KNOWLEDGE AND PRACTICE ON THE USE OF METERED DOSE INHALERS BY ASTHMATIC PATIENTS SEEN AT A PRIVATE GENERAL PRACTICE IN THE VHEMBE DISTRICT, LIMPOPO PROVINCE.

Submitted in partial fulfillment of the requirements for the M Med (Family Medicine) degree in the department of Family Medicine and Primary Health Care in the Faculty of Health Science, at the University of Limpopo (Medunsa Campus)

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DECLARATION

I Dr Zolelwa Temperance Magwentshu hereby declare that the work on which this research is based is original (except where acknowledgements indicated otherwise) and that neither the whole work nor any part of it has been, is being or is to be submitted for another degree at this or any other university.

SIGNATURE:…………………………. DATE: 25 October 2010

DEDICATION

I dedicate my research dissertation to my dear mother Adelaide & my beloved children Sabo,

Khuliso & Yondi.

ACKNOWLEDGEMENTS

I express my sincere gratitude to my supervisor Prof. GA Ogunbanjo for his guidance, patience and unwavering support over the years. It is well appreciated. Your supervision, deadlines and constant follow-ups saw me through this course.

To my colleagues, friends and family, the Obida family who walked the road with me and whose support cannot be articulated in words - I thank you.

I am very grateful to be a postgraduate student of Family Medicine (Medunsa Campus) – this discipline humbled me and instilled a sense of professional maturity towards my patients. A special note of gratitude goes to Mrs. Louise Erasmus who always assisted us with a smile.

To my beloved mother Adelaide Magwentshu who always gives me strength when I am down and who took care of my children during school time. Thank you for always seeing the best in me. To my brother and sisters: Piere (big sister- uMafungwashe), Bura and Yolisa; thank you for your support. You were great.

I am greatly humbled by my children Sipho-sabo, Khuliso & Yoanda (my SKY) whose love, tolerance and support was immeasurable-I love you guys.

To God is the Glory who through His will, all was accomplished.

ACRONYMS & ABBREVIATIONS

ABET   Adult Basic Education and Training

BA-pMDI   Breath-actuated pressured metered dose inhaler

CFC   Chlorofluorocarbons

COPD   Chronic Obstructive Pulmonary Disease

DPI   Dry Powder Inhaler

HFA   Hydro-fluoro-alkanes

LABA   Long Acting Beta 2 Agonist

MEDUNSA   Medical University of Southern Africa

MDI   Metered Dose Inhaler

MREC   Medunsa Research Ethics Committee

NICE   National Institute for Health and Clinical Excellence

p-MDI   pressured-Metered Dose Inhaler

REPC   Research Ethics and Publications Committee

SPSS   Statistical Package of Social Sciences

χ^2 Chi-squared

WHO   World Health Organisation

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ABSTRACT

Background

Asthma mortality in many countries is reported to be falling but the morbidity remains unacceptably high. One of the reasons for the latter is the reluctance to, and the inappropriate use of MDIs by patients resulting in inadequate dosing of medication and therefore poor asthma control. For family physicians to appropriately manage their asthmatic patients, they need to understand the patients' knowledge and practice on the use of MDIs.

Aim

The aim of the study was to determine the knowledge and practice of asthmatic patients seen in a private general practice on the use of MDIs.

Methodology

A descriptive cross-sectional study was undertaken with fifty randomly selected participants. A structured questionnaire was used for data collection and data analysis was done using Microsoft Excel spreadsheet and SPSS version 17 software.

Results

Sixty percent (60%, n=30) of the participants were females and forty percent (40%, n=20) were males. The majority of the participants eighty two percent (82%, n=41) had asthma for more than five years. All the participants used MDIs. Ninety four percent (94%, n=47) used Asthavent® and 88% Budeflam®. Ninety four percent knew that Asthavent® was a reliever and only 20% knew that Budeflam® was a preventer. Conversely, forty percent (40%, n=20) thought that Budeflam® was a reliever. The majority of the participants were unable to correctly demonstrate the main steps in the practical use of the MDI.

Conclusion

The correct use of MDI was found to be poor for most participants. The majority of the participants lacked knowledge and skill for effective use of the MDI. The findings from this study provide reasons for family physicians to continuously educate their patients on the correct use of the MDI.

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CHAPTER 1

1.1 BACKGROUND

The increasing prevalence of asthma is a matter of concern, as of 2010 three hundred million people were affected worldwide, and in 2009 asthma caused 250 000 deaths globally (GINA 2009). According to the 1997 National Asthma Education and Prevention Program of United States of America, there was between fourteen to fifteen million asthmatic patients in the United States alone (Kriner, Bernal and Binggeli 2003). While in South Africa asthma is the eighth leading contributor to the burden of disease (Mash et al 2009).

The rising incidence of asthma was disturbing even at a primary level such as the researcher's general private practice in the Vhembe district, Limpopo Province. At that time the researcher had interacted with asthmatic patients who were not keen on using asthma medications administered by inhalation. Some believed that aerosol inhalation will "condemn" them, that is, if an asthmatic attack occurred in the absence of an MDI (spray), the person will die as his/her body was used to the MDI. They preferred oral asthma medications to avoid what they referred to as "body dependency" to aerosol inhalation. Others used MDI only when there was an asthmatic attack and stopped the medication when they felt better, thereby defying the instructions of the service provider. This practice was also exercised in an attempt to minimize dependency on the MDI.

The non-acceptance and improper usage of these MDIs by the patients was a matter of concern to the researcher as this is contrary to the WHO guidelines for the management of asthma which recommend the use of beta-$_2$-agonists in the form of pressured metered-dose inhalers as the mainstay and first line treatment of asthma. This observation challenged the researcher to find out from these patients their knowledge and practice on the use of MDIs.

1.2 PROBLEM STATEMENT

Over the years of treating an accumulated pool of asthmatic patients the researcher has noticed that even though asthmatic patients have been taught the correct use of MDIs on numerous occasions, they were still unable to demonstrate MDI inhalation technique properly, resulting in poor control of their asthma. Their knowledge of asthma and the use of MDIs were also limited. At the same time there was an increase in the number of patients consulting with asthmatic attacks.

1.3 JUSTIFICATION FOR THE STUDY

The lack of knowledge and poor use of MDI (MDI technique) are some contributors to an increase in asthma morbidity. The latter does not only affect the quality of life of asthmatic patients but also places a huge economic burden on the health care systems of countries, especially developing countries. These costs are not only related to the health services but also to loss of school and work time, resulting in poor school performance

and a decline in productivity and adds more to the number of disability-adjusted life years (DALYs). (Mash et al 2009).

The findings of the study were expected to identify gaps that existed in the knowledge and use of MDIs by the patients at the researcher's practice, therefore providing opportunities for subsequent interventions.

CHAPTER 2

2. LITERATURE REVIEW

The literature search of systematic reviews and randomized controlled clinical trials was conducted using Internet search engines, mainly the United States National Library of Medicine (MEDLINE), EmBase and Cochrane Library databases. PubMed, Sabinet, and to a lesser extent Google search were also undertaken. Online journals such as CHEST online, British Medical Journal, Current Allergy and Clinical Immunology, the South African Family Practice Journal, South African Medical Journal and Professional Nurses Today were used as well. A broad search strategy was employed combining terms related to aerosol devices, patient's knowledge and practice on use of metered dose inhalers and management of diseases like asthma and chronic obstructive airways disease (COPD).

The literature search was done using the following search words: aerosol inhalation, metered-dose inhalers, knowledge and practice on use of MDI by patients, knowledge attitude and practice on use of MDI by health providers, inhalation technique, asthma monitoring and control and management of asthma.

The Department of Family Medicine Resource Centre, MEDUNSA assisted with obtaining some of the relevant literature. The literature review was about the knowledge and practice on the use of MDI by asthmatic patients, but during the search certain articles looked at the knowledge, attitudes, beliefs and practices of both asthmatic

patients and healthcare providers. An overview on the knowledge and practice on the use of MDIs by healthcare providers could be beneficiary as they are the mentors of these patients.

The literature review will be discussed under the following subheadings:

    2.1 Metered-dose inhalers

    2.2 Patient knowledge on asthma and metered dose inhalers

    2.3 Patient practice (inhalation technique) of the metered dose inhalers

2.1 Metered-Dose Inhalers (MDI)

Everard (2003) outlined a brief history of inhaled therapy. Inhaled therapy has been used for many hundreds of years with plants that were believed to have beneficial properties when burnt and inhaled. The first portable inhaler used in modern times was the asthma 'cigarette' launched about two hundred years ago. This cigarette provided some symptom relief, but it presented with atropine-like side-effects. In the 1930s, jet nebulisers were developed which were modified to portable hand-held glass and rubber bulb nebulisers used mainly for adrenaline drugs. These were fragile and inconvenient, and were replaced by the development of pressured MDIs in 1950.

A metered-dose-inhaler, sometimes called 'aerosol inhaler' is a pressurised canister that delivers a measured amount of medication to the lungs. Lum (2004) in the article 'How to use MDI' described a metered-dose inhaler as a hand-held portable device that delivers a specific amount of medication in aerosol form. There are three types of dispensers for

lung deposition of drugs currently available: the traditional press-and-breathe metered dose inhaler, dry powder inhaler and nebuliser.

MDIs are the most frequently used forms of administering inhaled bronchodilator drugs and corticosteroid therapy for chronic broncho-pulmonary diseases such as asthma and chronic obstructive pulmonary diseases. They have become the mainstay of acute and maintenance therapy for various allergic and respiratory conditions, as the medication is delivered to the site of the disease process (Lum 2007).

MDIs have been the most preferred dispensers because of their convenient small size (pocket size) which makes them easy to carry anywhere and the ease of their use, that is, one can simply press the MDI and it releases medication directly to the airways without any need of measuring the dose beforehand. Therefore MDIs are easy to carry, highly effective, extremely safe and allow accurate and consistent dose delivery. Compared to nebulisers metered-dose-inhalers have added advantages of operating autonomously without any external energy source, and their aerosolization time is short thus allowing accurate drug delivery with optimal use within seconds. They are scarcely affected by the environmental influences and there is no need for any specific maintenance except for regular cleaning (Melani 2007).

Recently MDIs have received considerable interests compared with nebulisers in the bronchodilatation of mechanically ventilated patients. Their cost- effectiveness, ease of administration, less personnel time, reliability of dosage and lower risk of contamination are more appealing than the huge cost of nebulisation especially in the present era of

limited financial resources. It has been estimated that substitution of nebulisers with MDIs in a seven-hundred bed hospital could reduce the cost of aerosol therapy by US$300 000 a year (Georgopoulos et al 2000).

In a systematic review conducted by Brocklebank et al (2001) which compared the effectiveness of inhaler devices in asthma and chronic obstructive airways disease, there was no difference in clinical effectiveness between nebulisers and alternative inhaler devices compared to the standard pressurized metered-dose-inhaler with or without a spacer. They also concluded that the cost-effectiveness evidence favours pMDIs as first-line treatment in all patients with stable asthma as long as the correct inhalation technique is taught. These conclusions were corroborated by Ram, Wright, Broecklebank and White (2001) in a systematic review of clinical effectiveness of pressurized metered-dose-inhalers versus other hand held inhaler devices for delivering beta-agonists bronchodilators in asthma.

An improvement on the MDI recently was the insertion of a counter as demonstrated in the salmeterol-fluticasone combination spray (Melani 2007). The counter allows proper management of asthma by the patient as the patient can identify the remaining doses of the aerosol and organize another spray on time.

However, MDIs' main limitation was and is still linked to the fact that many patients cannot use them correctly, thereby reducing their clinical efficacy. The efficacy of inhaler therapy is technique dependent, that is, its success depends on whether it is used

correctly. The use of MDI does not simply involve pressing of the MDI and release of the pre-measured dose of medication, but involves certain maneuvers that aim to deliver maximum dosages to the diseased area.

Melani (2007) reported that the poor inhalation technique can be minimized by use of add-on valve holding chambers, that is, spacers. Koning (2010) in a review article, "Spacer devices used with metered-dose-inhalers a breakthrough or gimmick", concluded that spacer devices are neither a breakthrough of such magnitude that their use should be mandatory for all users of MDIs nor useless gimmicks because in patients with poor coordination such as the elderly, cone-shaped and pear-shaped spacers might be more effective. In young children spacers with one-way valve for example Aerochamber[®] can be useful.

According to the NICE guidelines (2000), all children under the age of five years should use metered-dose-inhalers with spacers. Therefore spacers with one-way valve will be suitable for those patients who cannot manage hand-breath coordination, non-cooperative patients (children and the elderly) and those on ventilators. However the use of a spacer chamber is limited by its cumbersomeness and the need for routine maintenance with standardized procedure (Melani 2007).

2.2 Patient knowledge on asthma and MDI

Pereira, Clement and Simeon (2001) supported the International Consensus Report on the diagnosis and treatment of Asthma which recommends 'educating patients to develop a partnership in asthma management'. They strongly advocate that patients should be encouraged to take greater control of their conditions, thereby enhancing self-management. Health education is an important entity in today's culture of disease management. It provides basic knowledge about the disease, in this case, the concept of asthma and its management. Like other patients with chronic diseases for example diabetes mellitus, patients with asthma must take responsibility for the day-to-day management of the disease (Reed 2004). They must be able to identify, avoid or control exposure to environmental triggers which may cause inflammation of small airways and trigger an asthmatic attack.

On the first day of diagnosis of asthma, health professionals should properly counsel the patient. Counseling should involve in-depth talk on why patients should use MDIs, and also address the myths that patients may have about MDIs. Therefore the advice on use of pressured MDIs, the correct understanding of the treatment regimes, and the benefits of such treatment are essential to encourage patients to comply on MDI usage (Pereira, Clement and Simeon 2001).

Oliveira *et al* (1999) demonstrated the concept of health education in asthmatic patients by evaluating two groups: an educational group and a control group. Their study compared patients who had one hour sessions receiving information about symptoms and

signs of exacerbating factors, triggering factors, environmental control, relief and preventive medication. These patients were allowed to exchange ideas, and practice the correct manoeuvre on the use MDIs in each visit and were compared to those who did not receive any formal or structured education. At the end they demonstrated the desired outcomes in that there was a decrease in hospital admissions and improvement of quality of life in the educational group.

The educational group showed a significant improvement in knowledge about asthma management, and proper techniques on use of the MDI. It has been shown with other chronic diseases such as diabetes and hypertension that there is a correlation between patient education and literacy.

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Conversely lack of health education may lead to poor compliance to treatment. According to Chrystn and Price (2009), the non-compliance rates among people with asthma vary from 16% to 50% posing a real clinical problem. In the same study they found that almost a third of asthma patients reported not taking their prophylactic medication as prescribed. They concluded that half of patients with asthma underused their asthmatic medication and about 50% of people with difficult-to-control asthma were not compliant with oral corticosteroids.

2.3 Patient practice (Inhalation technique) of MDI

Williams *et al* (2006) in their study found that the educational level was the strongest predictor of MDI technique. In their study the reading ability of the patients was

measured and the patients' literacy skills were correlated to their asthma knowledge and MDI skills. Many patients with poor reading skills did not understand when to take "as needed" asthma medication and did not realize the importance of using an inhaler properly. Patients with poor reading skills could not comprehend the function of the different inhalers, that is, the 'preventers' and the 'relievers'. Therefore inadequate literacy is a barrier to asthma self-management skills (for example the inhalation technique) as these patients would not comprehend medical instructions (Williams et al 2006).

Although the development of MDIs was a landmark in asthma management, their use has been burdened by inappropriate training (Al-Wasil and Al- Mohaimeed 2003). These authors conducted a study to assess the inhalation technique of adult asthmatic patients in a primary health-care setting. They found that none of the patients performed all the inhalational steps without committing at least one error. The most common errors by patients in this study were failure to tilt the head backwards, failure to breathe out slowly to residual volume before actuation and not holding the breath for the minimum of ten seconds after inhalation. Synchronization of breathing with actuation was difficult for many patients (66%), who had difficulty breathing in slowly while actuating the inhaler. They concluded that, though MDIs are the mainstay in the management of asthma, the inhalation technique was very poor among their patients.

Pereira, Clement and Simeon (2001) in their study for correct pressurised metered dose inhaler technique in Trinidadian patients with asthma, found that even though patients had received a demonstration on the correct inhaler technique and 92% were confident of

employing the correct technique, only 41% actually demonstrated all the steps correctly. They concluded that pressured MDIs were difficult to use. Therefore incorrect users require frequent reinforcement of proper technique by properly trained health professionals. Incorrect technique with MDIs was more frequent in children and the elderly. The elderly failed to wait before the second actuation and also found breath holding difficult. The children could not wait (one minute) before the second actuation. .

The inhalational technique is one of the determinants of the bio-availability of the drug, and if done correctly there would be a decline in morbidity of asthmatic patients and subsequently the improvement of quality of life in asthmatic patients. In conclusion frequent reinforcement of proper inhalational technique by the caregivers should be routine, not only verbally or video-viewing but through demonstration by the patients and a proper technique correction by the health professional on every encounter.

CHAPTER 3

3. METHODOLOGY

3.1   Aim of study:

The aim of the study was to determine the knowledge and practice of asthmatic patients seen in a private general practice on the use of Metered Dose Inhalers.

3.2   Objectives of study:

3.2.1   To determine the patients' knowledge on the use of Metered Dose Inhalers.

3.2.2   To assess the adequacy of the patients' technique on the use of Metered Dose Inhalers.

3.3   Research question:

The research question for the study was *"What do asthmatic patients attending a general practice in Vhembe district, Limpopo province know about the use of MDI and how they use them in the management of asthma?"*

3.4   Study design

This was a descriptive, cross-sectional study.

3.5   Study population:

All asthmatic patients that presented and registered at the researcher's general practice formed the study population. The database of asthmatic patients was 100 at the time of the study.

3.6   Sampling method and sample size:

Based on the study population of 100 asthmatic patients from the researcher's practice register, using a 95% confidence level, study power of 80% and confidence interval of 10%, the sample size was 49. This was rounded up to 50 for ease of analyses. The sampling frame was done through the use of random numbers which participants picked as they came into the practice.

3.7   Inclusion criteria

All adult asthmatic patients aged 18 years and above (old and newly diagnosed) who attended the general practice of the researcher over a period of six months were included.

3.8   Exclusion criteria

These were the following exclusion criteria:

- Acute asthmatic patients who were very ill

- All asthmatic patients below 18 years of age

- Patients with COPD, emphysema, chronic bronchitis, pulmonary oedema and cardiac failure.

- Patients who were mentally incompetent

- Asthmatic patients who did not consent to take part in the study

3.9   Data collection:

A pilot study using a designed questionnaire was done on 5 patients to assess the need for any modification of the questionnaire or logistical problems that might emerge when the

study commenced. The questionnaire was comprised of demographic features, the knowledge on asthma and knowledge on use of MDIs. It was designed using the Patient Information Leaflet found in the Asthavent$^®$ metered-dose-inhaler (Appendix II) and in consultation with the statistician who assisted with data analysis. The patients who participated in the pilot study did not form part of the sample.

At the inception of the study, a written consent was obtained from each participant after the aim and objectives of the study were fully explained to them (Appendix I). Information on knowledge on use of MDIs was collected from the participants by a trained research assistant in the researcher's practice. The participants were given the option of either the English or TshiVenda version of the questionnaire to answer. Thereafter each participant was asked to demonstrate the use of the MDIs while a trained research assistant observed its use using a standardized check list of the various steps obtained from the package insert of the MDI (Appendix III) (Cipla Medpro 2002).

The research assistant was trained by the researcher to demonstrate the technique and to follow the required steps in the check list prior to the commencement of the study. The questionnaire was discussed and the correct use of MDIs was demonstrated to each participant. All the raw data was entered into the Microsoft Excel spreadsheet software and exported to SPSS Version 17 for analysis.

3.10   Data analysis:

Data was analysed using Microsoft Excel spreadsheet and SPSS Version 17 soft-wares and presented as frequency tables and figures. Association of variables was done using

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the demographic characteristics versus questions on knowledge and practice on the use of MDIs, using the chi-square test and the student t-test. Assistance with data analysis was obtained from a qualified statistician and overseen by my supervisor who is knowledgeable on the use of both soft- wares.

3.11   Variables

The variables identified were:

- **Knowledge:** refers to asthma information gained through experience or education. This was assessed with the use the questionnaire marked Appendix II

- **Practice:** refers to the action of inhalation, or process of correct use of the MDI. This was evaluated with the use of Appendix III.

3.12   Reliability and validity of study

3.12.1   Reliability of study

Reliability or reproducibility indicates whether the data collection tool, in this case the questionnaire performs consistently. This was assured by means of equal representation of variables in the questionnaire. In addition, the pilot study assisted in fine tuning the questions that were asked in a consistent manner. The same questionnaire was used for all participants, thereby assuring reliability of the data obtained. The questionnaire used was translated from English to TshiVenda by a qualified language specialist. Back translation was done by a different translator. To further ensure reliability, the researcher received training in interviewing techniques at the University of Limpopo; Medunsa campus and she in turn trained her research assistant.

3.12.2   **Validity of study**

Validity indicates the effectiveness of a questionnaire in measuring what it purports to measure. To ensure the validity of the current study a review of previously validated literature was done and then compared to the present study's checklist. The variables highlighted were well reflected in the questionnaire.

3.13   Bias

Bias is defined as any effect at any stage of a research process that tends to produce results that depart systematically from the true values (Ogunbanjo GA 2001). Bias can range from literature review, selection of the sample, data analysis or interpretation and publication of the result. This was minimized as follows:

a. To avoid researcher bias, the researcher was committed in producing true values at all stages of this study.

b. To minimize selection bias, patients were randomly enrolled into the study using a table of random numbers.

c. Data analysis and interpretation was guided by my supervisor who is well versed on the subject matter.

d. Reporting bias was minimized by the commitment of the researcher to report the true values, and findings that emerged from the data collected.

3.14   Ethical considerations:

Signed consent was obtained from each participant before inclusion in the study. Confidentiality and anonymity were ensured by the non-inclusion of participant names and data was analysed as group data. Permission and approval to conduct the study were

obtained from the Research Ethics and publications Committee (REPC MP 129/2006), Faculty of Health Science, University of Limpopo (Medunsa Campus) now referred to as Medunsa Campus Research Ethics Committee (MREC). After each participant had demonstrated the use of the MDI, the research assistant then demonstrated the correct use if the participant did not use it correctly. There were follow-up reviews after the study to see that the participants and other patients not included in the study continued to use the MDIs correctly.

CHAPTER 4

4. RESULTS

4.1 Demographic characteristics of the participants

4.1.1 Age of the participants

The sample size for this study was 50 participants. Sixty four percent (64%) of the participants were above the age of 50 years, which is 32/50. This was followed by the age group 40-49 years that made up 14%. The age group with the least number of participants was those between the ages of 21-29 years (4%) (Table 1, Figure 1).

Table I: Age of the participants (n=50)

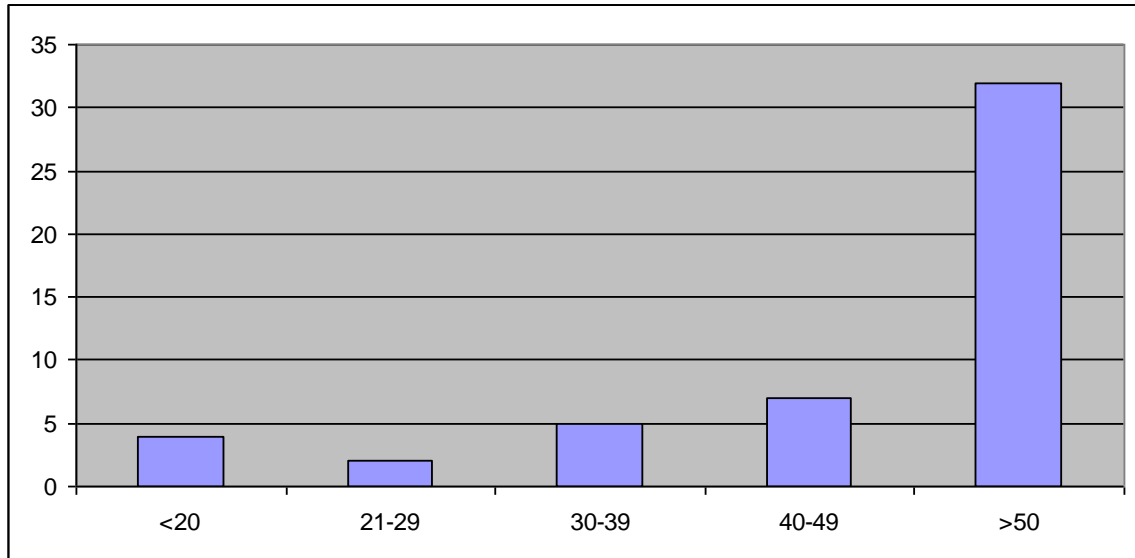| Age range (years)	Frequency	Percentage (%)
<20	4	8
21 – 29	2	4
30 – 39	5	10
40 – 49	7	14
>50	32	64
Total	**50**	**100**

Figure 1: Age of the participants

4.1.2 Sex of the participants

In terms of sex, there were 20 males (40%) and 30 females (60%) making the ratio of
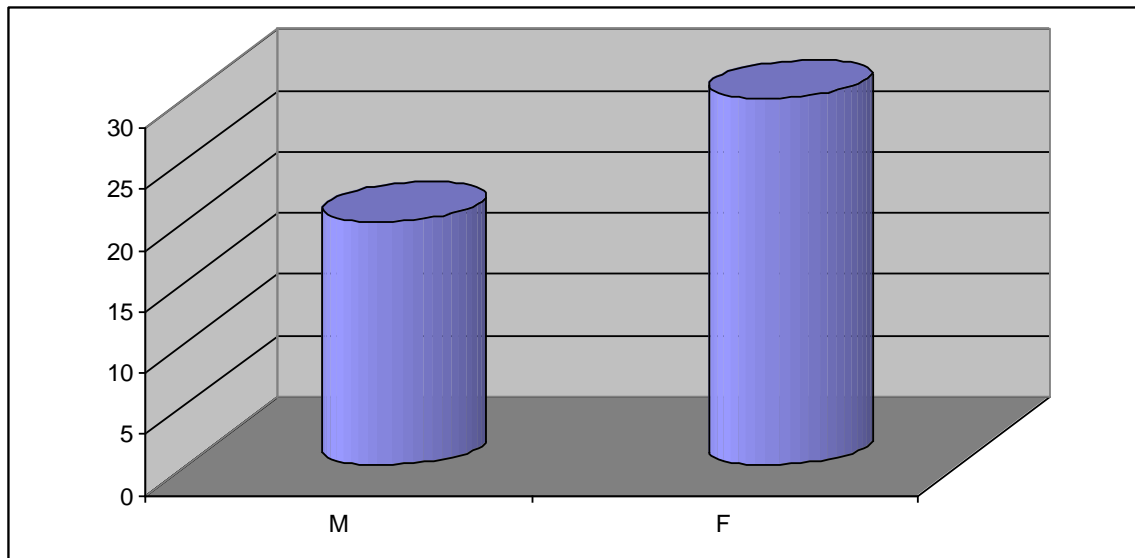
males to females 2:3 (figure 2)

Figure 2: Sex of the participants

4.1.3 Highest educational level of the participants

Almost half of the participants (46%) completed primary school as the highest level of education, followed by secondary level (30%). Only five participants (10%) completed tertiary education, while 1 (2%) completed Adult Basic Education and Training (ABET). Six (12%) indicated that they did not attend any form of schooling (Figure 3)
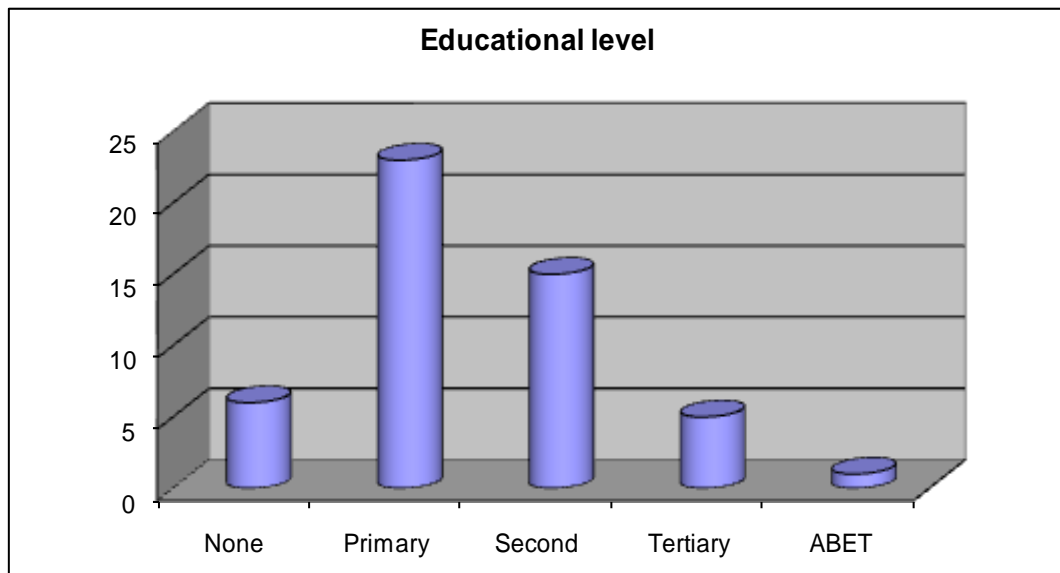
Figure 3: Educational level of the participants

4.2 Duration of asthma of participants

The vast majority of the participants 41/50 i.e. 82% reported to have had their asthma for more than five years and only 9 participants (18%) had the disease for less than 5 years (Figure 4).
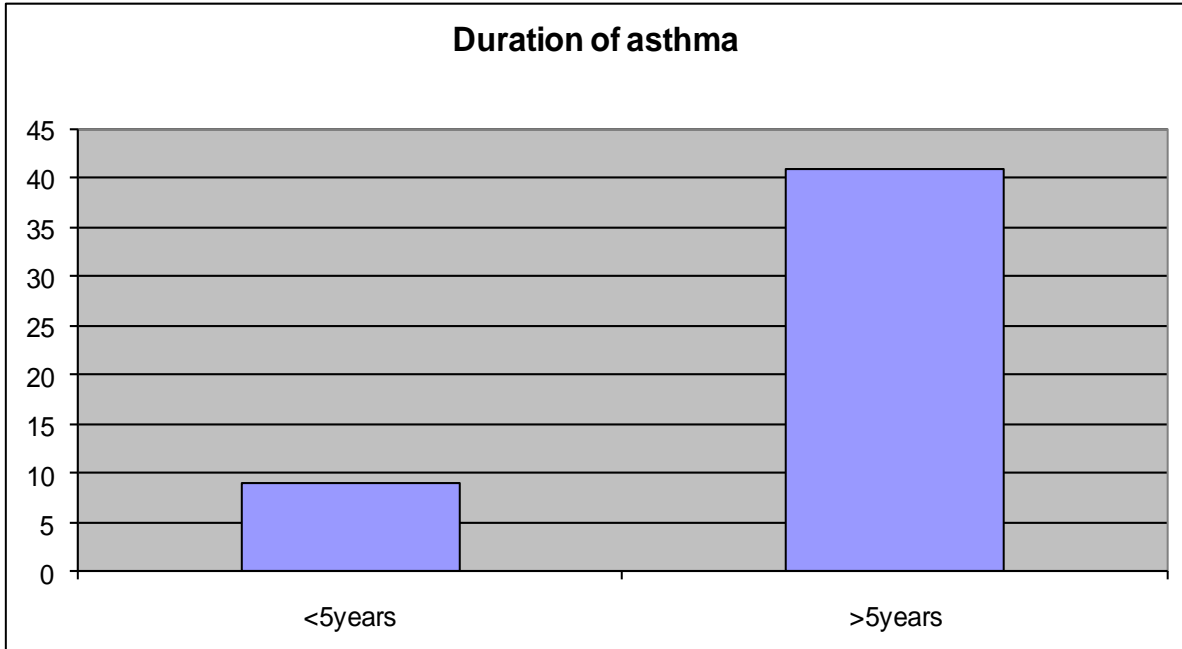
Figure 4: Duration of asthma

4.3 Last asthmatic attack of participants

When the participants were asked about their last asthmatic attacks, the responses were as follows: 30 (60%) indicated that their last asthmatic attacks were more than 4 weeks prior to the interviews, followed by 15 (30%) with less than two weeks preceding the study. The remaining 5 (10%) had their last asthmatic attacks between 2-4 weeks before the study (Table II, Figure 5).

Table II: Last asthmatic attack of participants

Last asthmatic attack	Frequency	Percentage (%)
< 2 weeks	15	30
2 – 4 weeks	5	10
> 4 weeks	30	60
Total	**50**	**100**
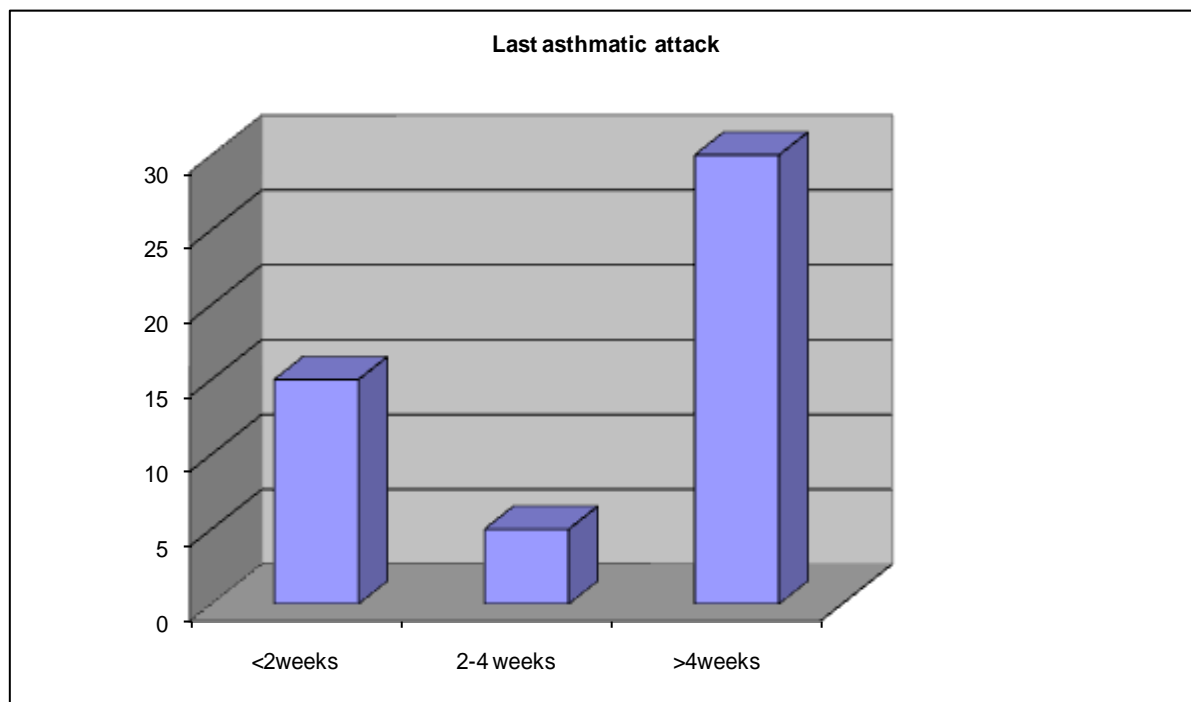
Figure 5: Last asthmatic attack of participants

4.4 Knowledge about asthma

4.4.1 Triggering factors for asthma

In terms of triggering factors, the respondents identified one or more factors as follows: Dust was the most common triggering factor at 92% (46/50), followed by exposure to cold air (43/50 - 86%), while smoking and physical exercise-induced asthma had the same frequency of 39/50 (78%). Other triggering factors (44/50) for asthma mentioned by the participants were: anger, working hard, different odour of paint, perfume, fatty foodstuffs and stress which accounted for 88%. (Table III, Figure 6).

Table III: Triggering factors for asthma

Triggering factors	Frequency	Percentage (%)
Smoking	39	78
Dust	46	92
Exercise	39	78
Cold air	43	86
Others	44	88
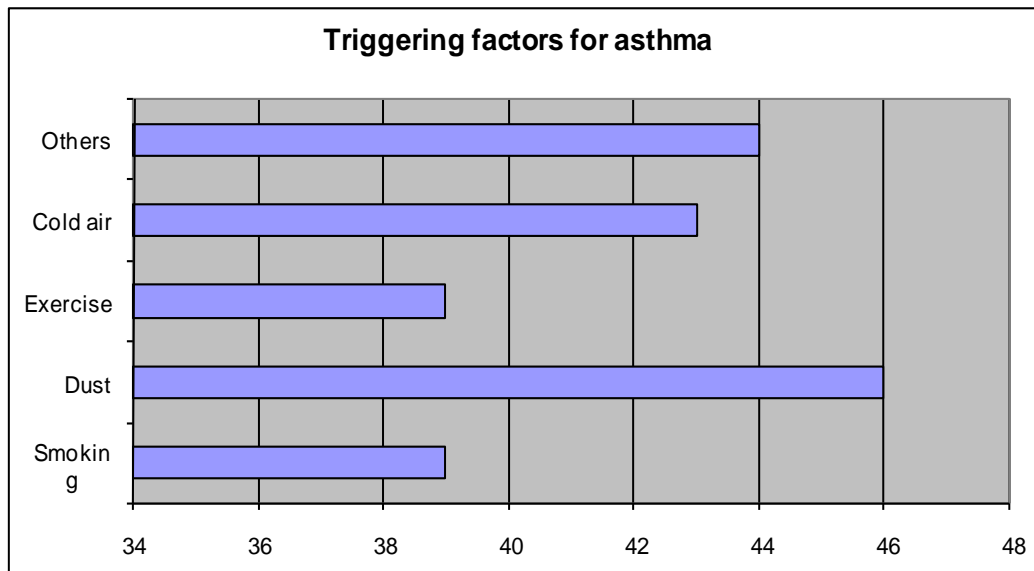
Figure 6: Triggering factors for asthma

4.5 Knowledge on MDI

4.5.1 Education on use of MDI

An overwhelming number of the participants 47/50 (94%) indicated that they were taught on how to use the MDI, while only 6% (3/50) reported that they did not get any form of education on how to use the MDI (Figure 7).

Education on asthma
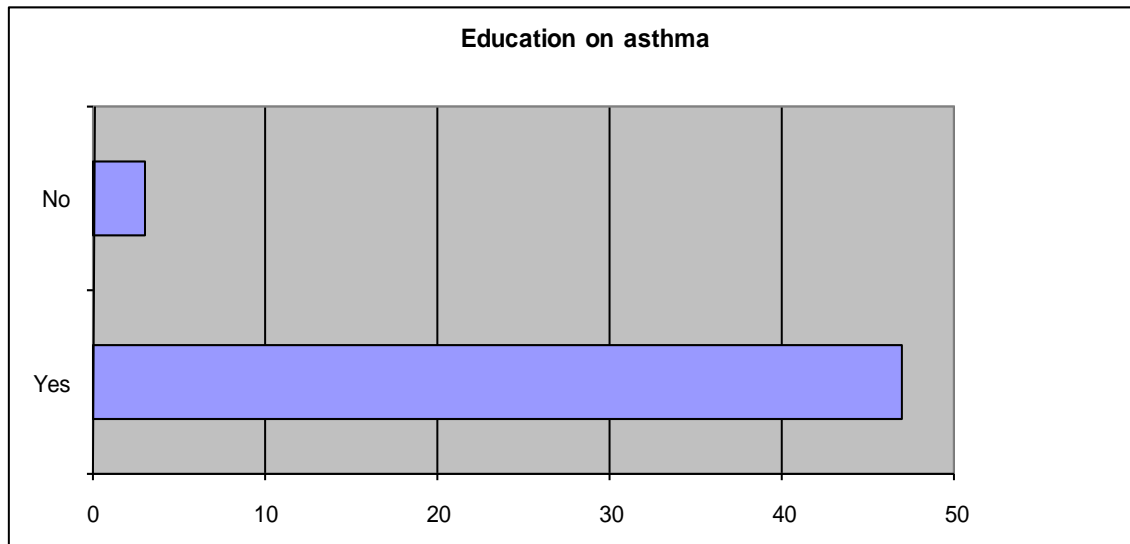
Figure 7: Education on use of MDI

4.5.2 Sources of information on use of MDI

When asked who taught them how to use the MDI, the participants identified more than one source of information. The nurses and doctors were the frequent educators on the use of MDIs. Nurses most frequently provided information, that is, 35/50 (70%), followed by doctors at 21/50 (42%). Two participants (4%) were taught by pharmacists on the use of MDI. Only one participant was taught by a family member while there was no participant who received any education from a friend (Table IV, Figure 8).

Table IV Source of information on use of MDI

Source of information on the use of MDI	Frequency	Percentage (%)
Doctors	21	42
Nurses	35	70
Pharmacist	2	4
Friend	0	0
Family	1	2
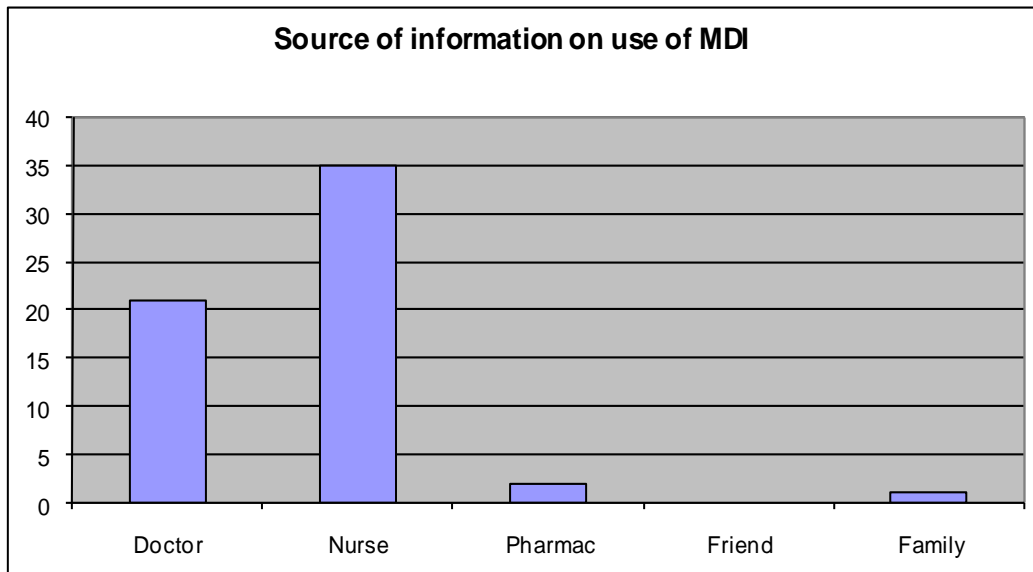
Figure 8: Source of information on use of MDI

4.6 Use of the MDI

All participants in this study used the MDI.

4.7 Number of MDIs used by participants

The majority of participants 45 (90%) used two metered-dose inhalers, while 4 (8%) used one inhaler. Only one participant used three metered-dose-inhalers (2%) (Table V, Fig 9).

Table V: Number of MDIs used by participants

Number of MDIs used by participants	Frequency	Percentage %
One	4	8
Two	45	90
Three	1	2
Total	**50**	**100**
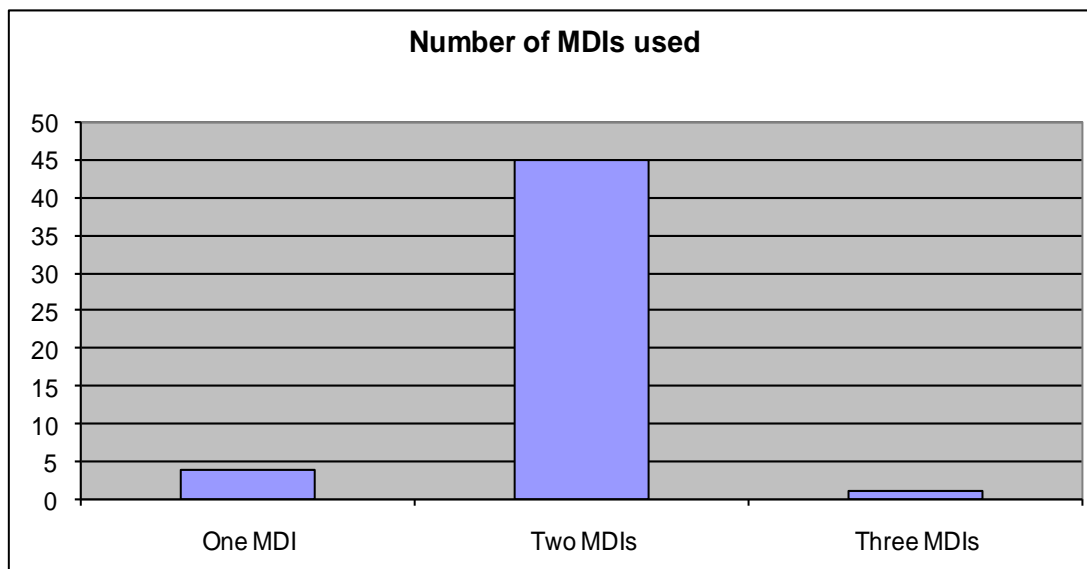
Figure 9: Number of MDIs used by participants

4.8 Types of MDI used

Forty nine participants (98%) knew the names of the MDIs with the exception of only one participant (2%) who did not indicate the name or type of MDI used (Fig. 10).
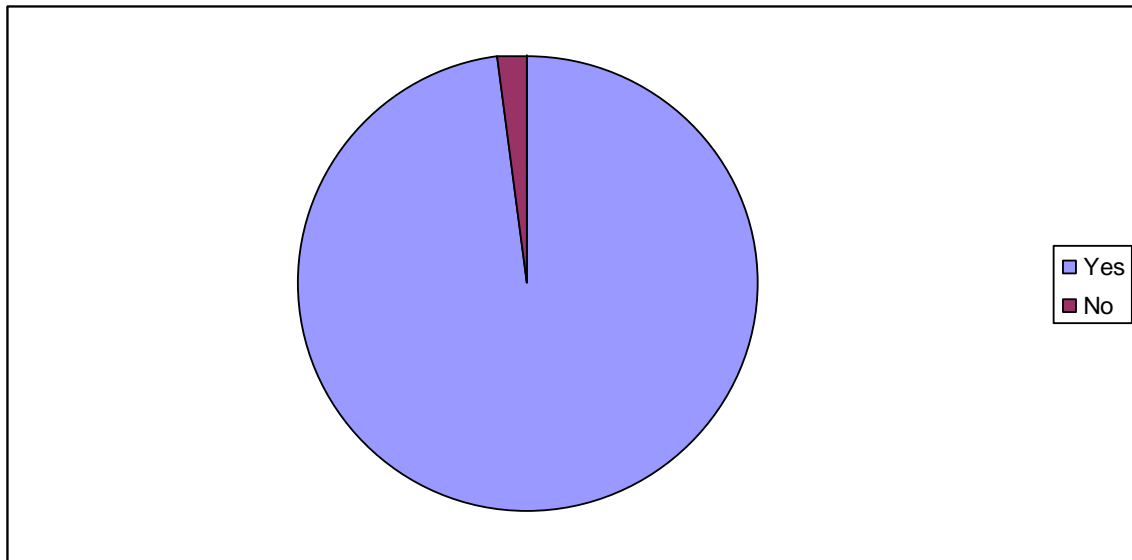
Figure 10: Types of MDI used

4.9 Names of MDIs used by participants

The most commonly used metered-dose-inhaler was Asthavent[®] at the frequency of 47/50 (94%), followed by Budeflam[®] inhaler at 44/50 (88%). Seretide[®] and Duovent[®] were both at 1/50 (2%) (Table VI, Fig 11)

Table VI Names of MDIs used by participants. n=50

Names of MDI used by participants	Frequency	Percentage (%)
Asthavent	47	94
Budeflam	44	88
Seretide	1	2
Duovent	1	2
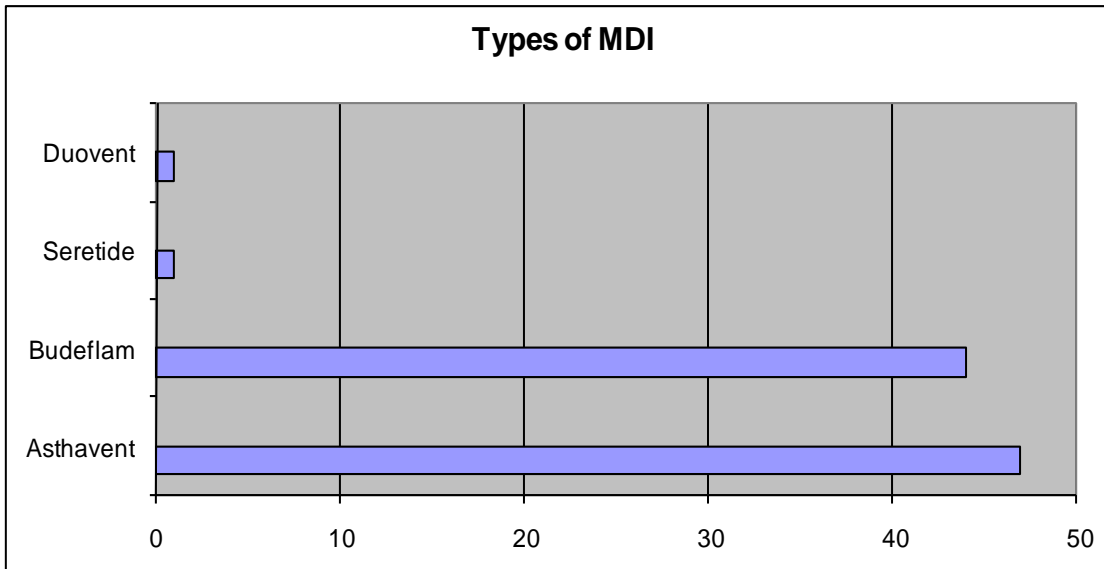
Figure 11: Names of MDIs used by participants

4.10 Reason for use of MDI

The majority of the respondents (47/50, 94%) indicated that Asthavent® metered dose inhalers are relievers, while 40% of these participants indicated Budeflam® metered dose inhalers as relievers (Table VII Fig. 12).

Table VII: Reason for use of MDI

	Prevention of an asthmatic attack	Relievers	No purpose	Unknown purpose	Others
Asthavent		47 (94%)	1 (2%)		1 (2%)
Budeflam	10 (20%)	20 (40%)	4 (8%)	6 (12%)	7 (14%)
Seretide		1 (2%)			
Duovent		1 (2%)			
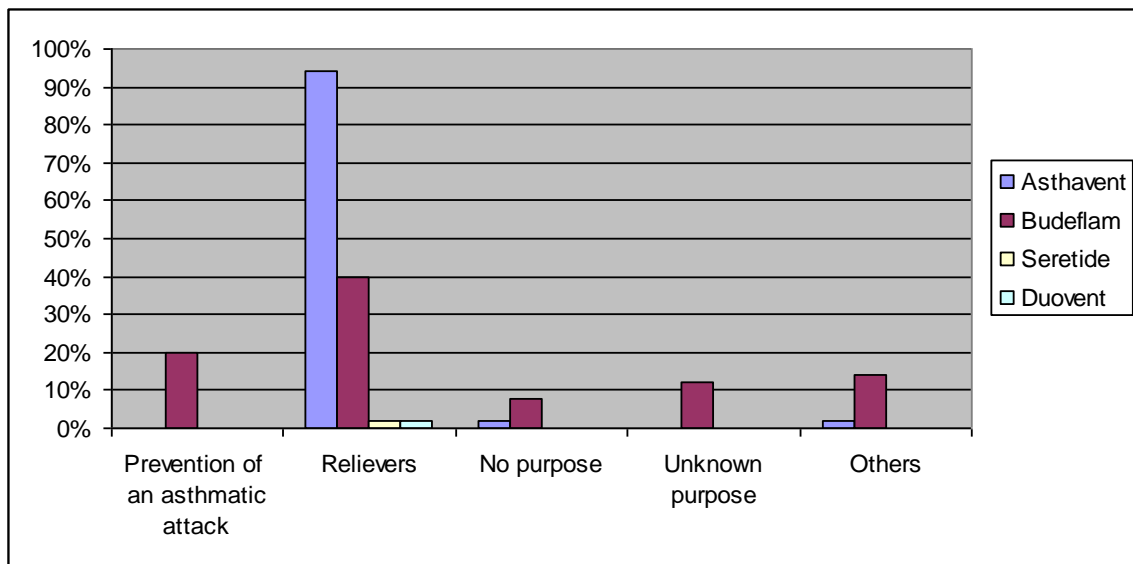
Figure 12: Reason for use of MDI

4.11 Inhalation technique of MDI

The most incorrectly demonstrated action of inhalation was synchronization of breathing with actuation. The majority of the participants (47/50, (94%) were unable to breathe out slowly while actuating the inhaler to release one dose, followed by failure to breathe out

slowly after holding the breath for ten seconds after inhalation (42/50, 84%). In addition, failure to breathe out slowly to residual volume before actuation and inability to hold the breath for ten seconds after inhalation had the same frequency of 41/50 (82%). Inability to tilt the head backwards was the fourth incorrectly demonstrated action (76%) followed by failure to wait for one minute if a second dose was required (74%) (Table VIII, Fig 13).

Table VIII: Inhalation technique of MDI (Cipla Medpro 2002)

| Steps on usage of MDI	YES	NO
1. Removes the mouthpiece cover, and check the mouthpiece thoroughly to see that it is clean.	50 (100%)	0 (0%)
2. Shakes the inhaler vigorously.	46 (92%)	4 (8%)
3. Holds the inhaler upright between index finger and thumb.	50 (100%)	0 (0%)
4. Breathes out gently through your mouth and immediately place the mouthpiece in your teeth (Do not bite it)	9 (18%)	41 (82%)
5. Grips the mouthpiece firmly with your lips.	37 (74%)	13 (26%)
6. Tilt your head slightly backwards.	12 (24%)	38 (76%)
7. Starts breathing in slowly through your mouth. (At the same time press the canister, to release one dose while continuing to breathe)	3 (6%)	47 (94%)
8. Removes the inhaler from your mouth and holds breathe for at least 10 seconds or as long as is comfortable.	9 (18%)	41 (82%)
9. Breathes out slowly.	8 (16%)	42 (84%)
10. If another dose is required, wait for at least one minute, repeat steps 1 to 4.	13 (26%)	37 (74%)
11. After use, replace the mouthpiece cover	50 (100%)	0 (0%)
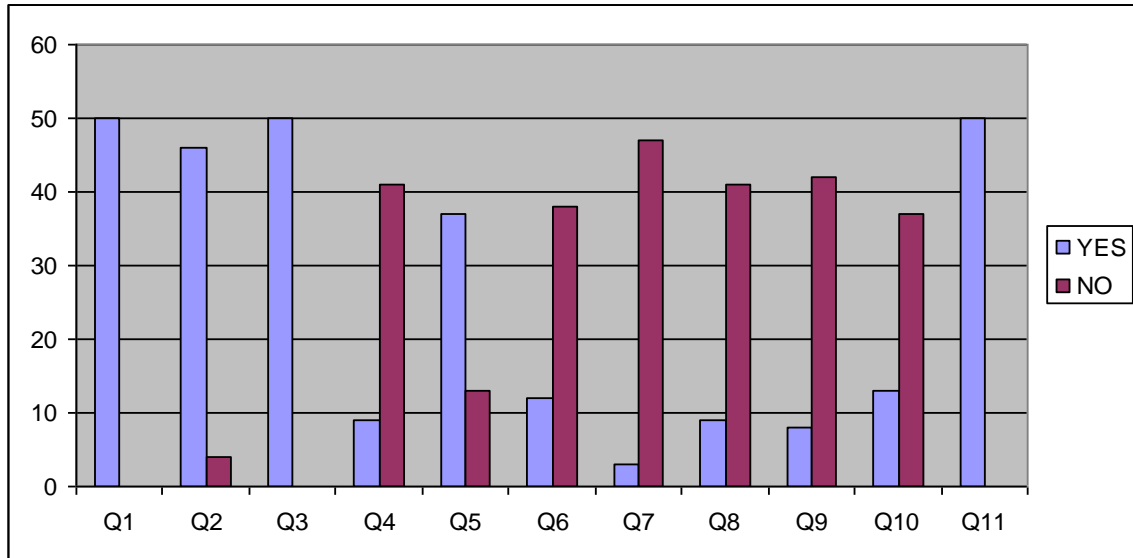
Fig: 13 Inhalation technique of MDI

4.12 Association of variables

4.12.1 Association of level of education and synchronisation of inhalation

The Pearson's chi-square test shows that there was significant association between the level of education and synchronisation of breathing with actuation. $\chi^2 = 12.175$, p = 0.016 (Table IX).

Table IX: Chi-square test for association of level of education and synchronisation of inhalation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.175a	4	.016
Likelihood Ratio	8.619	4	.071
Linear-by-Linear Association	5.836	1	.016
N of Valid Cases	50		

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4. 12.2 Association between training on use of MDI and synchronisation of breathing with actuation

There was no significant difference in synchronisation of breathing with actuation between participants who had education on the use of MDI and those who did not. t = 48, p = 0.660, χ^2 = 204, p = 0.652 (p<0.05) (Table Xa, Xb).

Table X (a): t-test of the association between training on use of MDI and synchronisation of breathing with actuation

Independent Samples Test

		t-test for Equality of Means		
		df	**Sig. (2-tailed)**	**Mean Difference**
Start breathing through your mouth	Equal variances assumed	48	.660	.064
	Equal variances not assumed	46.000	.083	.064

Table X (b): chi-square test of the association between training on use of MDI and synchronisation of breathing with actuation

Chi-Square Tests

	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	.204a	1	.652		
Continuity Correction	.000	1	1.000		
Likelihood Ratio	.383	1	.536		
Fisher's Exact Test				1.000	.827
Linear-by-Linear Association	.200	1	.655		
N of Valid Cases	50				

4.12.3 Association between the duration of asthma and types of MDIs used

There was a significant association between the duration of asthma and types of MDIs used at χ^2 = 10.253, p = 0.017 (that is the choice of the inhaler used was influenced by the duration of asthma) (Table XI).

Table XI Chi-square test of the association between duration of asthma and types of MDI used

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.253a	3	.017
Likelihood Ratio	7.980	3	.046
Linear-by-Linear Association	6.592	1	.010
No of Valid Cases	50		

CHAPTER 5

DISCUSSION

5. Introduction

The results will discussed according to subheading emerging from the results and this will be grounded in the literature. Comparisons will be made between the findings of this study and what is currently known.

5.1. Research methods

This was a descriptive cross-sectional enquiry which was conducted over a period of six months. This specific study design was chosen to collect data at a single point in time but also to allow the patients to flow in over six months. Its aim was to determine the patients' knowledge on the use of MDIs and also assess the adequacy of the patients' techniques on the use of MDIs. This study design was considered suitable as it would enable quick data collection since it is relatively economical in time and resources.

Fifty participants were randomly selected as they came to the practice. This small sample size made it difficult to generalize the findings.

5.2 RESULTS

5.2.1 Demographic characteristics of participants

Almost half of the participants completed primary school as the highest level of education and only five participants completed tertiary education, while six participants indicated that they did not attend any form of schooling. The participants' low level of education might have affected their understanding of basic concepts of asthma treatment such as 'relievers' and 'preventers'. In their study on inhaler technique in Turkish people with poor English, Goodyer, Savage and Dikmen (2006) demonstrated that translated patient information leaflet (PIL) used alone is of less benefit than the same leaflet used together with own-language verbal advice. In this study, it was also noted that most participants preferred to use the TshiVenda questionnaire than the English one despite their level of education.

Williams *et al* (2006) found that the reading level was the strongest predictor of MDI technique. In his study, the reading ability of the patients was measured and the patients' literacy skills were correlated to their asthma knowledge and MDI skills. Many patients with poor reading skills did not understand when to take "as needed" asthma medication and did not realize the importance of using an inhaler properly. These patients could not comprehend the function of the different inhalers; the 'preventers' and the 'relievers'. Inadequate literacy may therefore be a barrier to asthma self-management skills (for example MDI inhalational ability) as such patients cannot comprehend medical instructions (Williams et al 2006).

5.2.2 Duration of asthma

In this study the majority of the participants (82%) reported to have had their asthma for more than five years and only (18%) had the disease for less than 5 years. Though 82% of participants had asthma for more than five years, their knowledge and technique on the use of MDI was inadequate. However there was a strong association between the duration of asthma and the choice of MDI used (χ^2 = 10.253, p = 0.017).That is the choice of the inhaler used was influenced by the duration of asthma. Therefore participants who had asthma for a longer period were on combination therapy and even on long acting β_2-agonists (LABA), while most of those who had just been diagnosed with asthma or having had asthma for a shorter period were found to be on short acting β_2-agonists only.

5.2.3 Last asthmatic attack

Sixty percent of the participants experienced their last asthmatic attack more than four weeks from the time of enquiry. Therefore the participants were relatively controlled concerning their asthma. This finding is in contradiction with the fact that the majority of participants could not demonstrate all the steps of inhalation correctly while using metered dose inhalers.

5.2.4 Triggering factors for asthma

The participants identified more than one triggering factor with all of them scoring above seventy percent. Dust was the most common triggering factor at 92% followed by exposure to cold air at 86% while smoking and physical exercise-induced asthma had the same frequency of 39/50 (78%). Although Reed (2004) did not compare the triggering

factors, he emphasized the importance of identifying, avoiding or controlling these factors like any other chronic disease.

5.3 Knowledge on use of MDI

An overwhelming number of participants (47/50) indicated that they were taught how to use the MDI while only (3/50) did not get any form of education on how to use MDI. Nurses and doctors were the frequent educators on how metered dose inhalers should be used, with the nurses providing the highest information at the frequency of 35/50 while doctors were at 21/50. The study by Nyachwo (2003) demonstrated that nurses were frequent educators. In her study the researcher indicated that some medical practitioners assumed that pharmacists and nurses demonstrated and reviewed the use of MDI by their patients while others cited lack of time and absence of placebo inhalers as reasons for not demonstrating how MDI should be used.

Reed (2004) found that physicians took it for granted that all patients could swallow a pill and therefore assumed that all patients could use an inhaler. The researcher equates the use of an inhaler with riding a bicycle and describes this act as a skill that has to be learned through coaching and experience. Therefore in every encounter with asthmatic patients doctors should review their patients and if needed should demonstrate the inhalation technique of MDIs.

5.3.1 Types of MDIs used

Forty nine participants (98%) knew the types of MDIs they used either by name or by the colour of the container; (blue for Asthavent® and brown for Budeflam®) and only 2% participants who could not identify the MDIs.

5.3.2 Reasons for use of MDI

The majority of the participants (47/50, 94%) indicated that Asthavent® metered dose inhalers were relievers used to unblock a tight chest while 40% of these participants also indicated Budeflam® metered dose inhalers as relievers. Only 10/50 (20%) participants knew the purpose of the inhaled corticosteroid (Budeflam®). This finding raises a lot of concern as only 20% of participants knew that inhaled corticosteroids prevented asthmatic attacks. If the remaining 80% knew the role of inhaled corticosteroids and were to use them properly, their asthma would have been controlled. Furthermore if 40% of the participants thought that Budeflam® was a reliever, one would assume that it was used only during an attack and not twice daily as prescribed.

Literature shows that some physicians do not prescribe inhaled corticosteroids despite the standardized asthma guidelines with convincing evidence that these medications improve the patient's quality of life. The main reason cited as to why physicians were not prescribing inhaled corticosteroids is not lack of time, availability of equipment or educational support, but their disagreement with the recommendations. These physicians were more concerned with the adverse effects of these drugs than their action (Reed 2004).

Kemp et al cited in Reed (2004) performed a prospective two-year placebo–controlled study of possible adverse effects of daily inhalation of aerosol fluticasone, a topical corticosteroid on bone mineral density and function of the hypothalamic-pituitary-adrenal axis and on development of cataracts or glaucoma. This study showed that the low dose corticosteroids advised for mild, moderate and persistent asthma had no adverse effects. Furthermore the dose that was five times higher usually advised for severe asthma had a minimal transient effect on cortisol production. They concluded that inhaled corticosteroids do not have clinically important adverse effects on bone mineral density, cortisol production and glucose metabolism caused by equivalent effective doses of oral glucocorticoids like prednisone.

Therefore physicians and patients should comply with the GINA Guidelines, the American National Asthma Guidelines and the South African Thoracic Society Guidelines which recommend the use of inhaled corticosteroid in patients with persistent, even mild persistent asthma (Reed 2004), (Lalloo 2007).

5.4 Inhalation Technique of MDI

No participant performed all the inhalation steps correctly. The most common error in this study was failure to synchronize breathing with actuation. Ninety four percent (94%) of the participants had difficulty in breathing in slowly while actuating the inhaler to release one dose and continuing to breathe. This finding raises concerns as it is the single most important step of the whole inhalation technique since lesser amounts of the inhaled drug would reach the lungs, which would result in poor asthma control.

The other errors were; failure to breathe out slowly to residual volume before actuation and not holding the breath for ten seconds after inhalation. These steps were performed incorrectly by 82% of the participants. Failure to breathe out slowly after holding the breath for ten seconds (84%) was also one of the errors of inhalation.

These findings are similar to those from the study by Al-Wasil and Al-Mohaimeed (2003). In their study the common errors were; failure to breathe out slowly to residual volume before actuation, not holding the breath for ten seconds after inhalation and failure to synchronize breathing and actuation (66%). Failure to tilt the head backwards was the most common error in their study while in this study it is the fourth common error (76%) followed by failure to wait for one minute if a second dose is required (74%).

This shows that the MDI inhalation technique is very difficult to perform. This is in keeping with the findings of Pereira, Clement and Simeon (2001). In their study on correct pressurised metered dose inhaler technique in Trinidadian patients with asthma, they found that though patients had received a demonstration of the correct inhaler technique and 92% were confident of employing the correct technique, only 41% actually demonstrated all the steps correctly.

5.5 Association of variables

There was a significant association between the level of education of participants and the synchronisation of breathing with actuation. That is, participants with higher levels of education performed the synchronisation and actuation step of MDI technique better than those with lower levels of education. However in this study the level of education among

the participants was generally low and hence the poor performance of this technique. This reinforces the findings of Williams *et al* (2006) that the literacy level was the strongest predictor of MDI technique. In his study, many patients with poor reading skills did not realize the importance of using an inhaler properly.

On the contrary there was no significant association between training on use of MDI and synchronisation of breathing with actuation. This means that whether participants were trained or not on MDI use technique, they still performed poorly. This corroborates the findings of Pereira, Clement and Simeon (2001) that though patients had received a demonstration of the correct inhaler technique and they were confident of performing the correct technique, only a small percentage actually demonstrated all the steps correctly. They concluded that pressured MDIs are difficult to use. Therefore incorrect users require frequent reinforcement of proper technique by properly trained health professionals. The findings of this study also reinforce the view that MDIs are difficult to use.

5.6 Limitations to study

The following limitations were identified in this study.

The sample size was small and therefore results from this study can not be generalized to the general population. The fact that the research was carried out in a private general practice only made it to be unrepresentative of the entire population.

The other limiting factor was self reporting which predisposed the study to recall bias. The translation of the questionnaire from English to TshiVenda and the filled in

questionnaire back to English could have resulted in data interpretation due to limited

vocabulary.

CHAPTER 6

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The correct use of MDI was found to be difficult for most participants. The majority of the participants lacked knowledge and skill for effective use of MDI. The inefficient inhalation technique seems to be a common problem, resulting in poor drug delivery to the lungs and increased asthma morbidity.

6.2 Recommendations

- It should be mandatory for all health professionals to teach all patients with obstructive airway diseases; the nature of the disease, preventive measures, the need for use of an inhaler and demonstrate how the aerosol inhaler should be use.

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- Furthermore patient's inhalation techniques should be assessed by the health care practitioner at all reviews, to check that the correct technique is maintained, because skills deteriorate with time.

- Patient information leaflets should be translated into the local language.

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Appendix I: Consent Form

UNIVERSITY OF LIMPOPO (Medunsa Campus) CONSENT FORM

Statement concerning participation in a Clinical Trial/Research Project*.

Name of Study:

The knowledge and practice on the use of Metered Dose Inhalers by asthmatic patients seen at a private General Practice in the Vhembe district, Limpopo Province.

I have read the information on the aims and objectives of the proposed study and was provided the opportunity to ask questions and given adequate time to rethink the issue. The aim and objectives of the study are sufficiently clear to me. I have not been pressurized to participate in any way.

I understand that participation in this Study is completely voluntary and that I may withdraw from it at any time and without supplying reasons. This will have no influence on the regular treatment that holds for my condition neither will it influence the care that I receive from my regular doctor.

I know that this Study has been approved by the Research, Ethics and Publications Committee of Faculty of Medicine, University of Limpopo (Medunsa Campus). I am fully aware that the results of this Study will be used for scientific purposes and may be published. I agree to this, provided my privacy is guaranteed.

I hereby give consent to participate in this Study.

....
            Name of patient

....
Signature of patient or guardian

....
            Place

....
                Date

....
            Witness

_____

Statement by researcher (Dr. ZT Magwentshu)

I provided verbal and/or written* information regarding this Study.
I agree to answer any future questions concerning the Study as best as I am able. I will adhere to the approved protocol.

………........................
            Signature

.........................……
                Date

……………………………
            Place

Appendix II: Questionnaire

Title: The knowledge and practice on the use of Metered Dose Inhalers by asthmatic patients seen at a private General Practice in the Vhembe district, Limpopo Province.

Instructions: Please complete the questionnaire as complete as possible.

1. Age:

   <20 yrs ☐   21-29 yrs ☐   30-39 yrs ☐   40-49 yrs ☐   >50 yrs ☐

2. Gender: Male ☐   Female ☐

3. Level of education:

   None ☐   Primary level ☐   Secondary level ☐   Tertiary level ☐

4. Duration of asthma: <5 years ☐   >5 years ☐

5. Last asthmatic attack:

   <2 weeks ago ☐   2-4 weeks ago ☐   >4 weeks ago ☐

6. What makes your Asthma worse (triggers)?
   Smoking ☐   Dust ☐   Exercise ☐   Cold Air ☐

   Other causes (state them): _____

7. Have you received any education on the use of asthma inhalers?
   Yes ☐   No ☐

8. If yes, from whom? (If No, go to question 9)

   Doctor ☐   Nurse ☐   Pharmacist ☐   Friend ☐   Family member ☐

9. Have you ever made use of MDIs (Asthma Inhalers?)
   Yes ☐   No ☐

10. If not, why? …………………………………………………………….................................

11. If yes, how many Asthma Inhalers do you have? (MDIs)
    One ☐   Two ☐   Three ☐

12. Do you know the types of Asthma Inhalers (MDIs) you have used?
    Yes ☐   No ☐

13. If yes, name them………………………………………………………….........................

14. State the purpose of each of the Asthma Inhalers you have mentioned
    ………………………………………………………………………………………………………
    ……………………………………………………………………………………………………..
    ……………………………………………………………………………………………………..

Appendix III: Check list on MDI usage steps
_____

1. Removes the mouthpiece cover, and check the mouthpiece thoroughly to
   see that it is clean.   [ ]

2. Shakes the inhaler vigorously.   [ ]

3. Holds the inhaler upright between index finger and thumb.   [ ]

4. Breathes out gently through your mouth and immediately place the mouthpiece
   in your teeth (Do not bite it)   [ ]

5. Grips the mouthpiece firmly with your lips.   [ ]

6. Tilt your head slightly backwards.   [ ]

7. Starts breathing in slowly through your mouth. (At the same time press the

   canister, to release one dose while continuing to breathe)   [ ]

8. Removes the inhaler from your mouth and holds breath for at least 10 seconds
   or as long as is comfortable.   [ ]

9. Breathes out slowly.   [ ]

10. If another dose is required, wait for at least one minute, repeat steps 1 to 4. [ ]

11. After use, replace the mouthpiece cover.   [ ]

Appendix IV: REPC Certificate

UNIVERSITY OF LIMPOPO

Medunsa Campus

RESEARCH, ETHICS & PUBLICATIONS COMMITTEE

FACULTY OF MEDICINE

CLEARANCE CERTIFICATE

P O Medunsa
Medunsa
0204
SOUTH AFRICA

Tel: 012 - 521 4000
Fax: 012 - 560 0086

MEETING: 09/2006   PROJECT NUMBER: MP 129/2006

PROJECT: Title: The knowledge and practice on the use
                                Of metered dose inhalers by asthmatic patients
                                seen at a private general practice in the
                                Vhembe district, Limpopo Province
            Researcher: Dr ZT Magwentshu
            Supervisor: Prof GA Ogunbanjo
            Department: Family Medicine & Primary Health Care
            Degree: M Med (Family Medicine)

DATE CONSIDERED: November 16, 2006

DECISION OF COMMITTEE:

REPC approved the project.

DATE: November 22, 2006

PROF GA OGUNBANJO
CHAIRMAN (RESEARCH) REPC OF FBM

Note:	i)	Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee.
	(ii)	The budget for the research will be considered separately from the protocol. PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

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