.05 has been considered statistically significant.

10. Ethical Considerations

Ethical approval was obtained from the Research and Ethics Committee of the Department of Internal Medicine, College of Health Science Addis Ababa University.

All patients gave informed consent to participate in the confidential interview.

All patients gave informed consent to participate in project implementation and the follow up assessment.

5. Results

5.1 Sociodemographic characteristics of the study participants

We enrolled a total of 30 consecutive patients with stable asthma control from August 13/2024 – July 3/2024 that have attended 1st and 2nd follow up visit (n=30, 100.0%) . An overview of the relevant demographic and clinical characteristics of participants is provided in **Table 1**.

Of the total study participants, more than half were between the age of 51 and 70 years old and most of the respondents were female, 19 (63.3%). Almost all of the study participants were from the urban district and 18(60%) were married. Thirty-three percent of the study participants have completed primary education while twenty-three have graduated from higher education institute.

Among the study participants, 18(60%) were either government or private employees while 3(10%) were retried. Forty percent of the study participants had low income while fifty-seven percent had a middle level of income.

Table 1.The sociodemographic characteristics of the study participants among Asthmatic patients in the Chest Referral Clinic of Tikur Anbessa Specialized Hospital, 2023.

variable	Frequency	Percent
Age in years		
18-30	1	3.3
31-50	12	40
51-70	16	53.4
>70	1	3.3
Sex		
Male	11	36.7
Female	19	63.3
District residence		
Urban	29	96.7
rural	1	3.3
Marital status		
Single	8	26.7
Married	18	60
Divorced	3	10
widowed	1	3.3
Education level		
no formal education	5	16.7
primary	10	33.3
secondary	7	23.3
higher education	8	26.7
Occupation		
Government employee	9	30.0
private employee	9	30.0
self-employee	1	3.3
Unemployed	6	20.0
Retired	3	10.0
Housewife	2	6.7
monthly income		
Low (<3100birr	12	40.0
low-moderate (3100-12100)	17	56.7
moderate (12101-37600)	1	3.3
Residence		
urban	3	10.0
rural	27	90.0

5.2 Comorbid disease related characteristics of the study participants

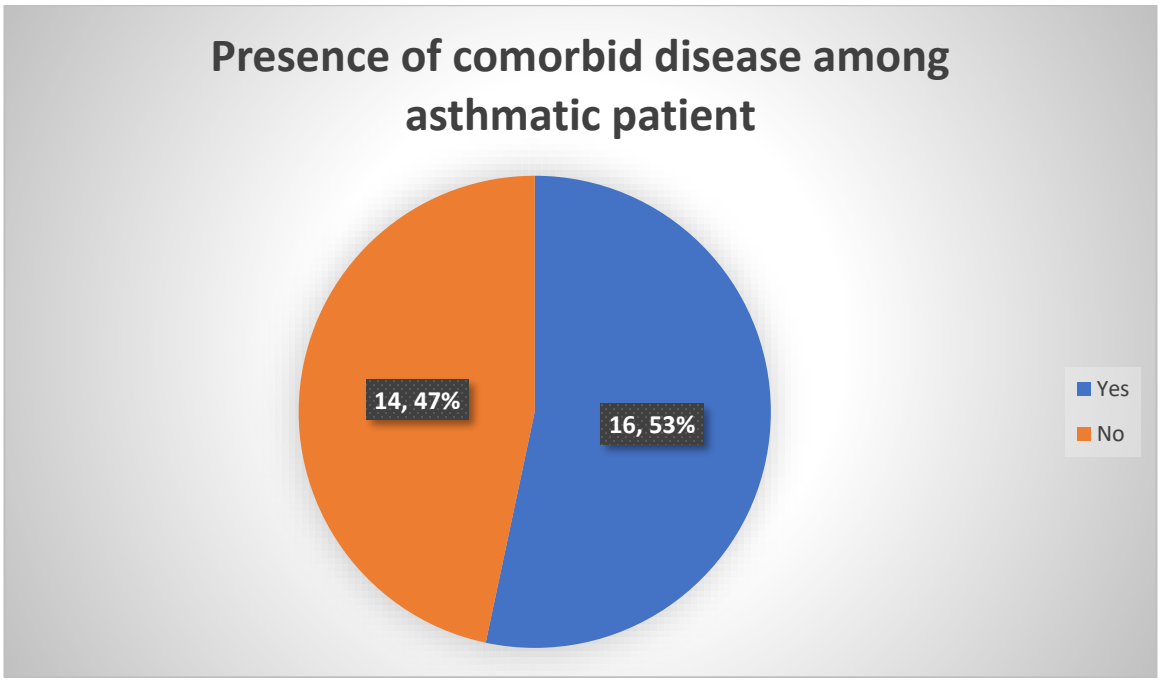


Figure 3. Presence of comorbid disease among asthmatic patients

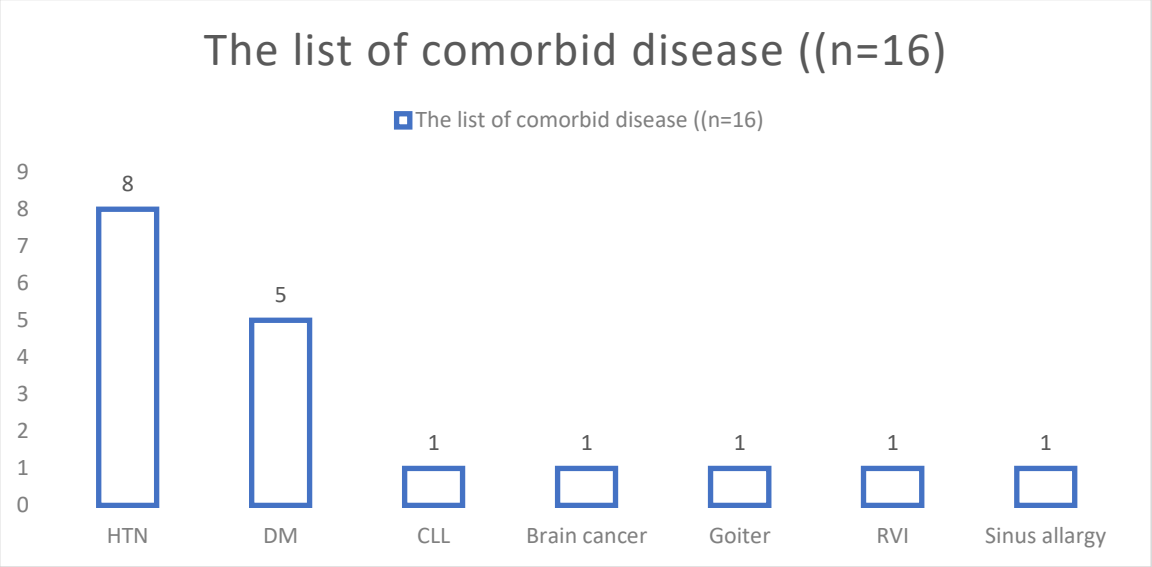


Figure 4- types of comorbidities

5.3 Asthma related characteristics of the study participants

Of the total study participants, 11 (36.7%) were MDI users while 2 (6.7%) patients were DPI users and 17 (56.6%) patients used both inhalers. Eighty-seven percent of the study participants have received health education about inhaler techniques by health provider. Among this, nearly all (96.2%) participants received education from physicians and all of them received information by verbal instruction (100%) . 93.3% of the study participants had regular follow up at chest clinic and 76.7% had visited emergency department due to exacerbation of asthma and 83% have used inhalers as intended.

Table 2. Asthma related characteristics of the study participants

Variable	frequency	Percent
Type of inhaler used		
Only MDI	11	36.7
Only DPI	2	6.7
Both	17	56.6
Duration of Asthma Diagnosis		
<5 years	3	10.0
5 – 10 years	6	20.0
>10 years	21	70.0
Health education given on inhaler use by health provider		

Yes	26	86.7
No	4	13.3
Health education was given by (n=26)		
Physician	25	96.2
Pharmacist	1	3.8
Types of education given		
Verbal instruction	26	100
Was the health education in the last 12 month		
Yes	24	92.3
No	2	7.7
Have regular follow up at the chest clinic		
Yes	28	93.3
No	2	6.7
Visited emergency department in the last 12 months for asthma exacerbation		
Yes	23	76.7
No	7	23.3
Use inhaler/regularly as intended		
Yes	25	83.3
no	5	16.7

5.4 Characteristics of pre-education inhaler technique

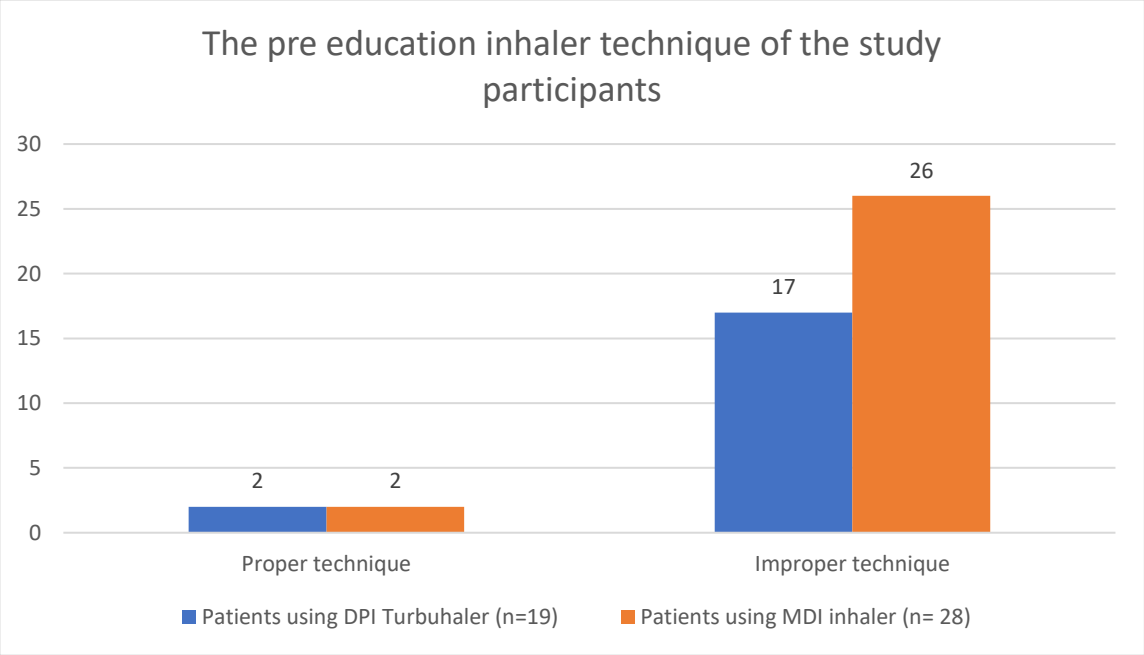


Figure 5.The study participants preintervention inhaler technique.

28 participants were evaluated in the use of their meter dose inhalers and from among these, 92.9% demonstrated improper inhaler techniques as defined by missing of one of the essential steps adopted from the adopted checklist and only 7.1% had demonstrated proper techniques.

Whereas from among 19 participants that were evaluated in using their DPI techniques, 89.4% demonstrated improper techniques whereas only 10.5% of the patients demonstrated proper inhaler techniques

In the DPI using group, Step 1 (''Remove the cap from the Inhaler'') and Step 4 ("Rotate grip until click is heard') was correctly completed by all patients (19), while Step 5 ('' Exhale away from mouthpiece'') was the most missed step. While the steps of 'exhale to residual volume and hold breath for 5 seconds' were correctly practiced by only 21.1% of the study participants.

In the PMDI using group, overall, the most correctly performed step was the first: "Remove mouthpiece cover and shake*",* 28(100%) and the most missed step was the third: "Exhale to residual volume", 5 (17.2%).

Table 3. Characteristics of pre-education inhaler techniques of the study participants

Variable	Frequency	Percent
Total user of turbuhaler technique (DPI)		
Yes	19	**63.3**
No	11	**36.7**
Inhaler technique of DPI users (n=19)		
Remove the cap from the inhaler (e)	19	100
Keep inhaler upright (e)	18	94.7
Rotate grip until a click is heard (e)	19	100
Exhale to residual volume	4	21.1
Exhale away from mouth piece	1	5.3
Place mouthpiece between teeth and lips	16	84.2
Inhale forcefully and deeply (e)	10	52.6
Hold breath for 5 seconds	4	21.1
Exhale away from mouthpiece	14	73.7%
Total pre-education user of PMDI technique		
Used	28	**93.3%**

Not used	2	**6.7%**
Correctly used the pMDI technique (n=28)		
Remove mouthpiece cover and shake	28	100%
Hold inhaler upright	23	82.1%
Exhale to residual volume	5	17.9%
Keep head upright or slightly titled	14	50%
Place mouthpiece between teeth and lips	27	96.4%
Inhale slowly and press canister	10	35.7%
Continue slow and deep inhalation	9	32.1%
Hold breath for 5 seconds	14	50%
Close the inhaler	25	89.3%

5.5 Asthma Control Tool Scores among participants Pre – Education

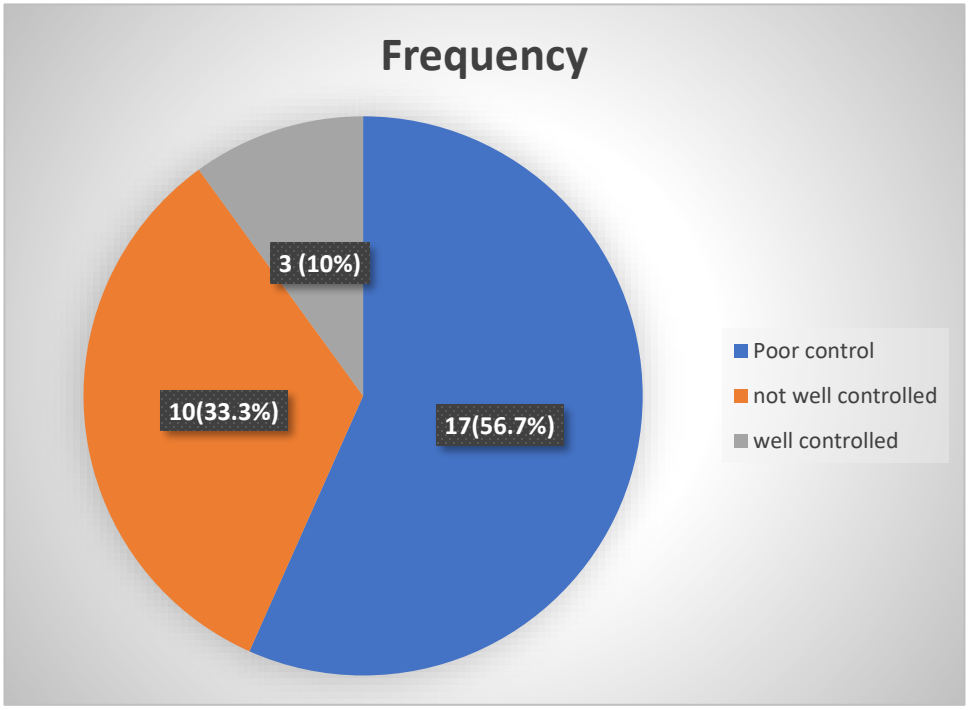


Figure 1.preintervention asthma control level

As rated per ACT tool, 56.7% of the project participants have a score of <15, while 33.3% have an ACT score between 16 – 20 , and only 10% of the participants have a score of > 20

Table 4. ACT score preintervention

variable	Frequency	Percent

In the past 4 weeks, how much of the time did your asthma keep you from getting to work, school or at home		
All of the time	4	13.3
Most of the time	5	16.7
Some of the time	11	36.7
A little of the time	7	23.3
None of the time	3	10
During the past 4 weeks how often have you had shortness of breath		
More than once a day	4	13.3
Once a day	8	26.7
3 to 6 times a week	7	23.3
once or twice a week	9	30
Not at all	2	6.7
During the past 4 weeks how often did your asthma symptom (wheezing, coughing, shortness of breath, chest tightness or pain) wake up at night or earlier than usual in the morning		
4 or more nights a week	3	10
2 to 3 nights a week	9	30
once a week	7	23.3
Once or twice	9	30
Not at all	2	6.7
During the past four weeks, how often have you used your rescue inhaler or nebulizer medication?		
3 or more times per day	3	10
1 or 2 times per day	10	33.3
2 or 3 times per week	9	30
Once a week or less		
Not at all	6	20
How would you rate your Asthma control during the past 4 weeks?		
Not controlled at all	6	20.0
Poorly controlled	11	36.7
Somewhat controlled	11	36.7
Well controlled	2	6.7

5.7 Improvement of asthmatic participants' inhaler technique after training

In this study 63.3% (n=19) of the study participants used turbuhaler technique. Accordingly, essential steps like 'Keeping the inhaler upright' improved from 94.7% to 100%, 'Exhaling to residual volume' improved from 21.1% to 78.9%, and 'Exhaling away from the mouth piece' improved from 5.3% to 100% and the overall proper turbuhaler inhaler technique improved from 5.3% to 52.6%.

Using the nonparametric Wilcoxon Signed Rank test , median score of total number of inhaler technique steps has increased from a baseline of 6 (IQR 5,6) to a median of 8 (IQR 7,9) with a Z-score -4.23 (Pvalue <0.001) 1 month after intervention with face to face education augmented with a pictogram pamphlet.5 out of the 9 steps in MDI technique had a significant improvement while the remaining 4 steps were mostly correct at baseline.

On the other hand, 93.3% (n=28) of the study participants used PMDI inhaler technique in both pre and post multimedia practice. As such important steps like 'holding the inhaler upright improved from 82.1% to 100%, 'Exhaling to residual volume' improved from 17.9% to 64.7% and the overall proper inhaler technique of PMDI improved from 7.1% to 35.7% as shown in the table below.

Use of DPI techniques have also showed a statistically significant improvement from a baseline median of 6 (IQR 4,7) to a median of 8 (IQR 8,9) with a Z score= - 3.75, P value <0.001. 6 out of the 9 steps of using DPI showed a significant improvement with the remaining 3 steps being mostly correct at baseline.

The total number of proper inhaler technique users without missing any of the essential steps has increased from 2 (10.5%) participants to 10 participants (52.6%) P=0.007 in DPI users and has increased from 2 participants (7.1%) to 10 (35.7%) participants P= 0.011 in MDI users.

Table 5. DPI and MDI inhaler techniques pre vs post intervention

Variable	Pre-education	Post education	Wilcoxon Rank Test – Z test	p-value
Total user of turbuinhaler technique in pre and post education				
Yes	19(63.3%)	19(63.3%)		
no	11(36.7%)	11(36.7%)		
Correctly used the turbuinhaler inhaler technique (n=19)				
Remove the cap from the inhaler €	19(100%)	19(100%)		

Keep inhaler upright €	18(94.7%)	19(100%)		
Rotate grip until a click is heard €	19(100%)	19(100%)		
Exhale to residual volume	4(21.1%)	15(78.9%)		
Exhale away from mouth piece	1(5.3%)	19(100%)		
Place mouthpiece between teeth and lips	16(84.2%)	18(94.7%)		
Inhale forcefully and deeply €	10(52.6%)	12(63.2%)		
Hold breath for 5 seconds €	4(21.1%)	17(89.5%)		
Exhale away from mouthpiece	14(73.7%)	18(94.7%)		
Overall proper inhaler technique				
Improper inhaler technique	**17(89.4%)**	**9(47.4%)**		
proper inhaler technique	**2(10.5%)**	**10(52.6%)**	**Z score=--2.71**	**0.007**
Median Score (IQR)	**6.00 (IQR 4,7)**	**8.00 (IQR 8,9)**	**Z score=-3.756**	**<0.001**
Total pre- post education user of PMDI technique				
Total MDI users	28(93.3%)	28(93.3%)		
Not used`	2(6.7%)	2(6.7%)		
Correctly used the pMDI technique (n=28)				
Remove mouthpiece cover and shake€	28(100%)	28(100%)		
Hold inhaler upright	23(82.1%)	28(100%)		
Exhale to residual volume	5(17.9%)	18(64.3%)		
Keep head upright or slightly titled	14(50)	26(92.9%)		
Place mouthpiece between teeth and lips	27(96.4%)	28(100%)		
Inhale slowly and press canister€	10(35.7%)	21(75%)		
Continue slow and deep inhalation€	9(32.1%)	15(53.6%)		
Hold breath for 5 seconds€	14(50%)	25(89.3%)		
Close the inhaler	25(89.3%)	28(100%)		
Overall proper inhaler technique by PMDI				
Improper technique	**26(92.9%)**	**18(64.3%)**		
Proper Technique	**2(7.1%)**	**10(35.7%)**	**Zscore=--2.53**	**P=0.011**
Median Score	**6.0(IQR 5,6)**	**8.00 (IQR 7,9)**	**Zscore=- 4.25**	**<0.001**

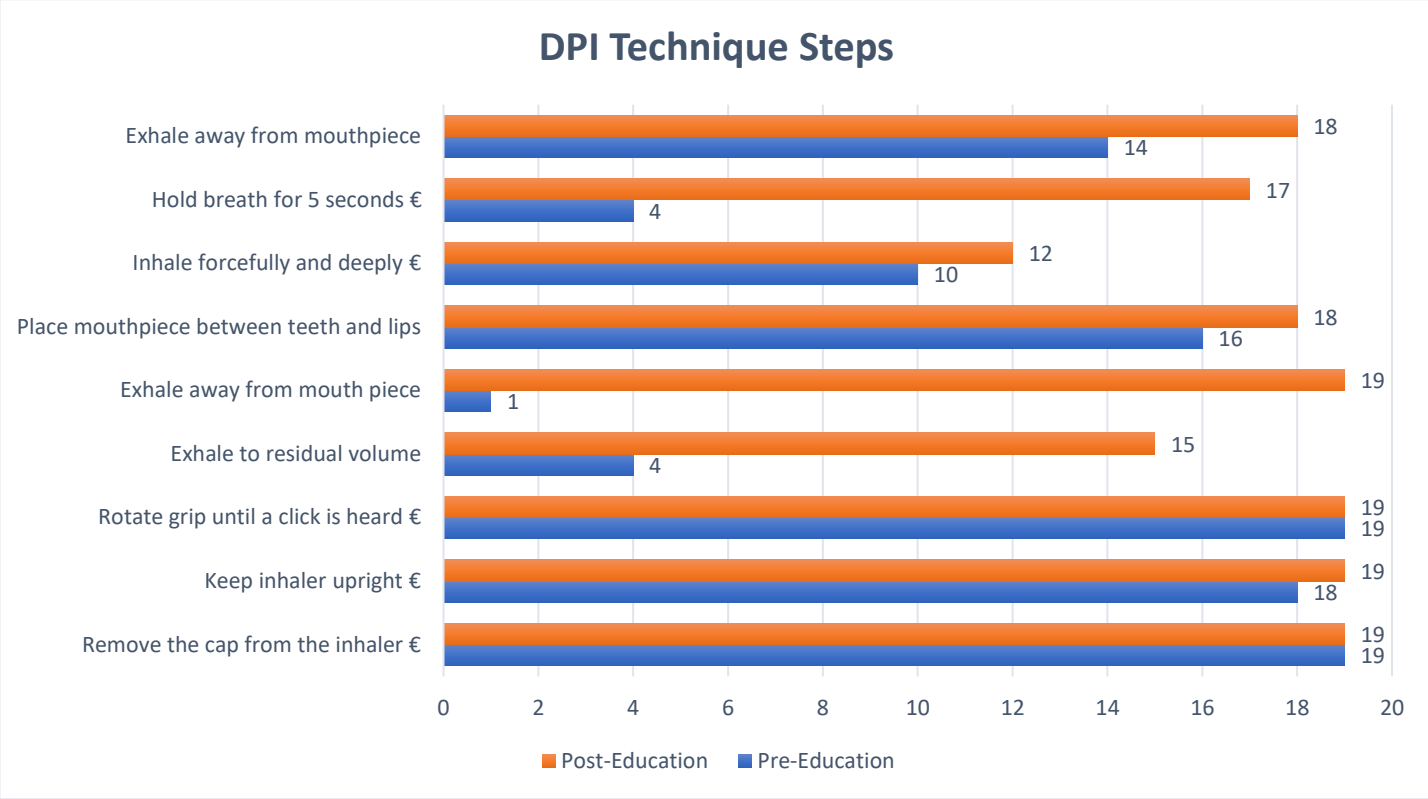
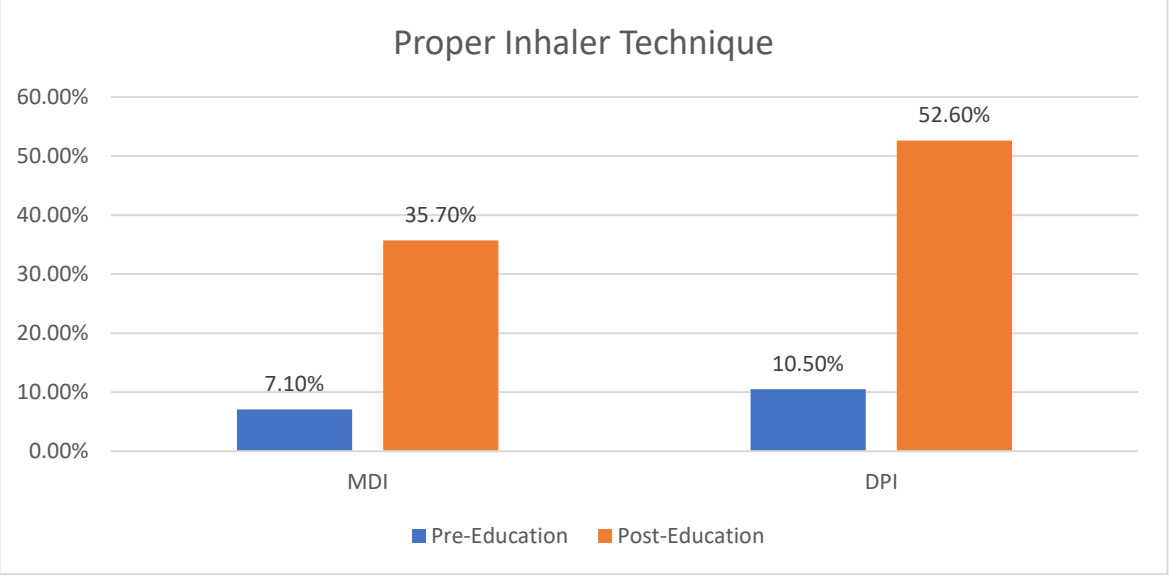


Fig 7- DPI technique pre and post intervention

Fig 8- Proper inhaler technique in DPI and MDI users pre and post education



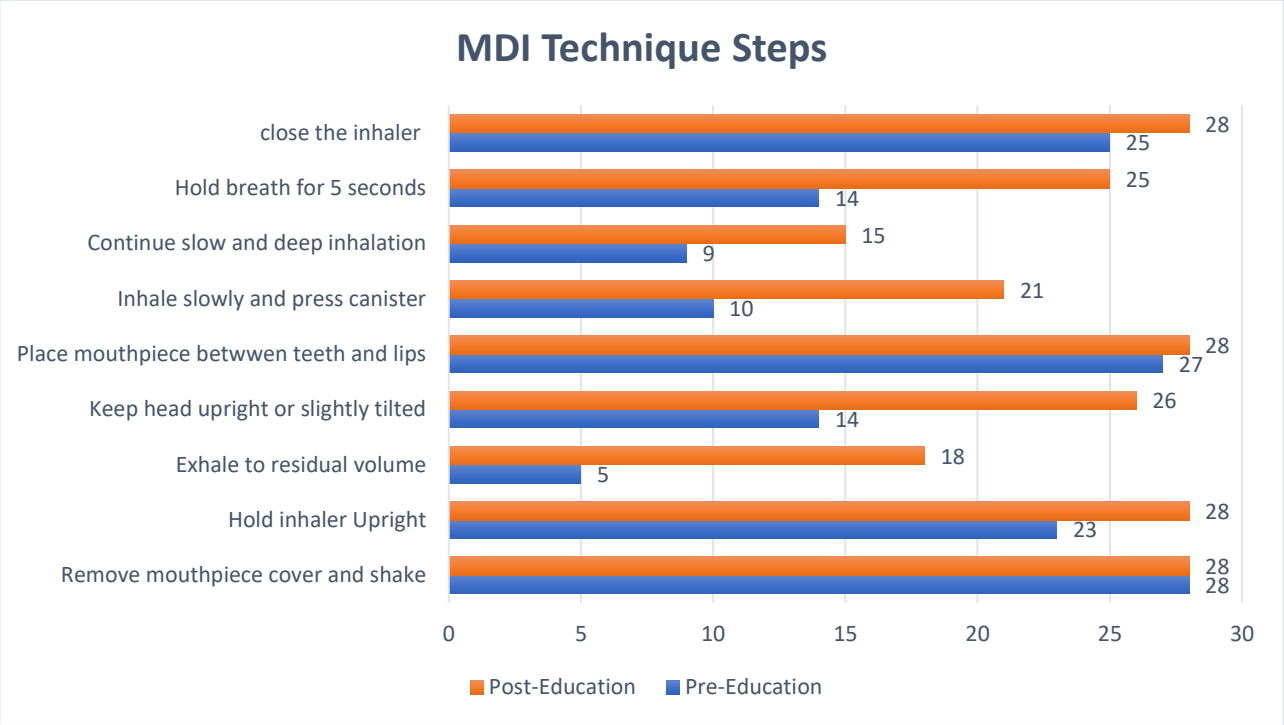


Fig 9- MDI technique pre and postintervention

5.8 The characteristics of pre and post education Asthma Control Test Scores

The finding of this study showed that the poorly controlled asthma level dropped from 56.7% to 46.7% after face-to-face demonstrations aided with pictograms and the well-controlled group increased from 10% to 23.3%. Preintervention median ACT score of 13.5 (IQR 10.75,18) increased to median=15 (IQR 11,18.5) post intervention. However, this increment in the ACT tool score post intervention was not statistically significant, P=0.074 .

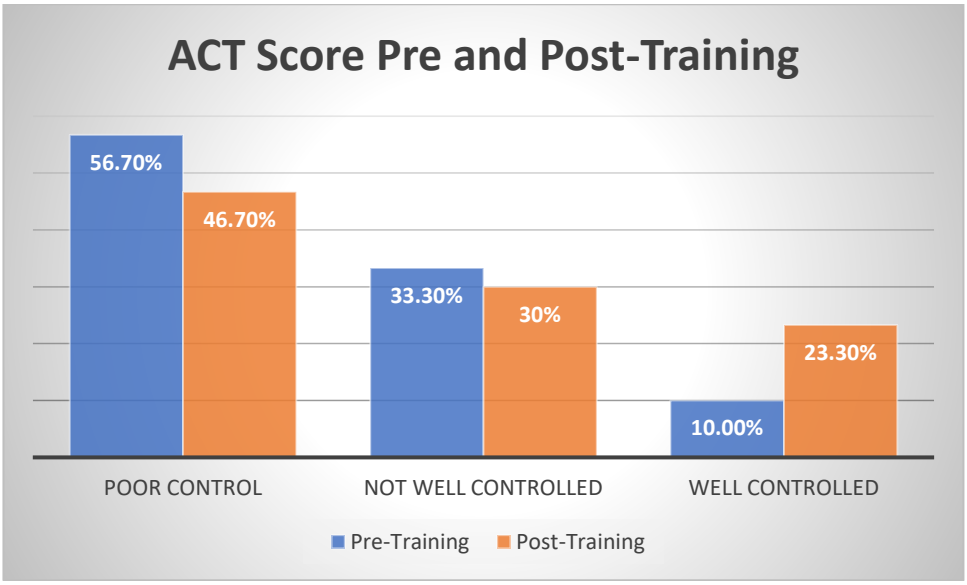


Fig 10- ACT tool score graded pre and post education

ACT tool Questions	Pre-intervention	Post-Intervention
In the past 4 weeks, how much of the time did your asthma keep you from getting to work, school or at home		
All of the time	4 (13.3%)	2 (6.7%)
Most of the time	5 (16.7%)	6(20%)
Some of the time	11(36.7%)	13(43.3%)
A little of the time	7 (23.3%)	7(23.3%)
None of the time	3(10%)	2(6.7%)
During the past 4 weeks how often have you had shortness of breath		
More than once a day	4 (13.3%)	4(13.3%)
Once a day	8(26.7%)	7 (23.3%)
3 to 6 times a week	7 (23.3%)	7 (23.3%)
once or twice a week	9 (30%)	7 (23.3%)
Not at all	2 (6.7%)	5 (16.7%)
During the past 4 weeks how often did your asthma symptom (wheezing, coughing, shortness of breath, chest tightness or pain) wake up at night or earlier than usual in the morning		
4 or more nights a week	3 (10%)	3(10%)
2 to 3 nights a week	9(30%)	8(26.7%)
once a week	7 (23.3%)	6(20%)
Once or twice	9(30%)	7(23.3%)
Not at all	2 (6.7%)	6(20%)
During the past four weeks, how often have you used your rescue inhaler or nebulizer medication?		
3 or more times per day	3(10%)	4 (13.3%)

1 or 2 times per day	12(40%)	9 (30%)
2 or 3 times per week	7 7(23.3%)	7 (23.3%)
Once a week or less	6 (20%)	7(23.3%)
Not at all	2 (6.7%)	3 (10%)
How would you rate your Asthma control during the past 4 weeks?		
Not controlled at all	6 (20%)	3(10%)
Poorly controlled	11 (36.7%)	7(23.3%)
Somewhat controlled	11(36.7%)	9(30%)
Well controlled	2 (6.7%)	11(36.7%)

Table 7- ACT tool questions scored frequencies pre and post education

Multimedia Use among participants

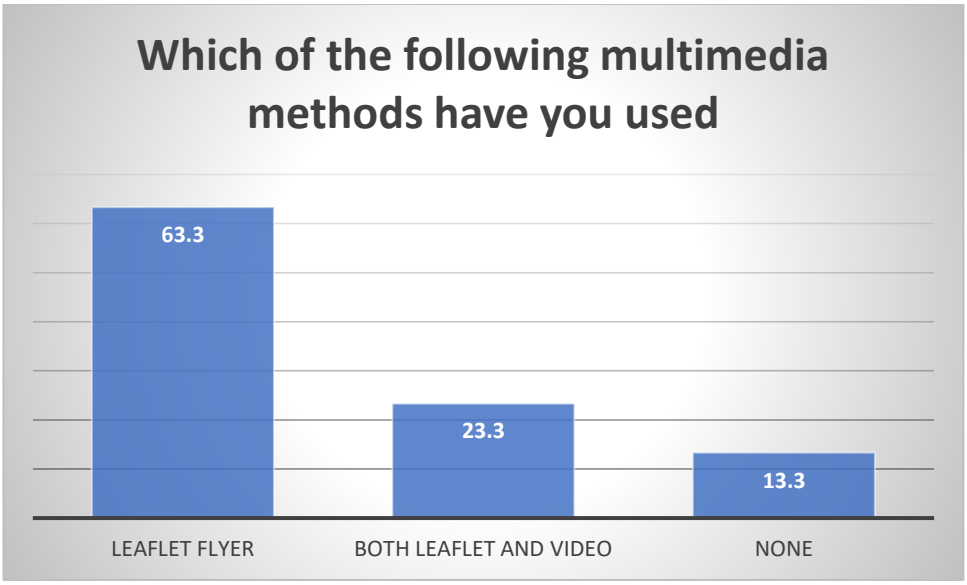


Figure11- Percentages of patients that have used multimedia demonstration

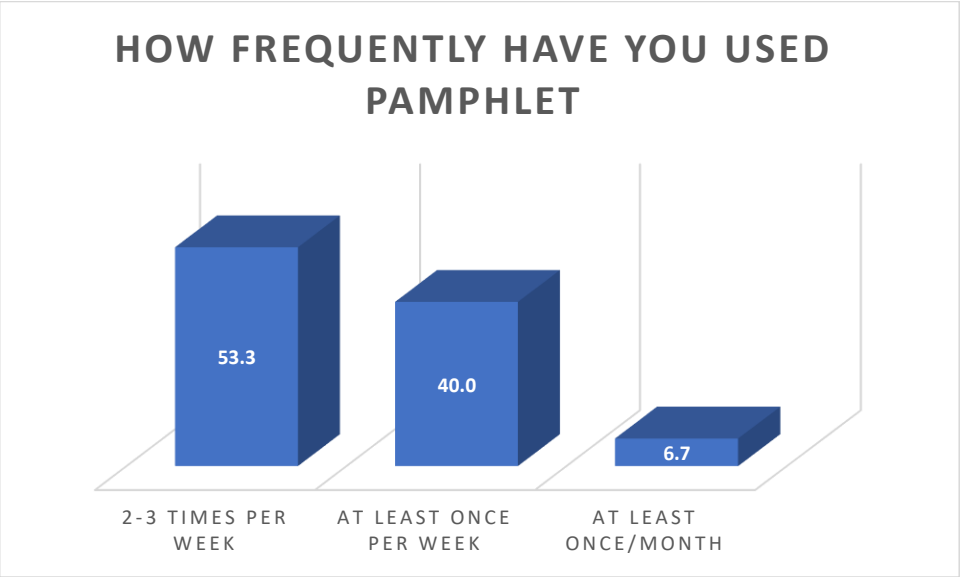


Fig 12-—Frequency of using pamphlet pictogram among trained participants

From among the participants not using a video demonstration, 100% have answered that it was due to not owning a smart phone.

Among the participants that have used the pamphlet pictograms, about 83.3% of the participants have claimed that the contents of the pamphlets distributed were easy to understand and 80% of these participants believe that it has helped them in improving their inhaler techniques .

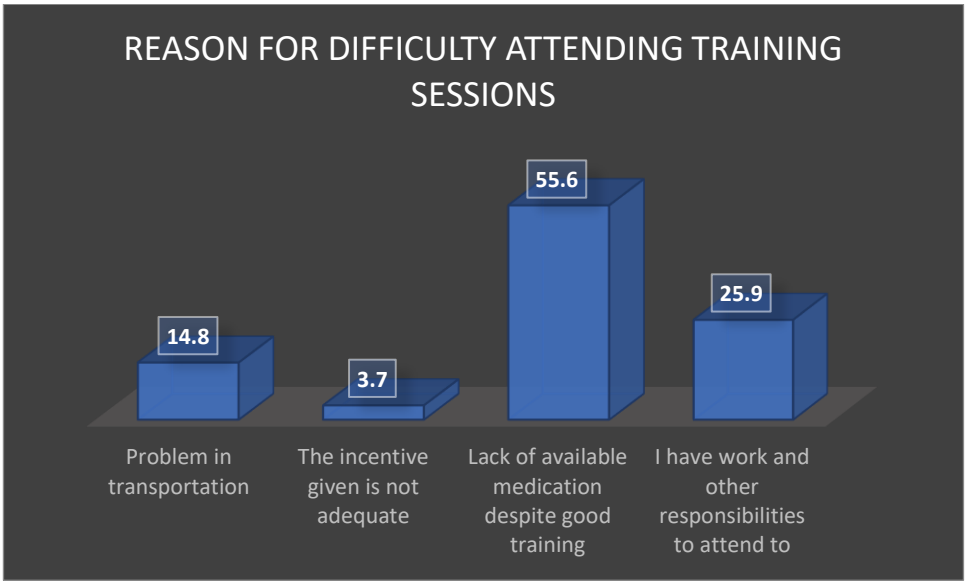


Fig 13- Reason for difficulty attending training sessions

5.7 Factors Associated with Improved Inhaler Technique

According to the non-parametric tests done, Mann-Whitney and Kruskal Wallis test depending on categories , the following sociodemographic data including age, previous health education on inhaler use and level of education of participants has not shown a significant association with increment of inhaler techniques among their respective subcategories.

Characteristics		All patients	Median of Postintervention Inhaler technique score among categories (IQR)	P-value
Age	≤50	14(46.7%%)	9 (IQR 7,9)	**0.084**
	>50	16(53.3%)	8 (IQR 5,8)	
Sex	Male	11(36.7%)	7.5 (IQR 6,9)	0.062
	Female	19(63.3%)	8 (IQR 5,9)	
Marital status	Single	8(26.7%)	9 (IQR8,9)	0.19
	Married	18(60%)	8 (IQR 6,9)	
	Widowed	1(3.3%)	-	
	Divorced	3(10%)	8 IQR (6,9)	
Education level	No formal	5(16.7%)	8.5 (IQR 5,9)	**0.4**
	Primary & Secondary	17(56.7%)	8 (IQR 6,9)	
	Higher education	8(26.7%)	9 (IQR 6,9)	
Monthly income	Low	12(40%)	8 (IQR 6,9)	0.55
	Low moderate	17(56.7%)	8 (IQR 5,9)	

	Moderate	1(3.3%)	-	
Health education given within the last 12 months?	Yes	26 (86.7%)	8 (IQR 5,9)	0.35
	No	4 (13.3%)	9 (IQR 7,9)	
Comorbidity	Yes	16(53.3%)	8 (IQR 6,9)	0.5
	No	14(46.7%)	8(IQR6,9)	
Duration of asthma occurrence	<10	8(26.7%)	7 (IQR 6,9)	0.4
	≥10	22 (73.3%)	8 (IQR 5,9)	
Use their inhaler regularly	Yes	25(83.3%)	8 (IQR 5,9)	0.7
	No	5(16.7%)	8 (IQR 7,9)	

Table 8- Association between patient characteristics and improved inhaler technique

6.Discussion

From this project, we were able to demonstrate an improvement in the proper use of inhaler technique with P value of <0.001 in both MDI and DPI users after receiving a face-to-face demonstration aided with pamphlet pictograms.

This is the first reported pilot quality improvement project in Ethiopia in which face to face trainings assisted with multimedia demonstration particularly pictogram pamphlets have illustrated improvement in MDI and DPI usage techniques.

This educational intervention has shown evident success and brought about a statistically significant increase in the improvement of the implementation of the several steps of MDI and DPI technique and shown an increase in the total number of correct steps practiced by the participants postintervention.

The median score of total number of inhaler technique steps has increased from a baseline median of 6 (IQR 5,6) to a median of 8 (IQR 7,9) with a Z-score -4.23 (Pvalue <0.001) 4 weeks after intervention with face-to-face demonstrations augmented with a pictogram pamphlet with a significant improvement in 5 out of 9 steps of MDI technique

Furthermore, significant improvement in the essential steps that deem inhaler technique usage proper and improper have been demonstrated by showing that the total

users of proper MDI technique have increased from 7.1% preintervention to 35.7% of the participant post intervention P=0.011.

This is in congruence with the pilot quality improvement study done in South Africa, which had demonstrated an increase in MDI technique from a baseline mean of 4.6 $\pm$2.2 to 7.9$\pm$2.7 P<0.05 after implementing the use of a study leaflet augmented with MDI demonstrations [21] .

Use of DPI techniques have also showed a statistically significant improvement from a baseline median of 6 (IQR 4,7) to a median of 8 (IQR 8,9) with a Z score= - 3.75, P value <0.001, 4 weeks after intervention has been implemented with a significant improvement in 6 out of the 9 steps of DPI technique.

10 among 19 participants were able to demonstrate proper DPI inhaler techniques implying an improvement of participants' proper inhaler technique use from 10.5% preintervention to 52.6% postintervention with results being maintained for 4 weeks post intervention. Similar significant achievement have been demonstrated on Marando etal where 80% of patients demonstrated correct DPI technique and results were maintain for 2 weeks after intervention after implementing structured leaflets and demonstrations of inhaler techniques [20].

Majority of the participants were able to use the pamphlet pictograms as the contents were easy to understand. However, application of video assistance was difficult due to lack of smart phones among the participants.

Moreover, not only did the use of proper inhaler technique improve among the participants but overall numerical data has showed a decrease in proportion of patients with poor ACT scores and a general trend towards a better asthma control as determined by the ACT tool.

The finding of this study showed that the poorly controlled asthma level dropped from 56.7% to 46.7% after face-to-face demonstrations aided with pictograms and the well-controlled group increased from 10% to 23.3% (P=0.074). In Basheti etal, ACT score after educational intervention has shown a significant improvement , P=0.003 ,with an increase in the number of patients with complete control using ACT tool at 26 weeks of follow up after receiving an educational intervention [9] .

Therefore, even though small sample size and short duration of follow up period might have contributed in the inability of this project to demonstrate a statistically significant increase in the postintervention ACT score, the trend seems to favor an improvement in the symptom control of our participants.

Age, education level and previous inhaler technique instructions have not been significantly associated with a higher score of improved inhaler technique. This however, can be explained by the small sample size that make it difficult to establish associations.

7. Conclusion

Use of face-to-face demonstrations aided with multimedia demonstrations particularly pamphlet pictograms have proven to show a statistically significant increase and improvement in the overall MDI and DPI techniques among our asthmatic participants with results being maintained for 4 weeks postintervention.

Our participants were 10x and 5 X more likely to demonstrate proper technique for DPI and MDI inhalers respectively while mastering of essential steps after receiving the face-to-face demonstrations augmented with pamphlets. This signifies the effectiveness of face-to-face demonstration in a group setting with a teach back method aided with multimedia and particularly pictogram pamphlets in significantly improving the inhaler techniques of asthmatic patients.

8.Strength and Limitations

8.1 - Limitation

Small sample size and short follow up period of 4 weeks could be mentioned as a limitation. However there are similar literatures that have been done with similar sample size and an even shorter follow up period of 2 weeks. Furthermore, we had enrolled a limited number of patients in this local quality improvement project as this practice was reported to be preferable for rapid process improvement.[24]

This project was conducted in one center and selection bias might have occurred due to the project being done on asthmatic patients in the Chest clinic of TASH.

Use of multiple interventions makes it difficult in discerning which was most effective way in bringing about the change in inhaler technique.

Lack of medication throughout the country has discouraged participants overall in attending this training. explaining the drop out reason for 15 of the patients recruited at the beginning of the study and hesitancy in the rest of the participants.

8.2 -Strength

Despite the limitations, especially the nationwide shortage of inhaler medications, this is the first quality improvement project to our knowledge done in Ethiopia that has been reported and brought about a significant difference in the overall MDI and DPI inhaler techniques of participants.

Our study has the merit of showing that a face to face demonstration in participant groups with a teach back method, complemented by a pictogram pamphlet, can achieve adequate levels of effectiveness in inhaler technique proficiency and maintain it at a 4-week follow-up.

9- Recommendation

We recommend for this pilot project study to help implement a regular training program for asthmatic patients in the proper use of MDI and DPI inhaler technique.

Trained health professionals demonstrating the inhaler techniques face-to-face in groups of asthmatic participants with a teach back method should be used during the trainings and must be undertaken at regular intervals.

We strongly recommend for health professionals to use Pictogram pamphlets to augment their training programs as they are easy to use and effective.

Furthermore, assessing patient inhaler technique by using a checklist of critical steps with repetition has to be done at every encounter with the physician and attempts on documentation of their inhaler techniques with every visit has to be made

We strongly recommend that this pilot project study paves the way for the extension of this kind of quality improving service to other hospitals in service of asthmatic patients and it helps eventually in the development of nationwide strategies for improving inhaler techniques among all patients using inhalers throughout the country

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ANNEXES

Annex I

MDI inhaler techniques adopted by National Asthma Education and Prevention Program (NAEPP) guidelines

Annex I The checklist includes the following steps

a. Turbuhaler Technique Checklist

Mark here	Steps	Description/Action
	1	**Remove the cap from the Inhaler**[a]
	2	**Keep inhaler upright**[a]
	3	**Rotate grip until a click is heard**[a]
	4	Exhale to residual volume
	5	Exhale away from mouthpiece
	6	Place mouthpiece between teeth and lips
	7	**Inhale forcefully and deeply**[a]
	8	Hold breath for 5 seconds[†]
	9	Exhale away from mouthpiece

a- Essential steps (step 1,2,3,4, 7 and 8)

b. pMDI Technique Checklist

Mark here	Steps	Description/Action
	1	**Remove mouthpiece cover and shake[a]**
	2	Hold inhaler upright
	3	Exhale to residual volume a
	4	Keep head upright or slightly tilted
	5	Place mouthpiece between teeth and lips
	6	**Inhale slowly and press canister[a]**
	7	**Continue slow and deep inhalation[a]**
	8	Hold breath for 5 seconds
	9	Close the inhaler

a- essential techniques (step 1, 3, 6, 7 and 8)

ANNEX II-

Baseline characteristics Questionaire

PART I: Socio-demographic Data

1. Age in years: 1.18-30 2. 31-50 3.51-70 5. >70
2. Sex : 1. Male 2. Female
3. District of residence: 1. Urban 2. Rural
4. Marital status: 1. Single 2. Married 3. Divorced 4. Widowed
5. Educational level:
   1. No formal education 2. Primary school 3. Secondary school 4. Higher education Student

6. Occupation: 1. Governmental 2. private 3. Self-employed 4. Unemployed

7. Monthly income (in Ethiopian Birr): 1, low (<3100 birr) 2. low moderate (3100-12100 birr), 3. moderate (12101-37600 birr) 4. high (>37600 birr)

8. Residence: 1. Rural 2. Urban

Part II. Other Characteristics

1. Other documented co-morbidity (Specify)

2. Duration since asthma diagnosis (in months)

3. Type of inhaler used
   1. MDI 2. DPI (specific type) 3. Both

4. Were you given health education on inhaler use by health provider?
   1.Yes 2. No

5. If yes for question number 4, who gave you the health education?
   1. Physician 2 Pharmacist 3. Nurse

6. If yes for question number 4, what type of education you get?
   1. Verbal Instruction 2. Written instruction 3. Demonstration

7. If yes for question number 4 did you have it in the last 12 months?
   1.yes 2. No

8. Are you regularly coming to your follow-up at the chest clinic as your doctors appointed you?
   1. Yes 2. No

9. Have you visited emergency department in the last 12 months for asthma exacerbation?
   1. Yes 2. No

10. Do you use your inhaler/s regularly /as intended?
    1. Yes 2. No

Annex III Questionnaires

Asthma Control Test Tool

Asthma Control Test™

1. In the past 4 weeks, how much of the time did your asthma keep you from getting as much done at work, school or at home?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
o	o	o	o	o
1	2	3	4	5

2. During the past 4 weeks, how often have you had shortness of breath?

More than Once a day	Once a day	3 to 6 times a week	Once or twice a week	Not at all
o	o	o	o	o
1	2	3	4	5

3. During the past 4 weeks, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?

4 or more nights a week	2 to 3 nights a week	Once a week	Once or twice	Not at all
o	o	o	o	o
1	2	3	4	5

4. During the past 4 weeks, how often have you used your rescue inhaler or nebulizer medication (such as albuterol)?

3 or more times per day	1 or 2 times per day	2 or 3 times per week	Once a week or less	Not at all
o	o	o	o	o
1	2	3	4	5

5. How would you rate your asthma control during the past 4 weeks?

Not Controlled at All	Poorly Controlled	Somewhat Controlled	Well Controlled	Completely Controlled
o	o	o	o	o
1	2	3	4	5

Leaflet /Video use for Improvement of MDI/ DPI Inhaler Technique Questionaire

1- Which of the following Multimedia methods have you used ?
A- Leaflet Flyer
B- Video
C- Both
D- None

2- If yes to above question, how frequent have u used it
A- Daily basis B- 2-3 times /week C- Everytime I use the inhaler D - barely used it through out the study period

3- The content of the video /leaflet that I have used is well understood
A- Yes B- NO

4- Reason for not using video prepared
A- I don't own a smart phone
B- I did not understand the content
C- It was time consuming
D- I forgot about it

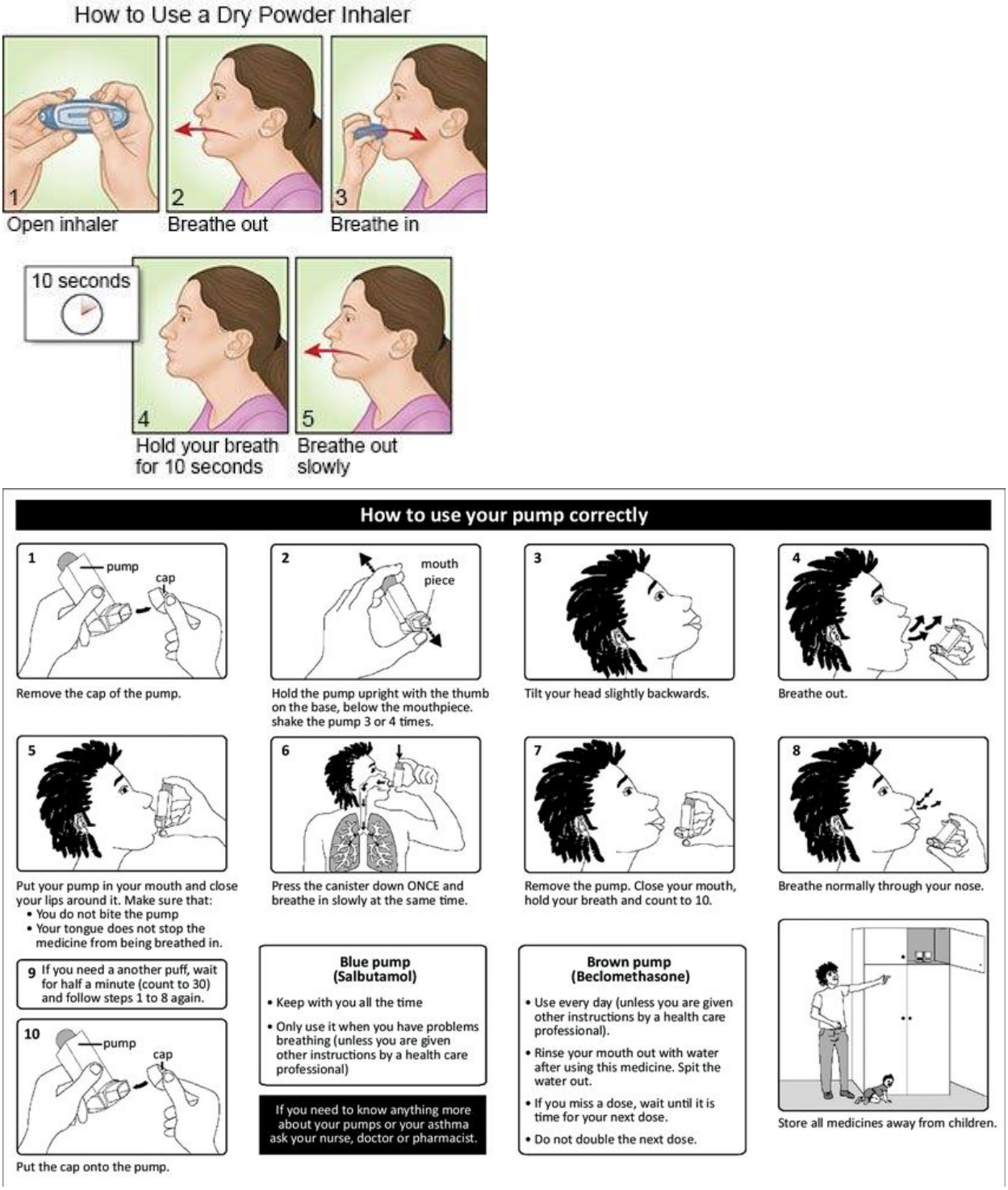
5- Reason for not using leaflet distributed
A- I cannot read
B- It was difficult to understand the content
C- I lost the paper
D- I forgot about it

6- Do you believe the leaflet/Video has helped in improving your inhaler technique
A- Yes B- no C- can't tell

7- What was the most important determinant to hinder you from attending the training
A- Problem in transportation
B- The incentive given is not adequate
C- Lack of available medication despite good training
D- Couldn't attend due to work and other responsibilities

Annex IV

FIGURE 1: English version of the illustrated leaflet describing use of the DPIs and MDIs



Annex V: Consent form I-care

Title of the project: Using person to person training and multimedia demonstrations for improvement of MDI and DPI inhaler technique among Asthmatic patients in the Chest Referral Clinic of Tikur Anbessa Specialized Hospital 2023, A Quality Improvement Project

Please initial box:

1.I confirm that I have read/listened to and understood the information sheet for the above stud and have had the opportunity to ask questions……

2.I understand that my participation is voluntary and that I am free to withdraw any time, withou giving any reason without my medical care or legal rights being affected…….

3.I understand that section of any of my medical notes may be looked at by responsible individuals from research team where it is relevant to my taking part in research. I gave permission for thes individuals to have access to my records…….

4.I agree to take part in the above study …….

Name of patient	date	signature
……..	……	…….
Name of person taking consent	date	signature
……	……..	…….
Researcher	date	signature

Annex VI: Patient Information sheet

Study title

Using person to person training and media demonstrations for improvement of MDI and DPI inhaler technique among Asthmatic patients in the Chest Referral Clinic of Tikur Anbessa Specialized Hospital 2023, A Quality Improvement Project

Name of the investigators: Eman Omer(MD), Dawit kebede (MD), Hanan Yesuf (MD), Addisu Melkie (MD)

You are being invited to take part in a quality improvement study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read or listen the following information carefully and discuss it with relatives if you wish. Ask us if there is anything that is not clear or if you would like more information. take time to decide whether or not you wish to take part.

What is the purpose of the study?

Asthma control level is significantly poor in Ethiopia and poor inhaler technique has been identified as one of the risk factors. In this project, we would like to provide education and training for improving asthma inhaler techniques to improve asthma control

Possible harms: there is no harm in participating in this research.

Benefits: Once your inhaler technique is assessed, if there any identified errors you will be instructed on the proper way of inhalers use, and given formal demonstrations and multimedia trainings.

Confidentiality: all information which is collected about you during the course of the study will be strictly confidential**.**

Autonomy: all the information you give us is highly valuable to the study.it is up to you to decide whether or not to take part. If you decide to participate, you will be given this information sheet to keep and be asked to sign a consent form. whether you consent or not to be part of the study, you right for care in this hospital will not be compromised and you can withdraw from the study any time.

What will happen to the research? The data will be collected over the study period, intervention provided then pre and postintervention comparison will be done and the result will be available in 8 months.

Who is organizing and funding the research? Research is going to be funded by Addis Ababa University.

Thank you

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