

# Knowledge of undergraduate physiotherapy students in the Western Cape regarding the correct administration of bronchodilators via metered dose inhalers

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## Abstract

**Background:** International studies have shown that there is a lack of practical and theoretical knowledge amongst various health professionals regarding the correct administration of bronchodilators via metered dose inhalers that may result in poor outcomes and negative side effects in patients. The aim was to evaluate the knowledge of undergraduate physiotherapy students in the Western Cape regarding the correct administration of bronchodilators via metered dose inhalers.

**Method:** A cross-sectional quantitative descriptive survey including 330 participants was conducted. Data were collected using a self-developed, self-administered English questionnaire. Analysis included descriptive and inferential statistical tests with results significant at  $p \leq 0.05$ .

**Results:** Similar to other studies significantly fewer students had the correct knowledge with regards to the correct administration of BD's via MDI's in relation to the correct steps ( $p=0.000$ ), overdose ( $p=0.000$ ), side effects ( $p=0.000$ ) and contra-indications ( $p=0.000$ ) of BD administration via MDI.

**Conclusion:** Teaching and learning should be directed towards improving theoretical and practical skills with regards to the correct administration of BD via MDI. Dosage, side effects and contra-indications of BD usage are aspects that also need to be emphasized in the respiratory physiotherapy curriculum. This will assist in ensuring accurate demonstration and education for safe patient administration. Regular evaluation of technical skills and theory is also recommended.

**Key words:** bronchodilator, metered dose inhaler, student, physiotherapy and knowledge

## Introduction

Many health professionals including physiotherapists are involved in the evaluation and treatment of respiratory patients such as those suffering from Asthma and Chronic Obstructive Pulmonary Disease (COPD). Self-administered inhaler therapy is a treatment strategy used for these patients as it is a rapid form of treatment that is cost-effective and safe with fewer side effects than oral therapy (Hanania et al., 1994). The most commonly used form of administering bronchodilators (BD's) to a patient is via a metered dose inhaler (MDI) (Hanania et al., 1994).

One of the main aims of BD therapy is to decrease airflow limitation, and therefore improve dyspnoea and exercise tolerance (Liesker et al., 2002). It has been reported that even with the best technique of administering BD's via MDI's, only 10-15% of the aerosol reaches the lung. Patients tend to fail to use the MDI's properly when administering BD's with 24-89% having poor technique. This may give rise to clinically relevant problems which may result in poor outcomes in these patients (Hanania et al., 1994). Although it has been recommended that education by health professionals is one of the ways to improve patient technique there is no

concrete data regarding the ability and knowledge of health professionals to use MDI's as very few studies are available (Liesker et al., 2002). From the few studies that were available, it was found that health professionals lack rudimentary skills and elementary theoretical knowledge regarding the use of MDI's. This therefore impacts on their education to patients and the resultant poor patient technique (Hanania et al., 1994; Kelling et al., 1993).

Qualified physiotherapists as well as physiotherapy students are required to educate patients with respiratory conditions such as asthma and COPD on the correct technique of administering BD's via MDI's. Re-evaluation of the inhalation technique should be constant as it takes an average of ten visits for patients to learn it correctly (Muchão et al., 2008). Insufficient practical and theoretical knowledge regarding the correct administration of BD's via MDI's on the part of the physiotherapist could lead to the incorrect demonstration of the technique therefore affecting the learning process.

This could result in poor patient technique, poor effects of the treatment and lack of improvement in the condition (Muchão et al., 2008; Scarfone et al., 2002; Hanania et al., 1994). Physiotherapists and physiotherapy students need to know the indications, precautions, side effects, contra-indications, dosage and the correct steps in administration of BDs via MDI's to effectively manage and educate respiratory patients as problems may arise from incorrect administration of BD's via MDI's (Mikelsons, 2007).

At the universities in the Western Cape undergraduate physiotherapy students are required to do clinical practice as part of their curriculum. Respiratory physiotherapy theory and practical components are introduced to students from 2nd year of study as preparation for clinical practice in 3rd and 4th year. Part of this module includes theoretical and practical knowledge of various respiratory therapies including the correct administration of BD's via MDI's.

The few studies available have each used different methodological designs and outcome measures to determine the knowledge of health

professionals including physiotherapists (physical therapists) with regard to the correct administration of BD's via MDI's. There is a need however for similar studies in developing countries. It has been recommended that future physiotherapists and other health professionals become familiar with these techniques as undergraduates so that after graduation they can both apply their knowledge and participate in the education of other health professionals (Muchão et al., 2008).

No study has been done on the knowledge of undergraduate physiotherapy students regarding the correct administration of BD's via MDI's specifically in the Western Cape. Therefore the aim of this study was to evaluate the knowledge of undergraduate physiotherapy students in the Western Cape regarding the correct administration of BDs via MDIs. Based on the findings of this study, teaching and learning can then be emphasized in the undergraduate respiratory physiotherapy curriculum to ensure that competent physiotherapists graduate.

## **Methods**

### **Setting and Design**

This cross-sectional quantitative descriptive survey included 619 undergraduate students from Physiotherapy Departments at the three Universities in the Western Cape. A convenient sampling method was used as all students at each University could participate in the study. As this is a non-probability sample the results cannot be generalized but will assist in the understanding of the problem.

### **Procedure**

Permission and ethical clearance was obtained from the Senate Research Grants and Study Leave Committee of the University of the Western Cape as well as each Physiotherapy Head of Department. Informed consent was obtained from each participant before commencement of data collection. Data was collected from the 1st, 2nd, 3rd and 4th year students at each University at the times convenient to each Physiotherapy Department.

For ethical reasons the three University Physiotherapy Departments will be referred to as University 1, University 2 and University 3.

### **Instrumentation**

A self-developed English questionnaire with close-ended questions was used. The questionnaire was developed specifically for the purpose and methodology described in this study. Of the very few studies found many used a variety of different methods to obtain information regarding the knowledge of health care professionals regarding BD administration via MDI's (Muchão et al., 2008; Hanania et al., 1994; Kelling et al., 1993).

The methods used in these studies included practical evaluation and some written evaluation in the form of a test or questionnaire and were not all time and cost effective for use in this study. The reliability and validity of their instruments were also not reported on. Thus the content of the self-developed questionnaire was based on findings from the literature from similar international studies conducted (Muchão et al., 2008; Hanania et al., 1994; Kelling et al., 1993) as no validated and reliable tools were available for use in this study.

The content included in the studies used was applicable to the South African context. However due to resource limitation it was not possible to utilize the practical tests used in some of the studies to evaluate health professionals knowledge regarding the correct administration of BD's via MDI's.

The questionnaire contained information regarding university and year of study, age category, gender and where they first learnt about BD administration via MDI as well as questions related to knowledge of BD's, MDI's, the use of these by students and their families, whether students needed to or ever taught patients how to administer BD's via MDI's, the correct steps in administration, knowledge of overdose, side effects and contra-indications. Each question was an individual item. The responses for each item was dichotomized into yes and no, or true and false responses.

The self-developed questionnaire was piloted on 12 randomly selected undergraduate physiotherapy

students for understanding, timing and consistency of or agreement between responses. The test – retest method for reliability was used to determine intra-rater reliability. The questionnaire was administered to 12 subjects and then re-administered two weeks after the first administration date. The results of the pilot study were analyzed. Agreement between responses between the two tests for the 12 participants ranged between 67 and 100% (intra-rater reliability). No changes were needed as all participants reported understanding of the items (face validity). The questionnaire took between 10 and 15 minutes to complete.

Scoring of this questionnaire to determine what was known and unknown to students regarding the administration of BD's via MDI's was purely descriptive with the numbers of yes or no and correct or incorrect responses calculated and then analyzed for significance. Missing or omitted data was scored as incorrect as it could be assumed that students did not know the answer.

### **Data Capturing and Analysis**

The self-developed questionnaire was coded and data was entered into the SPSS version 16 data editor and analyzed. Descriptive data was analyzed using descriptive statistics and presented as frequencies and percentages and one sample t-tests and one way Anova tests were used to determine significant outcomes. Results were significant at a p-value  $\leq 0.05$ .

### **Results**

#### **Response Rates**

A total response rate of 53.31% (n=330) was obtained. The response rate of University 1 was 65.46% (n=127/194), University 2 was 44.2% (n=107/242), University 3 was 50.53% (n=95/188).

#### **Knowledge outcomes of the total population from the three universities**

The table below illustrates the knowledge of all undergraduate physiotherapy students regarding the correct administration of BD's via MDI's in terms of numbers and percentages of students who correctly identified concepts relating to BD administration via a MDI as well as significant outcomes.

**Table1. Knowledge outcomes of the total population from the three universities**

Question	Number of Students (n and %)	Significant difference (significant p-value=*)
<b>Do you know what a MDI is?</b>		
Yes:	230/328 (70.1%)	p = 0.00*
No:	98/328 (29.9%)	
<b>MDI Definition:</b>		
Correct:	174/330 (52.7%)	p = 0.00*
Incorrect:	156/330 (47.3%)	
<b>Do you know what a BD is?</b>		
Yes:	254/328 (77.4%)	p = 0.00*
No:	74/328 (22.6%)	
<b>BD Definition:</b>		
Correct:	95/330 (28.8%)	p = 0.00*
Incorrect:	235/330 (71.2%)	
<b>In which Year were you taught about BD's and MDI's?</b>		
1st:	15/222 (6.8%)	p = 0.00*
2nd:	193/222 (86.9%)	
3rd:	11/222 (4.95%)	
4th:	3/222 (1.35%)	
<b>Do you or a relative use a BD via a MDI?</b>		
Yes:	103/322 (32%)	p = 0.00*
No:	219/322 (68%)	
<b>Are BD's useful for Obstructive Lung Disease?</b>		
Yes:	211/300 (70.3%)	p = 0.00*
No:	89/300 (29.7%)	
<b>Have you ever needed to teach a patient to administer BD's via a MDI?</b>		
Yes:	52/321 (15.8%)	p = 0.00*
No:	269/321 (84.2%)	
<b>Have you ever taught a patient how to administer a BD via a MDI?</b>		
Yes:	49/322 (15.2%)	p = 0.00*
No:	273/322 (84.8%)	
<b>Knowledge of correct sequence of steps of administering BD's via a MDI:</b>		
Correct:	81/294 (27.6%)	p = 0.00*
Incorrect:	213/294 (72.4%)	
<b>It is very hard to overdose on a BD administered via a MDI.</b>		
True:	178/305 (58.4%)	p = 0.00*
False (correct answer):	127/305 (41.6%)	
<b>There is a set dosage for the use of BD's administered via MDI's.</b>		
True:	274/306 (89.5%)	p = 0.00*
False (correct answer):	32/306 (10.5%)	
<b>Are there any side effects related to the use of BD's via MDI's?</b>		
Yes:	248/307 (80.8%)	p = 0.00*
No:	59/307 (19.2%)	
<b>Knowledge of correct side effects:</b>		
Correct:	5/330 (1.5%)	p = 0.00*
Incorrect:	325/330 (98.5%)	
<b>Are there any contra-indications related to the use of BD's via MDI's?</b>		
Yes:	206/293 (70.3%)	p = 0.00*
No:	87/293 (29.7%)	
<b>Knowledge of correct contra-indications:</b>		
Correct:	10/330 (3%)	p = 0.00*
Incorrect:	320/330 (97%)	

The table below illustrates the knowledge of first, second, third and 4th year undergraduate physiotherapy students regarding the correct administration of BD's via MDI's in terms of

numbers and percentages of students who correctly identified concepts relating to BD administration via a MDI.

**Table 2. Difference in knowledge outcomes amongst the different year levels from the three universities**

Question and p-value (most significant p-value = *)	First Year	Second Year	Third Year	Fourth Year
<b>Do you know what a MDI is? (p=0.00)*</b>				
Yes:	33/91 (36.3%)	85/98 (86.7%)	45/58 (77.6%)	67/81 (82.7%)
No:	58/91 (63.7%)	13/98 (23.3%)	13/58 (22.4%)	14/81 (27.3%)
<b>MDI Definition: (p=0.00)*</b>				
Correct:	29/92 (31.5%)	59/98 (60.2%)	27/59 (45.8%)	59/81 (72.8%)
Incorrect:	63/92 (68.5%)	39/98 (39.8%)	32/59 (54.2%)	22/81 (27.2%)
<b>Do you know what a BD is? (p=0.00)*</b>				
Yes:	28/92 (30.4%)	87/96 (90.6%)	59/59 (100%)	80/81 (98.8%)
No:	64/92 (69.6%)	9/96 (9.4%)	0/59 (0%)	1/81 (1.2%)
<b>BD Definition: (p=0.00)*</b>				
Correct:	13/92 (14.1%)	31/98 (31.6%)	13/59 (22%)	38/81 (46.9%)
Incorrect:	79/92 (85.9%)	67/98 (68.4%)	46/59 (78%)	43/81 (53.1%)
<b>In which Year were you taught about BD's and MDI's? (p=0.00)*</b>				
1st:	5/5 (100%)	0/5 (0%)	0/5 (0%)	0/5 (0%)
2nd:	6/88 (6.8%)	82/88 (93.2%)	0/88 (0%)	0/88 (0%)
3rd:	3/54 (5.6%)	51/54 (94.4%)	0/54 (0%)	0/54 (0%)
4th:	1/75 (1.3%)	60/75 (80%)	11/75 (14.7%)	3/75 (4%)
<b>Do you or a relative use a BD via a MDI? (p=0.176)</b>				
Yes:	15/85 (17.6%)	42/98 (42.9%)	21/58 (36.2%)	25/81 (30.9%)
No:	70/85 (82.4%)	56/98 (57.1%)	37/58 (63.8%)	56/81 (69.1%)
<b>Are BD's useful for Obstructive Lung Disease? (p=0.727)</b>				
Yes:	55/73 (75.3%)	56/92 (60.9%)	42/55 (76.4%)	58/80 (72.5%)
No:	18/73 (24.7%)	36/92 (39.1%)	13/55 (23.6%)	22/80 (27.5%)
<b>Have you ever needed to teach a patient to administer BD's via a MDI? (p=0.00)*</b>				
Yes:	1/86 (1.2%)	12/96 (12.5%)	13/58 (22.4%)	26/81 (32.1%)
No:	85/86 (98.8%)	84/96 (87.5%)	45/58 (77.6%)	55/81 (67.9%)
<b>Have you ever taught a patient how to administer a BD via a MDI? (p=0.00)*</b>				
Yes:	0/85 (0%)	9/98 (9.2%)	15/58 (25.9%)	25/81 (30.9%)
No:	85/85 (100%)	89/98 (90.8%)	43/58 (74.1%)	56/81 (69.1%)
<b>Knowledge of correct sequence of steps of administering BD's via a MDI: (p=0.00)*</b>				
Correct:	5/66 (7.6%)	27/92 (29.3%)	14/58 (24.1%)	35/78 (44.9%)
Incorrect:	61/66 (92.4%)	65/92 (70.7%)	44/58 (75.9%)	43/78 (55.1%)
<b>It is very hard to overdose on a BD administered via a MDI. (p=0.164)</b>				
True:	37/75 (49.3%)	59/96 (61.5%)	33/55 (60%)	49/79 (62%)
False (correct answer):	38/75 (50.7%)	37/96 (38.5%)	22/55 (40%)	30/79 (38%)
<b>There is a set dosage for the use of BD's administered via MDI's. (p=0.47)</b>				
True:	68/75 (90.7%)	87/96 (90.6%)	49/55 (89.1%)	70/80 (87.5%)
False (correct answer):	7/75 (9.3%)	9/96 (9.4%)	6/55 (10.9%)	10/80 (12.5%)
<b>Are there any side effects related to the use of BD's via MDI's? (p=0.07)</b>				
Yes:	56/74 (75.7%)	77/97 (79.4%)	45/56 (80.4%)	70/80 (87.5%)
No:	18/74 (24.3%)	20/97 (20.6%)	11/56 (19.6%)	10/80 (12.5%)

Question and p-value (most significant p-value = *)	First Year		Second Year		Third Year		Fourth Year	
<b>Knowledge of correct side effects: (p=0.24)</b>								
Correct:	1/92	(1.1%)	4/98	(4.1%)	0/59	(0%)	0/81	(0%)
Incorrect:	91/92	(98.9%)	94/98	(95.9%)	59/59	(100%)	81/81	(100%)
<b>Are there any contra-indications related to the use of BD's via MDI's? (p=0.48)</b>								
Yes:	52/72	(72.2%)	65/90	(72.2%)	36/53	(67.9%)	53/78	(67.9%)
No:	20/72	(27.8%)	25/90	(27.8%)	17/53	(32.1%)	25/78	(32.1%)
<b>Knowledge of correct contra- indications: (p=0.05)</b>								
Correct:	4/92	(4.3%)	5/98	(5.1%)	1/59	(1.7%)	0/81	(0%)
Incorrect:	88/92	(95.7%)	93/98	(94.9%)	58/59	(98.3%)	81/81	(100%)

## DISCUSSION

Research has shown that a definite lack of theoretical and technical or practical knowledge exists amongst different health professionals regarding the correct administration of bronchodilators via metered dose inhalers (Muchão et al., 2008; Hanania et al., 1994; Kelling et al., 1993). Few studies regarding this topic are available and each study uses different methods of evaluation of knowledge regarding BD administration via MDI. This study only used a survey questionnaire to evaluate the knowledge of undergraduate physiotherapy students regarding BD administration via MDI unlike other studies that evaluated this knowledge via both survey questionnaires, written and clinical or practical testing of the various health professionals. Even so the current study similarly depicts that there is a lack of theoretical knowledge in all aspects regarding the correct administration of BD's via MDI's which may impact practical skill and patient demonstration and education (Muchão et al., 2008; Scarfone et al., 2002; Hanania et al., 1994).

Physiotherapists are required to teach and demonstrate the use of MDI's in a clinical setting (Mikelsons, 2007). Mikelsons, 2007 and Scarfone et al., 2002 stated that patients wanted more emphasis to be placed on the demonstration of administering asthma medication, one of these being the administration of BD's via MDI's. As the practical technique of BD administration via MDI was not evaluated it could not be determined whether practical skill was as poor as theoretical knowledge as this may further impact on correct patient technique as suggested by the literature (Muchão et al., 2008; Scarfone et al., 2002; Hanania et al., 1994).

Knowledge acquired in connection with BD administration via MDI was obtained in the second year of study amongst all undergraduate physiotherapists at the three universities in the Western Cape with first years showing the least amount of knowledge.

Significantly more than half the students did not know the correct steps in administering a BD via a MDI, the correct side effects and contra-indications and that it is easy to overdose when administering a BD via a MDI and that the dosage that may be given may vary. These are important areas of knowledge that require increased emphasis during teaching and learning of the respiratory module as it has been reported that poor theoretical knowledge of the above on the part of the health professional may result in poor patient demonstration and education with consequent poor patient technique and improvements in the respiratory condition (Muchão et al., 2008; Scarfone et al., 2002; Hanania et al., 1994).

It also indicates that the majority of the students could be hazardous and ineffective in the management of patients with respiratory conditions due to this lack of theoretical and practical experience in the use of BD via MDI. This finding is supported by Hanania et al., 1994.

It was interesting to note that although significantly most students said they knew what a BD was they incorrectly identified definitions of BD's and therefore may have guessed the answer. Although they correctly identified that side effects and contra-indications exist they could not correctly identify the side effects and contra-indications related to this therapy. This is important to note as it shows the



need to question deeper when assessing or evaluating health professionals and particularly students' knowledge about a particular therapy.

In general significantly fewer students reported the need to teach or having taught the technique to patients. This may attribute to the general lack of theoretical knowledge as daily use of this therapy may not be required in all clinical placements and therefore result in lack of experience gained and the possibility of theoretical knowledge being forgotten (Kelling et al., 1983; Muchão et al., 2008). When comparing years of study, significantly more fourth year students needed to teach or had taught patients BD administration via MDI. Thus revision and re-evaluation of theoretical and practical skills is required at this level as students are only taught and evaluated on this in their second year and may forget the skill by the time they reach fourth year and graduate especially if they do not work mainly in the field of respiratory therapy (Hanania et al., 1994).

## CONCLUSION

The outcomes of this study suggests that emphasis be placed on the administration of BD's via MDI's and the correct steps, dosage, side effects and contra-indications in order to improve the theoretical knowledge and technical skills required by undergraduate physiotherapy students during clinical practice. These areas need to be thoroughly and accurately covered in theory as well as with constant hands-on practice in the physiotherapy respiratory module taught at the Universities. This will assist physiotherapy students and future physiotherapy graduates in improved, safe and effective management of respiratory patients requiring this therapy as it is suggested that hands on demonstration will eliminate unfamiliarity (Kelling et al., 1983). It is also recommended that studies such as these be conducted with new graduates and long practicing physiotherapists as well as other health care therapists involved in patient education specifically with regards to BD administration via MDI. Based on the findings of this study current teaching and learning practices should therefore be directed towards improving theoretical and practical skills of BD administration via MDI to assist in competent physiotherapists graduating.

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