

Adequacy of inhaler technique used by people with asthma or chronic obstructive pulmonary disease

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ABSTRACT

INTRODUCTION: Asthma and chronic obstructive pulmonary disease (COPD) are ongoing concerns to the health system. Poor inhaler technique results in less than optimal delivery of medicine to the lungs and consequent inadequate symptom control.

AIM: This study aimed to assess inhaler technique amongst people with asthma and/or COPD. The secondary aims were to investigate who provided education on inhaler technique and whether age, gender or ethnicity was associated with poor inhaler technique.

METHODS: People with asthma or COPD who presented to a community pharmacy with a prescription for a respiratory inhaler were invited to participate in the study. Participants completed a brief questionnaire and had their inhaler technique assessed against a standard checklist.

RESULTS: There were 103 participants from 26 pharmacies, 86 with asthma and 17 with COPD. Just over half (52.5%) of the assessments indicated good inhaler technique, with 68% of people using the Turbuhaler having good technique compared to 53% for the pressurised metered dose inhaler (pMDI) with spacer and 47% for the pMDI alone. The majority of people (76%) received their initial inhaler technique instruction from their doctor. Over half of participants did not recall having their inhaler technique rechecked.

DISCUSSION: After prescribing appropriate therapy, correct inhaler technique is a cornerstone of achieving adequate therapy. Rechecking inhaler technique is a gap in care that needs to be addressed from an interdisciplinary perspective.

KEYWORDS: Asthma; chronic obstructive pulmonary disease; dry powder inhalers; metered dose inhalers; spacer inhalers

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Introduction

The incidence of asthma in New Zealand is one of the highest incidence rates in the world, affecting approximately 16% of adults in the population.¹ The incidence is even greater for Maori (22%) and Pacific people (20%).² Hospitalisation rates for asthma have more than doubled in the last 30 years,³ with rates of 1 per 1000 for those older than 15 years.⁴ Similarly the incidence of Chronic Obstructive Pulmonary Disease (COPD) is increasing in New Zealand, affecting approximately 200 000 adults.¹

Direct delivery of the medication to the lungs (inhalation therapy) is a major component of the treatment of asthma and COPD. Inadequate inhaler technique in people with asthma or COPD is reported in up to 85% of people, depending on the study definition.^{5–8} Optimal inhaler technique allows maximal drug delivery to the lungs, improving the therapeutic benefit and leading to improved symptom control, such as reduced frequency of nocturnal symptoms, and cough.⁶ Poor inhaler technique results in inadequate drug delivery, and decreased symptom control.⁷ People with asthma and poor inhaler technique were

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shown to have poorer symptom control compared to those with good inhaler technique (31% versus 19%), with a subsequent increase in medical or emergency visits.⁸

As optimal drug delivery is essential in the management of respiratory disease, it is important to assess the patient's inhaler technique before initiating or altering a drug regimen.⁹ Use of inhalers can be influenced by a number of factors. Elderly people appear to have a poorer technique compared to younger people.⁷ Variation in inhaler technique among different ethnic groups has been shown, although the reasons for this are unclear.⁸ There are conflicting results as to whether gender influences adequacy of inhaler technique.^{7,10}

Devices such as a pressurised metered dose inhaler (pMDI) used with a spacer and the breath-activated dry-powder Turbuhaler have been shown to have higher rates of adequate technique than a pMDI,^{11,12} although a recent study has shown no significant difference in inhaler technique adequacy between a pMDI and dry-powder inhalers.¹³

The majority of patients are educated on correct inhaler technique by physicians or nurses and, to

a lesser extent, pharmacists.¹⁴ Inhaler technique is also dependent on repeated education, as inhaler technique may deteriorate after initial education.^{15,16} Confusion among health professionals over who should take responsibility for patient education may result in people not receiving follow-up education on the correct use of their inhalers, contributing to the high rates of poor technique reported.¹⁷

The aim of this study was to assess inhaler technique amongst people with asthma or COPD. The secondary aims were to investigate who provided education on inhaler technique and whether age, gender or ethnicity was associated with poor inhaler technique.

Methods

Community pharmacies on the North Shore, Auckland, were identified and invited to participate in the study. Based on data provided by the North Shore City Council, the North Shore population is demographically similar to the Auckland population with the exception of having a smaller proportion of Maori and Pacific people, and is similar to the national population with the exception of having a greater proportion of Asian people (Table 1).¹⁸

Table 1. Demographic characteristics of participants and comparison by ethnicity with North Shore, Auckland and New Zealand populations

Characteristic	Participants with asthma (n=86)	Participants with COPD (n=17)	Total participants (n=103)	North Shore population ¹⁸	Auckland population ¹⁸	New Zealand population ¹⁸
Age in years						
mean age (range)	39.4 (18–88)	66.1 (35–89)	43.8 (18–89)			
Gender						
Male, n (%)	35 (41)	6 (35)	41 (40)			
Female, n (%)	51 (59)	11 (65)	62 (60)			
Ethnicity* n (%)						
European	59 (69)	16 (94)	75 (73)	68%	57%	68%
Asian	12 (14)	1 (6)	13 (13)	19%	19%	9%
Maori/Pacific	5 (6)	0 (0)	5 (4)	9%	25%	22%
Other [†]	10 (11)	0 (0)	10 (10)	2%	2%	1%

COPD Chronic obstructive pulmonary disease

* For the North Shore, Auckland and New Zealand populations approximately 8% of people selected more than one ethnicity

† 10% of participants selected 'New Zealander' as their ethnicity and were coded 'Other'

People collecting a prescription for an inhaler for asthma or COPD who agreed to participate were asked to complete a questionnaire including information on who provided their education on inhaler technique. They were also asked to demonstrate their inhaler technique using placebo inhalers. Those who used more than one inhaler device were asked to demonstrate their technique for all their devices. The assessment was conducted in a private area within the pharmacy. All participants received a Pharmaceutical Society of New Zealand Self-Care card for asthma or COPD, with special instruction in any areas of their inhaler technique that was assessed as unsatisfactory. The pharmacist was also asked to provide follow-up and check inhaler technique at the next visit.

Study inclusion criteria were people older than 18 years old with asthma or COPD, who were using a pMDI, pMDI with spacer, Turbuhaler or Accuhaler (a dry-powder breath-activated device) and the type of inhaler device had not been changed in the past month. People with asthma or COPD diagnosed within the last three months, those who could not self-administer their medication, and those who had difficulty with English were excluded from the study.

Information from five pharmacies indicated that there were 10 to 15 prescriptions for an inhaler presented daily. Using 25 pharmacies with 10 to 15 patients per pharmacy was considered to provide an adequate number of participants.

The researchers were trained on the correct technique for every inhaler device available in New Zealand. This training was conducted by a nurse specialist from Asthma Auckland, a non-government organisation that supports people with asthma and COPD, and provides education programmes about asthma and COPD to community groups, schools and workplaces.

A standardised checklist was developed that covered the key points of correct inhaler technique for a pMDI, pMDI with spacer, Turbuhaler and Accuhaler (Table 2). This checklist was adapted from the Australian Respiratory Guidelines,¹⁹ pharmaceutical industry leaflets and training provided by Asthma Auckland. One point was assigned

WHAT GAP THIS FILLS

What we already know: Asthma and COPD is a leading cause of hospitalisation. Correct inhaler technique improves the control of these conditions and can reduce morbidity. Historically, poor inhaler technique has been reported.

What this study adds: Inhaler technique in this New Zealand community sample was poor for many individuals. There appears to be no clear professional ownership or responsibility for the role of educating and re-educating people on correct inhaler technique.

for each correct step demonstrated, resulting in a maximum score of eight. Three steps for each device were designated essential by the researchers. It was considered that even if the overall score was high, if one of these steps was incorrect, then inhaler technique would be poor. As the cap was removed prior to assessing inhaler technique to fit the disposable mouthpiece, this was not counted as one of the three essential steps. Good technique was defined as achieving a minimum score of five, with the three essential steps correct.

Confusion among health professionals over who should take responsibility for patient education may result in people not receiving follow-up education on the correct use of their inhalers, contributing to the high rates of poor technique reported.

The questionnaire (see the Appendix in the web version of this paper) and checklist were assessed for content and face validity with the assistance of a university staff member with longstanding asthma. Comments on the comprehensibility, format and practicality of the questionnaire were noted and incorporated into the questionnaire.

A generalised linear mixed model was used with 'good' or 'poor' as the binary outcome to determine whether there was any relationship with inhaler type, gender, age, duration of inhaler use, who first taught how to use it and whether or not technique had been rechecked. Location of the pharmacy, based on the NZDep2006 Index of Deprivation,²⁰ was used as a proxy for socioeconomic differences. To allow for the within

Table 2. Checklist for optimum inhaler technique

pMDI	pMDI + spacer	Turbuhaler	Accuhaler
1. Remove the cap from the inhaler	1.* Shake the inhaler well	1. Remove the cap from the inhaler	1.* Hold Accuhaler horizontally
2.* Shake the inhaler	2. Fit the inhaler into the opening at the end of the spacer	2.* Keep inhaler upright	2.* Push the lever away from the mouthpiece until you hear the 'click'
3. Hold inhaler upright	3. Place mouthpiece between lips and teeth to seal the mouthpiece	3.* Rotate grip anti-clockwise then back until a click is heard	3. Exhale as much as you can
4. Exhale to residual volume	4. Breathe out gently	4. Exhale to residual volume	4. Exhale away from the mouthpiece
5. Place mouthpiece between lips and teeth to seal the mouthpiece	5.* Press the inhaler once only	5. Exhale away from the mouthpiece	5. Place mouthpiece between lips and teeth to seal the mouthpiece
6.* Inhale slowly and simultaneously and activate the canister	6. Take 5–10 slow breaths in and out through the mouth	6. Place mouthpiece between teeth and lips	6.* Inhale forcefully and deeply
7.* Continue slow and deep inhalation	7.* Do not remove the spacer from the mouth between breaths	7.* Inhale forcefully and deeply	7. Remove Accuhaler from the mouth
8. Take inhaler out of mouth and hold breath for 5–10 seconds	8. Remove spacer from the mouth	8. Hold breath for 5–10 seconds	8. Hold breath for 5–10 seconds

pMDI Pressurised metered dose inhaler device

* Note that steps marked with an asterisk are considered essential

Source: This checklist was developed from guidance issued by the National Asthma Council Australia,¹⁹ pharmaceutical industry leaflets and training provided by Asthma Auckland.

participant correlation, findings from participants using more than one type of inhaler were analysed using a random effect model.

Ethics approval

Ethics approval for the study was obtained from the Northern Y Regional Ethics Committee, August 2009 (NTY 09/05/044).

Results

Twenty-six pharmacies, one more than required, were enrolled in the study, generating 103 participants. Eighty-six participants had asthma and 17 had COPD. Table 1 summarises the demographic characteristics of participants. The majority of participants were of European descent (73%), followed by Asian descent (13%). Only one person was Maori and only one person was of Pacific ethnicity. The people with COPD were older, with a mean age of 66.1 years compared to 39.4 years for those with asthma. Overall, 60% of participants were female.

A pMDI was used by 77% of people with asthma and 53% of people with COPD. A further 41% of people with COPD used a pMDI with a spacer, compared to 14% of people with asthma. A Turbuhaler was used more commonly by people with asthma (24%) compared to COPD (6%).

Twenty-one of the 103 participants used more than one inhaler type. Of these, 62% preferred the pMDI, 33% the Turbuhaler and 5% the pMDI plus spacer. Some of the reasons cited for preferring the pMDI included: ease of use; they could feel the medication working; they were more confident using it due to duration of use. Only one participant expressed a preference for a pMDI with spacer as they felt that they had better symptom control compared to with use of a pMDI alone. Another participant found it inconvenient to use a pMDI with spacer. Seven participants preferred Turbuhalers for one or more of the following reasons: convenience; the dose counter; considered more hygienic; felt it gave them better symptom control. Those participants who reported that they did not like Turbuhalers

indicated that they found them difficult to use when they were short of breath and that their symptoms were not relieved instantly.

Inhaler technique

Table 3 summarises the inhaler technique scores for the different inhaler types. Just over half (52.5%) of the assessments indicated good inhaler technique, defined as having at least five out of eight steps correct, including all three essential steps on the checklist for inhaler technique. People using the Turbuhaler were more likely to demonstrate good technique (68%) compared to the pMDI plus spacer (53%) and the pMDI (47%).

For all devices, step 1 was performed correctly 100% of the time, but this step was pre-empted by the researcher needing to remove the cap to add the disposable mouthpiece. Participants' performance against the checklist is shown for pMDI use (Figure 1), pMDI with spacer use (Figure 2) and for Turbuhaler use (Figure 3). A common error for all devices was failure to adequately exhale to residual volume prior to inhalation. This was performed poorly by 40% of participants for the pMDI and approximately 50% of participants for the pMDI plus spacer and the Turbuhaler.

For the pMDI, the other common error for 27% of participants was not inhaling slowly while simultaneously activating the inhaler, and not continuing a slow deep inhalation. When the pMDI was used with a spacer, 42% of participants failed to take 5 to 10 slow breaths from the spacer.

Poor inhaler technique was not significantly different across age groups for any of the devices. Similarly there was no significant difference in inhaler technique between males and females, with 60% of females having poor technique compared to 45% of males.

Small numbers meant that comparison by ethnicity was not possible. Although 56% of people of European descent had poor inhaler technique with the pMDI compared to only 36% of people of Asian descent, the study was underpowered to detect any significant difference between the groups.

Inhaler technique education

The majority of people received their initial instruction on inhaler technique from their doctor (76%), with a further 11% receiving initial instruction from a nurse, 9% from 'other' (parents, leaflets, internet) and 4% from their pharmacist. Over half (56%) of participants did not recall having their inhaler technique rechecked. Of those who did recall having their inhaler technique rechecked, this was done by a doctor (22%), nurse (18%), at a respiratory support group (3%) or by a pharmacist (1%).

Discussion

Inhaler technique

This study found that, in keeping with other studies,^{5,7,18} almost half of participants had poor inhaler technique. Participants using a pMDI

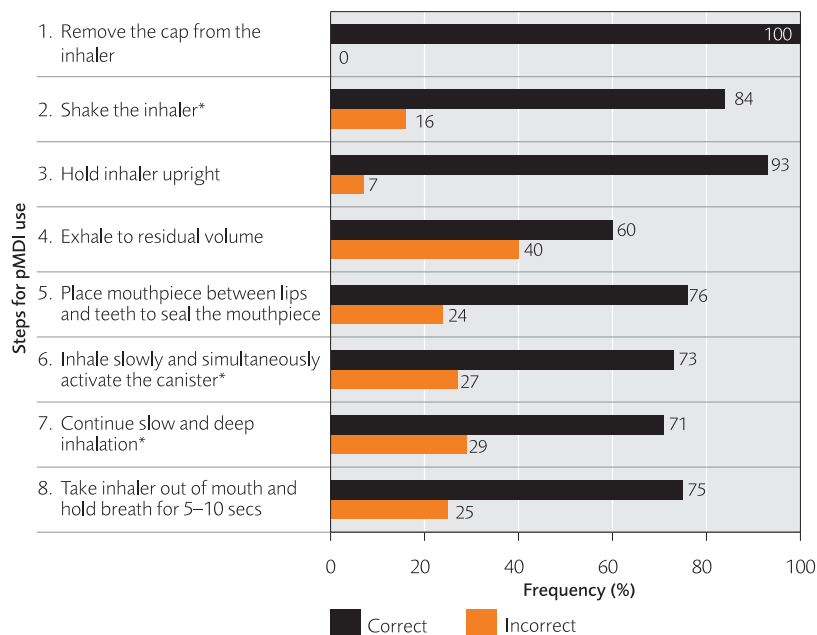
Table 3. Inhaler technique scores for different inhaler devices

Type of inhaler	Good technique* (n=62) n (%)	Poor technique (n=56) n (%)	Assessments of device use (n=118†) n (%)
pMDI	35 (47)	40 (53)	75 (100)
pMDI with spacer	10 (53)	9 (47)	19 (100)
Turbuhaler	15 (68)	7 (32)	22 (100)
Accuhaler	2 (100)	0 (0)	2 (100)

* Good technique was defined as having at least five out of eight steps correct, including all three essential steps on the checklist for inhaler technique (see Table 2). Poor technique was defined as not reaching the standard defined as good technique.

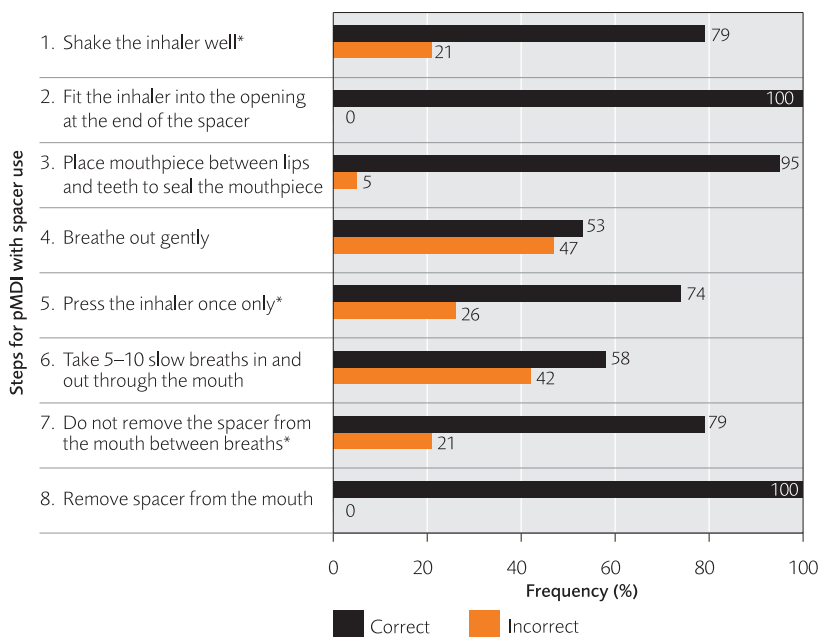
† Number is greater than the total number of participants (N=103) as some patients were using more than one type of inhaler device.

Figure 1. Participants' pMDI use assessed against the eight steps for correct use in the checklist



* Essential steps for optimal pMDI technique

Figure 2. Participants' pMDI with spacer use assessed against the eight steps for correct use in the checklist



* Essential steps for optimal pMDI with spacer technique

demonstrated poorer technique compared to those using a Turbuhaler or pMDI plus spacer.

The most common error by participants for all devices was failure to exhale fully prior to inhalation from the device, a recognised and ongoing error.^{15,21,22} For the Turbuhaler, nearly one-quarter of participants failed to inhale forcefully and deeply, predominantly those with COPD. This may reduce the efficacy of this inhaler device for people with COPD and a poor inspiratory rate, as noted in other studies.^{23,24} Fifty-eight percent of participants using a pMDI with spacer device were over 60 years of age, indicating that medical practitioners are appropriately selecting inhaler devices for this group.

This study's findings did not support other studies^{9,21,25} indicating that older people had poorer inhaler technique compared to people under 60 years; however, for age as well as for gender, reduced participant numbers meant that this study was underpowered to demonstrate a difference.

Education on inhaler technique

Providing education on correct inhaler technique is an integral component of asthma and COPD education plans and has been shown to improve symptoms, self-management and adherence to therapy.^{26,27} Initial education on inhaler technique was predominantly provided by doctors. The role of the doctor in patient education is important as the doctor-patient relationship is essential for successful management of asthma and COPD.²⁸ In keeping with studies completed in other countries, only a minority of patients received their initial education from nurses and pharmacists.^{29,30} Educational approaches, such as the use of multimedia and medication information leaflets, have been investigated.^{30,31} These approaches should be used to supplement the education provided by health care staff. Ideally, disease management would begin with the doctor providing the basis of disease care and management, with nurses and pharmacists providing supplementary education, reviewing and teaching improved inhaler device use.

Limitations

The number of prescriptions for inhalers dispensed from a pharmacy was assessed prior to the study. However, the person who collected the prescription was not always the patient, resulting in fewer participants interviewed than planned.

An unexpected finding was that some participants used multiple actuations without waiting or shaking in between doses. As the study planned to look at a 'one-off' technique demonstration, this inadequacy in technique was not reflected in the overall score.

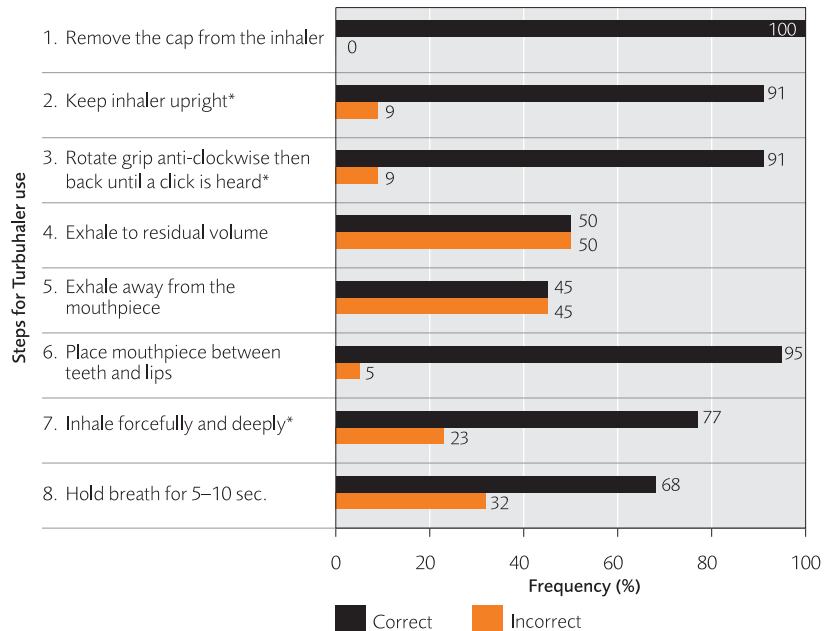
Conclusions

This study showed that a high proportion of the participants had poor inhaler technique, which is consistent with the findings of other studies. A pMDI was the most common device used and the device for which most participants demonstrated poor inhaler technique. The most common error for all devices was failure to exhale adequately before administering the dose. The study did not identify any specific factors that contribute to poor inhaler technique overall. An important finding was that less than half of the participants had received a reassessment of their inhaler technique. There is a need for reinforcement of inhaler education through an interdisciplinary approach.

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Figure 3. Participants' Turbuhaler use assessed against the eight steps for correct use in the checklist



* Essential steps for optimal Turbuhaler technique

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COMPETING INTERESTS

None declared.

APPENDIX 1: Participant interview questionnaire

Gender:	Male		Female		Age:	years	
Ethnicity:	NZ Maori	NZ European	Pacific Islander	Asian (Chinese or Indian)	European	Other	
Current medical condition:	Asthma	COPD	How would you rate the control of your asthma/COPD symptoms on a scale of 1–10? (1 being unproblematic/unrestrictive 10 being very severe/life threatening)				
For how many years have you had asthma/COPD?							
Which type of inhalers do you currently use?	Pressurised Metered Dose Inhaler (pMDI)		pMDI plus Spacer	Accuhaler	Turbuhaler		
What is the name of your inhaler/s?							
How long have you been using these inhalers?							
How often do you use your inhaler?							
Do you have a preference for a particular type of inhaler?	If yes, please specify and why?					No	
Who first told you how to use your inhalers?							
How often do you see the following health professionals regarding asthma/COPD?	Doctor		Pharmacist	Nurse	Respiratory Support Group		
Has anyone re-checked your inhaler technique since initial education?	If yes, when, how often and by whom?					No	
How often do you wake up at night due to asthma/COPD symptoms?	Often		Occasionally	Almost never	Never		
How often do you experience a cough due to asthma/COPD?	Often		Occasionally	Almost never	Never		
Have you ever taken prednisone tablets to treat a bad attack of asthma/COPD?	If yes, how often a year did you have to take it?					No	
Have you been admitted to hospital with asthma/COPD?	If yes, how often in the previous year were you admitted to hospital?					No	
Do you have a Home Peak Flow Meter?	If yes, how often do you self-monitor your Peak Flow?					No	
	Often		Occasionally	Almost never			