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ORIGINAL ARTICLE / RESEARCH

Correct Use Of A Metered Dose Inhaler: A Prospective Interventional Study Among Healthcare Professionals In A Nepalese Teaching Hospital

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ABSTRACT

Background: Asthma and Chronic Obstructive Pulmonary Disease (COPD) are common in Nepal. Inhaled medications form the cornerstone of the management of these diseases. Metered Dose Inhalers (MDIs) are a common mode of delivering inhaled medications, and hence knowledge of the healthcare professionals regarding MDIs is the cornerstone for educating the patients about the correct use of MDIs. **Objectives:** To study the correct use of MDIs by the doctors, nurses, pharmacists and medical interns, and to evaluate the impact of an educational intervention on the use. **Methods:** A prospective, interventional study was carried out at the Manipal Teaching Hospital, Pokhara, Nepal. The subjects were asked to demonstrate the technique using a placebo inhaler, and the steps were graded as per the National Asthma Education and Prevention Program (NAEPP) criteria. Intervention was done by demonstrating correct MDI use with the help of placebo inhalers and an information leaflet. The post intervention response was analyzed using appropriate statistical tests. **Results:** Altogether 143 health professionals (male 53.8%, female 46.1%) were studied prior to intervention, and 101 (male 41.5%, female 58.4%) of them in the post interventional phase. The overall mean ± SD score obtained by the professionals was 4.44 ± 2.07 (pre intervention), and 7.68 ± 1.74 (post intervention). ($P < 0.001$, Z value - 10.020, Mann Whitney test). With regard to the individual scores of different categories of healthcare professionals, the scores for the nurses were 3.99 pre intervention and 8.14 post intervention, for doctors it was 5.96 and 7.18, for pharmacists it was 5.8 and 7.1, and for interns it was 4.72 and 7.12. None of the professionals could initially demonstrate all the ten steps involved in the correct use of MDI. Following the intervention one doctor, four medical interns, and eight nurses all demonstrated the steps correctly. **Conclusion:** MDI use among healthcare professionals was poor before the intervention. The intervention was substantially effective in improving the technique.

Keywords: Doctors, Education, Intervention, Metered dose inhalers, Nurses, Pharmacists.

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Introduction

Respiratory diseases like asthma [1] and Chronic Obstructive Pulmonary Disease (COPD)[2] are a common cause of morbidity and mortality worldwide. In Nepal, a combination of asthma and bronchitis constitutes a major cause of mortality[3]. Bronchodilators and anti-inflammatory agents are important for the treatment of these diseases. On systemic administration, these agents produce considerable side effects. In order to overcome this problem and to have a quicker onset of action and better efficacy, inhaled medications

are preferred[4]. However failure of treatment is still a common problem for these diseases[5]. One of the reasons for this is incorrect use of Metered Dose Inhalers (MDIs), the commonest method of inhaled drug delivery[6]. It has been demonstrated to occur approximately in 75% of the patients using MDIs. [1]

In order to improve MDI use, healthcare professionals should teach the patients to correctly use MDIs. Two studies from Nepal have demonstrated the usefulness of counseling by pharmacists in using MDIs[7],[8]. To correctly teach MDI use, healthcare professionals like doctors, pharmacists and nurses should have adequate knowledge about the use of MDIs[9]. Studies from different countries have demonstrated poor knowledge among these professionals regarding MDI use[10],[11],[12]. Poor knowledge among healthcare professionals can lead to an incomplete and improper information about the patients. Studies have recommended training programs for healthcare professionals in order to improve their knowledge about the correct use of inhalers[10],[13],[14]. These type of studies are lacking in Nepal.

Moreover, in Nepal, a large proportion of the patient population is illiterate, and hence the role of healthcare professionals in the education of the patients is very important. The doctors at our hospital educate the patients regarding the correct use of MDIs while prescribing them to the ambulatory patients. The nurses teach the ambulatory as well as the hospitalized patients about MDI use. The pharmacists at our hospital counsel the patients about the proper use of inhalers at the Medication Counseling Center (MCC) located adjacent to our out-patient pharmacy[15]. Before educating patients, healthcare professionals need to have an adequate knowledge about the correct use of inhalers.

Thus, at the Manipal Teaching Hospital, a 700 bedded tertiary care center, doctors, nurses and pharmacists are involved in teaching the patients about the correct use of inhalers. However, their knowledge level regarding the correct use of inhalers is not known. Hence, the present study was carried out.

Objectives:

The present study was conducted with the following objectives.

1. To study the proficiency of the proper use of MDI demonstrated by the doctors, nurses, pharmacists and medical interns

2. To evaluate the impact of an educational intervention on the improvement in MDI use, if any.

Methodology

Study site: Manipal Teaching Hospital, Pokhara, Nepal, a 700 bedded tertiary care teaching hospital.

Study type: Prospective, interventional study

Study period: The study was carried out in three phases, the pre interventional, interventional, and the post interventional phase, with a one week gap between the phases.

Inclusion criteria: Doctors (only who prescribe MDIs), nurses and pharmacists were included in the study.

Study tool: An 'MDI use evaluation score chart' was prepared as per the National Asthma Education and Prevention Program (NAEPP) criteria[16], and was used in the study. For every correctly carried out step, a score of '1' was given, and for every incorrect step, a score of '0' was given. The score chart used is listed in Appendix 1.

Operational modality: The study had three phases, the pre interventional, interventional, and post interventional phase. The healthcare professionals were asked, after obtaining verbal consent, to demonstrate the use of the placebo inhaler, and the steps were graded as per the NAEPP criteria. Following the evaluation, the healthcare professionals were educated about the proper use of MDI. The educational intervention was carried out for doctors, nurses and pharmacists separately. Doctors and medical interns were contacted individually, nurses were trained in small groups, and pharmacists were educated during the Continuing Pharmacy Education (CPE), which is carried out by the Drug Information Center (DIC) members of our hospital on a fortnightly basis. All the healthcare professionals were also given information leaflets which described the ten steps involved in the correct use of MDIs. Following the intervention, the technique of the use of MDI was studied after a period of one week.

Statistical methods: We used the Mann Whitney test to compare the overall improvement in the

scores of the health care professionals if any, following the intervention (P< 0.05). For the analysis, we used the Microsoft excel spread sheet and the Statistical Package for Social Sciences (SPSS) version 9.5.

Results

Age distribution: The details regarding the demographic distribution of the healthcare professionals are listed in [Table/Fig 1].

Table/Fig 1. **Demographic distribution of the healthcare professionals**

Demographic characteristics	Parameters	Pre intervention (n= 143)	Post intervention (n=101)
		% (Number)	% (Number)
Sex	Male	53.85 (77)	41.58 (42)
	Female	46.15 (66)	58.42 (59)
Age (In years)	10-20	10.49 (15)	7.92 (8)
	21-30	81.82 (117)	82.18 (83)
	31-40	6.99 (10)	9.90 (10)
	41-50	0.70 (1)	0 (0)
Category	Medical Doctor	18.18 (26)	10.89 (11)
	Intern	25.17 (36)	30.69 (31)
	Pharmacist	10.49 (15)	9.90 (10)
	Staff nurse	46.15 (66)	48.51 (49)

The overall knowledge regarding correct use of MDIs: The percentage of the professionals demonstrating each step of the MDI use correctly was identified and the details are listed in [Table/Fig 2].

Table/Fig 2. Percentage of professionals demonstrating each steps correctly

Steps	Pre intervention (n=143)	Post intervention (n=101)
Shake vigorously	70.63	100
Remove cap	95.10	99.01
Hold upright	90.21	95.05
Breathe out gently, Not fully	32.87	71.29
Start breathing in slowly deeply	9.79	77.23
Actuate during inspiration	43.36	70.30
Continue slow inhalation	20.98	69.31
No aerosol loss is visible	24.48	22.77
Hold breath for 10 seconds	29.37	75.25
Next dose after 1 minute	27.97	89.11

Evaluation of the impact of the intervention: The impact of the intervention program was evaluated and the scores obtained by the health professionals were compared. The overall mean ± SD score obtained by the professionals was 4.44 ± 2.07 (pre intervention) and 7.68 ± 1.74 (post intervention).

Distribution of the score based on their profession: The mean score obtained by the professionals were calculated as per their profession. The scores pre intervention and post intervention amongst nurses were 3.99 and 8.14, for doctors it was 5.96 and 7.18, for pharmacists it was 5.8 and 7.1, and for interns it was 4.72 and 7.12 respectively.

Distribution of the score based on the age of the professionals: The scores obtained by the professionals were grouped, based on their age. The average score obtained during pre intervention and post intervention by the professionals in the age group of 11-20 years was 3.07 and 8.38, followed by 4.5 and 7.62 for the age group 21-30 years, 6.1 and 7.8 for the age group 31-40 years, and lastly, 2 and 0 for the age group 41 and above.

Distribution of the score based on the length of service: The average score obtained by the professionals was grouped, based on their length of service. The details are listed in [Table/Fig 3]

Table/Fig 3. Distribution of the average score based on the length of service in the hospital (Maximum score 10)

Length (Months)	Pre intervention	Post intervention
≤10	4	7.47
11-20	4.78	8
21-30	4.06	7.58
31-40	5.13	8.42
41-50	5.83	7
51-60	5	9
>60	4.73	7.38
Data not available	3.33	8.5

Number of professionals who demonstrated all the steps correctly: None of the professionals in our study could demonstrate all the ten steps involved in the correct use of MDI during the pre intervention period. Following the intervention, 1 doctor, 4 interns, and 8 nurses demonstrated all the steps correctly.

Discussion

The present study identified a substantial improvement in the technique of inhaler use by the health care professionals of the hospital following the intervention.

Non-compliance to pharmacotherapy is a common reason for therapeutic failure[17]. Studies have identified that up to 10% of hospital admissions, and more than 20% of nursing home admissions can be attributed to non-compliance[18],[19]. In Nepal, respiratory diseases like asthma and COPD are highly prevalent[8]. Non-compliance and treatment failure in these diseases may arise due to improper use of MDIs. In Nepal, the local manufacturers do not manufacture MDIs, and hence Patient Information Leaflets (PILs) in the native language for the patients, are not available.

The present study identified that healthcare professionals had a poor knowledge about the correct use of MDIs. It was surprising to know

that none of the healthcare professionals could demonstrate the proper use of MDIs. In a study from Iran, which included physicians and nurses, only 6.93% could demonstrate MDIs correctly[13]. In another study from Oman, 15% of respondents performed all the steps correctly[14]. Our study has thus recorded a very poor understanding of healthcare professionals regarding MDI use. We could not identify the reason behind such a finding. The burden of respiratory diseases is so high in our region, that the use of MDI is unavoidable. In such a circumstance, the poor understanding of the healthcare professionals regarding the use of MDI can be dangerous. However, a few of the healthcare professionals could demonstrate the correct steps of MDI use. A study from Turkey, conducted amongst nurses, had demonstrated a significant improvement in MDI use after a training program[20]. The authors also suggested a training program for nurses, and recommended repeat programs for better outcomes. The findings of our study also recommend training programs for the professionals to improve their knowledge. This training needs to be linked with managerial interventions as well.

The most difficult step identified by the professionals was the 'step 5', which included 'Start breathing in slowly and deeply'. This step is very essential so that the medication can reach the respiratory tract. If one fails to inhale, the medication can deposit in the oral cavity, and can lead to wastage of the drug. This step can also be difficult for the patient. The study from Turkey reported the most improperly performed step to be 'hold breath for 10 seconds'[10]. Thus the difficult steps observed by the population can vary from place to place. In general, the steps that require hand to mouth coordination (steps 5-7) can be challenging. In such cases, a spacer can be beneficial, and can solve the co-ordination problem to a greater extent[20]. However, in a poor country like Nepal, one should communicate to the patients, the cost factor before prescribing a spacer.

In our study, we found that overall, nurses had a poor score prior to the intervention. The knowledge of the nurses in this regard is very vital, as they teach the patients regarding MDI use when the patients get admitted in the hospital. However, the overall improvement in the score was higher in nurses than all the other professionals.

For the ambulatory patients using MDIs, the role of Pharmacists is very essential. The Pharmacists at the MCC of our hospital provide counseling to the patients regarding appropriate MDI use. In a preliminary evaluation carried out at our MCC, asthma or COPD was the commonest presumed diagnosis among the patients visiting the center, and MDIs were the most commonly used counseling aids[19]. Inadequate knowledge of the pharmacists working in the MCC can be dangerous, as they can give incorrect information to the patients. This problem can be overcome by incorporating more time on use of the MDI in the CPE program conducted by our hospital DIC every alternate week[21].

The poor knowledge of the doctors and medical interns reveals the need for educational intervention among them as well. One of the better approaches could be, to include changes in the medical curriculum, which incorporate the issues like MDI demonstration. In our college, Pharmacology is taught in a problem based, integrated manner, with the other basic sciences subjects. We also teach communication skills to the students during the practical sessions[22]. The use of MDI is taught during the practical sessions. A similar approach can be followed in other institutions. A low level of knowledge among the medical interns further justifies the need of teaching MDI techniques to the medical students.

The overall poor knowledge of the healthcare professionals also necessitates alternative methods to overcome this problem. One of the methods could be providing Patient information leaflets to all the patients who are being prescribed with MDIs. These leaflets should be made in the local language, and should also incorporate pictorials.

Limitations: Our study had a few limitations. We had a high number of dropouts in the subjects following the intervention. We evaluated the impact of intervention only once, after one week. We did not evaluate the sustainability of the intervention on the knowledge of the healthcare professionals.

Impact: The present study created awareness among the healthcare professionals regarding the importance of having adequate knowledge of inhaler techniques. Through this study, we could also provide some knowledge inputs to the doctors, nurses, pharmacists, and medical interns of our hospital. This improvement in the knowledge could improve the practice outcomes of these health care professionals.

Future research: This study provides scope for future research in many ways. Similar studies

covering different regions of Nepal can be carried out.. Healthcare professionals who received the education can be followed up for improvement in the practical outcomes on inhaler use. Long term follow up of the professionals can be done to evaluate the sustainability of the intervention.

Conclusion:

The present study identified poor understanding among healthcare professionals, regarding the correct use of inhalers. It was also surprising to know that even pharmacists who provide counseling to the patients were not able to demonstrate the different steps of the use of MDI correctly. Though the intervention was successful in increasing the knowledge of the healthcare professionals, there is scope for further improvement. It would be beneficial to have a periodic educational program for the healthcare professionals regarding MDI use.

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Appendix 1.

MDI TECHNIQUE EVALUATION SCORE CHART

Details of the responder

Name:	**Age:**	**Gender:**
Professional qualification :	**Department:**	**Date:**
Length of service:	Specialty:	

Scoring chart

Steps followed

		Correct	Incorrect	Score
☐	Shake vigorously	☐	☐	☐
☐	Remove cap	☐	☐	☐
☐	Hold upright	☐	☐	☐
☐	Breathe out gently, not fully	☐	☐	☐
☐	Start breathing in slowly and deeply	☐	☐	☐
☐	Actuate during inspiration	☐	☐	☐
☐	Continue slow inhalation	☐	☐	☐
☐	No aerosol loss is visible	☐	☐	☐
☐	Hold breath for 10 seconds	☐	☐	☐
☐	Next dose after 1 minute	☐	☐	☐

Total score: **----------**

Signature of the investigators: ……