

## Pharmacist-Led Inhaler Training for Nurses

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Inhaled medications for acute episodes and chronic symptom management are common regimens for respiratory diseases. However, because of their various delivery mechanisms, inhalers can be challenging to use. Many inhaler designs have different methods of priming, dose preparation, inhalation instructions, and maintenance. This makes inhaler technique potentially challenging for patients. According to the 2020 Global Initiative for Chronic Lung Disease (GOLD) guidelines, greater than two-thirds of patients diagnosed with chronic obstructive pulmonary disease (COPD) make at least one mistake while using their inhalers.<sup>1</sup> Lavorini and colleagues also found that up to 94% of patients diagnosed with asthma and COPD do not use inhalers correctly, leading to decreased medication efficacy.<sup>2</sup> Furthermore, Vanoverschelde and colleagues determined there is a four-fold increase in exacerbation risk if inhalers are not used correctly.<sup>3</sup> In order to maximize the benefits of these medications and decrease the risk of future exacerbations, proper inhaler technique is crucial.

Patient education on inhaler use has demonstrable benefits in reducing exacerbation rate. According to a meta-analysis by Maricoto et al., a statistically significant decrease in exacerbation risk was noted in elderly patients after they received a patient education intervention (risk ratio = 0.71).<sup>4</sup> Nurse-driven education has been proven to increase patients' knowledge of and adherence to inhalers, and in-person training has been shown to be the most effective way of improving inhaler techniques compared to watching videos or reading pamphlets.<sup>5,6</sup> Unfortunately, not all health care professionals are familiar with proper inhaler technique for the various devices currently on the market. Self and colleagues evaluated nurses' use of a metered-dose inhaler plus spacer and found that only 66% of participants performed the steps correctly which increased to 88%

### Abstract

**Objective:** To evaluate inhaler technique and confidence level in registered nurses educating patients on inhaler use after a pharmacist-led training session.

**Methods:** Educational handouts for nurses were developed and reviewed for the 13 types of inhaler devices currently prescribed within the Marshfield Clinic Health System (MCHS). After assessing baseline inhaler technique and confidence via scoring rubric and questionnaire, respectively, for four of the most prescribed devices out of 13, a live, pharmacist-led inhaler training session with PowerPoint slides and demonstrations was offered to the nurses with the option to listen online concurrently. Inhaler technique and confidence level were re-assessed after the training session. The confidence level and average scores of techniques among participants were compared before and after training to determine whether the training session was beneficial.

**Results:** A total of six nurses participated in this project. The percentages of inhaler steps correctly performed prior to the training session ranged from 30%–50% at baseline and increased to over 90% for all four devices after training. Nurses who attended the session online concurrently due to scheduling conflicts had slightly lower post-training scores compared to nurses who attended in person. Confidence level ranged from “not confident” to “extremely confident” before training and from “very confident” to “extremely confident” after training.

**Conclusions:** A pharmacist-led training session focused on four common inhaler devices enhanced nurses' inhaler technique and increased their confidence level in using and training patients on these devices. Possible clinical implications include increased quality of care delivery to patients and subsequently decreased disease burden on patients with chronic respiratory conditions requiring inhaled medications.

correct after a pharmacist demonstration.<sup>7</sup> Similarly, assessment of health care professionals' inhaler technique revealed that only half of the administration steps for dry power inhalers were performed correctly.<sup>8</sup> Furthermore, health care professionals who attended training sessions on inhaler use had consistently better performance with these devices

compared to non-participants. These results demonstrate a need for inhaler technique education for practitioners as well as patients.

At Marshfield Clinic Health System (MCHS), transition-of-care registered nurses visit patients admitted for disease states associated with high readmission rates (e.g., COPD exacerbation) in person

**TABLE 1. Average Percentage of Steps Correctly Completed Pre- and Post-Training (N = 6)**

	<i>Metered-Dose Inhaler (MDI)</i>	<i>Diskus®</i>	<i>Handihaler®</i>	<i>Respimat®</i>
Total Number of Steps for Each Inhaler	8	7	9	7
<b>Steps Completed Correctly</b>				
Pre-training (%)	54.2	50	48.1	31
Post-training (%)	93.8	95.2	96.3	92.9
Post-training score for participants attending session in-person (n=4)	97	100	100	100
Post-training score for participants attending session online (n=2)	87.5	85.7	88.9	78.6

prior to discharge and via phone a few days after discharge. These nurses are the first line of contact for these patients after discharge and provide education to prevent 30-day readmissions. To enhance nurse education of patients with COPD, asthma, and other chronic respiratory conditions, the authors developed and implemented a pharmacist-led staff training session focused on inhaler techniques.

## Methods

### Design

This project was designed as a before-and-after in-person evaluation of inhaler techniques and confidence of nurses after a live, pharmacist-led training session. Outcomes were the percentages of inhaler steps correctly performed and the confidence level of nurses in using the devices and training patients to use the different devices. The project was deemed exempt from review by the Institutional Review Board.

### Development of Training Materials for Nurses

Educational handouts intended to aid in the training session for nurses were developed for the 13 devices currently used by MCHS. Information sources for the handouts included inhaler package inserts and patient education leaflets developed by MCHS respiratory therapists. Each handout included the device name, brand names, priming techniques, steps for inhalation technique, cleaning recommendations, storage requirements, device expiration, and reminder tips.

Assessment questions were also provided for each step of the inhalation process for ease of discussing technique over the phone with patients if needed. The handouts were reviewed by two co-investigators and given to the nurses during the training session.

### Development of Assessments

Out of the 13 inhalers mentioned above, the top four devices used at MCHS were selected for in-depth teaching and assessment. They were the metered-dose inhaler (MDI), Diskus®, Handihaler®, and Respimat®.

To evaluate nurse confidence level in using inhalers and training patients on device use, a 5-point Likert scale questionnaire, which ranges from 1 (“not confident”) to 5 (“extremely confident”), was created for each inhaler type. Because understanding the educational material does not necessarily reflect an individual’s ability to teach others the same material, the questionnaire was designed for self-assessment as well as for patient assessment.

To facilitate technique scoring, the administration steps from the educational handouts mentioned previously were taken directly to make a scoring rubric (Supplement 1).<sup>9</sup> If one step was performed completely correctly, 1 point was given. If anything was missed in a step, 0 points were given without the option of a partial point. The total score received for each inhaler type was then divided by the total number of steps to get the percentage of steps correctly performed.

To ensure scoring accuracy, a mock technique walk-through was conducted

with a pharmacist (who was independent from the project) prior to nurse assessment. During this mock assessment, the independent pharmacist demonstrated the inhaler techniques while both the lead investigator and co-investigator scored the demonstration and noted any omissions or points for clarification in the training materials and corresponding assessment. The pharmacists then compared their assessments and notes. Variability in scoring was minimized by identifying and addressing different scenarios that could occur and determining how these scenarios would be scored according to the rubric.

### Baseline Assessment

One week before the training session, baseline confidence level and inhaler technique for the four most common inhaler devices were assessed in person for all six nurse participants. The nurses were first asked to fill out the questionnaires. Then, the primary investigator evaluated inhaler technique for the four main types of inhaler devices prescribed by providers by watching the nurses use the demonstration inhalers in person and scoring those demonstrations against the scoring rubric. The co-investigator was also present for observation.

### Nurse Training Session

A live, pharmacist-led inhaler training session was offered to the nurses with the option to listen online at the same time. PowerPoint slides, handouts, and inhaler demonstrations were used throughout the training. The session started with a

**TABLE 2. Confidence Level of Nurses in Using Inhalers Pre- and Post-Training (N=6)**

<i>Pre-training Confidence Level Per Inhaler Type</i>				
	<i>Metered Dose Inhaler n (%)</i>	<i>Diskus® n (%)</i>	<i>Handihaler® n (%)</i>	<i>Respimat® n (%)</i>
Extremely confident	1 (16.7)	1 (16.7)	1 (16.7)	0 (0.0)
Very confident	3 (50.0)	4 (66.7)	3 (50.0)	2 (33.3)
Somewhat confident	1 (16.7)	0 (0.0)	1 (16.7)	1 (16.7)
Slightly confident	1 (16.7)	0 (0.0)	0 (0.0)	1 (16.7)
Not confident	0 (0.0)	1 (16.7)	1 (16.7)	2 (33.3)
<i>Post-training Confidence Level Per Inhaler Type</i>				
	<i>Metered Dose Inhaler n (%)</i>	<i>Diskus® n (%)</i>	<i>Handihaler® n (%)</i>	<i>Respimat® n (%)</i>
Extremely confident	4 (66.7)	4 (66.7)	4 (66.7)	2 (33.3)
Very confident	2 (33.3)	2 (33.3)	2 (33.3)	4 (66.7)
Somewhat confident	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Slightly confident	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Not confident	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

*Note: Percentages do not add up to 100% due to rounding error.*

brief overview of COPD disease state, pharmacotherapy categories, and device options. Following this review, an in-depth 15-minute presentation was given on the four devices, which included a comparison of the individual devices and demonstration of administration steps with placebo devices. All participants who attended in person were also given demonstration inhalers to follow along. The total training lasted approximately 40 minutes.

### **Post-Assessment**

Nurse confidence levels and inhaler technique were reassessed in person immediately after the training session for participants who attended in person. Participants who listened online were assessed a week after the training due to scheduling conflicts. Nurses who did not reach 100% competence on inhaler technique were re-educated on the steps missed right after the first attempt and immediately reassessed until 100% was achieved. The confidence levels and average score of technique from the first attempt were compared to the ones before training

to determine whether the training session was beneficial. The scores of subsequent technique reassessments were not compared nor reported.

### **Results**

Six transition-of-care nurses participated in the training session. Due to scheduling conflicts, two of the six participants attended the training session online without access to demonstration inhalers.

For each inhaler device, the average of the six nurses' scores was calculated for both the pre- and post-assessment. The average percentages of inhaler steps correctly performed among nurses prior to the training session ranged from 30% to 50% at baseline and increased to over 90% for all four devices after training (Table 1). Nurses who attended the session online had slightly lower post-training scores on average compared to nurses who attended in person. All four nurses who did not get 100% during the first post-training assessment were able to reach 100% on the second attempt after re-education. The most commonly missed steps for each device during the post-assessment were "sit

up straight or stand up" for MDI, "hold the device in a level, horizontal position" for Diskus®, "listening for the capsule to vibrate or rattle" for Handihaler®, and "point inhaler towards the back of your throat" for Respimat®.

The confidence level of using and teaching inhaler technique pre- versus post-training in nurses is shown in Tables 2 and 3. Prior to training, answers ranged from "not confident" to "extremely confident." After training, responses ranged from "very confident" to "extremely confident." Though confidence level improved for all inhaler classes post-training, nurses were not as confident using or educating patients on the Handihaler® and Respimat® inhalers versus the MDI and Diskus® inhalers.

### **Discussion**

Although it is known that technique is crucial in using inhalers, most studies to date have focused on evaluating patients' skills and describing how inhaler technique influences medication adherence and readmission rates.<sup>2-4</sup> There is currently limited literature describing health care professionals' inhaler techniques

and determining how this knowledge may impact patient care.<sup>7,8</sup> This study demonstrated that providing an in-person, pharmacist-led training session to transition-of-care nurses improved their inhaler technique and enhanced their confidence level in educating patients on the proper use of inhaler devices and medications. These results correspond to the findings of Self et al. and Bashedi et al. and support the provision of in-person inhaler training sessions for health care professionals who provide care to patients with respiratory conditions.<sup>7,8</sup>

Review of post-assessment scores indicated that the most missed steps for each inhaler were actions that do not require direct manipulation of the devices. Rather, these were steps involving positioning the inhaler or body for the MDI, Diskus®, and Respimat® devices or listening for sounds for the Handihaler® device. These steps could be easily missed by users if they are not verbally emphasized by the demonstrator. Re-educating health care professionals may remind them to highlight these steps to patients.

We speculate the slightly lower confidence level of nurses in using and training patients on the Handihaler® and Respimat® devices after training may be due to these being newer devices or having more complicated steps, or that using the device itself is not as self-explanatory as other inhaler devices. Some nurses commented that they had never seen a Respimat® device before. However, overall, the nurses' technique and confidence level increased for all devices after the training session. This finding reinforces the importance of educating health care professionals on inhaler technique, especially for newer devices.

Though the average of first attempt post-training scores was slightly lower for participants who attended the online session, improvements were seen in the percentage of steps completed successfully, regardless of training format. Due to small sample size, it is unclear whether this difference was caused by a lack of access to demonstration inhalers for the online attendees. Since there was a delay in the post-training assessment of online trainees, it is also possible the scores differed due to recall bias and skills attrition. Nevertheless,

**TABLE 3. Confidence Level of Nurses in Teaching Patients to Use Inhalers Pre- and Post-Training**

Pre-training				
	Metered-Dose Inhaler	Diskus®	Handihaler®	Respimat®
Extremely confident	1	1	1	0
Very confident	3	4	3	2
Somewhat confident	1	0	1	1
Slightly confident	1	0	0	1
Not confident	0	1	1	2
Post-training				
	Metered-Dose Inhaler	Diskus®	Handihaler®	Respimat®
Extremely confident	4	4	3	2
Very confident	2	2	3	4
Somewhat confident	0	0	0	0
Slightly confident	0	0	0	0
Not confident	0	0	0	0

there was no difference between the two groups in their confidence level in using and training patients on these devices.

Aside from differences in post-training assessments for in-person and online participants, a major limitation of this project is its small sample size. By providing this training to transition-of-care nurses only, our pre- and post-training dataset is limited to six nurses. This approach limits the generalizability of our findings and could lead to potential bias due to the Hawthorne effect. Further bias might have been introduced by the limited number of evaluators.

Due to time constraints, one co-investigator, who was present at the mock technique walk-through, also helped evaluate two nurses for the post-training assessments. Although this might cause slight variation in scoring, variability was minimized by discussing the rubric during the mock assessment walk-through and reviewing the results of the post-training assessments immediately after the assessment. Using a standardized scoring metric for pre- and post-training assessments ensured consistency among evaluators and assessments performed at different times. Future directions for this

project might include re-educating and reassessing the participants' technique and confidence level at least one year post-training to evaluate skill retention. Providing additional training may help reinforce the commonly missed steps in administration, introduce nurses to new devices on the market, and facilitate skill retention. Expanding the training session to include other health care professionals would further increase our sample size and permit adequately powered statistical comparisons of pre- and post-training datasets and identify differences in pre- and post-training performance between in-person and online participants to determine which setting maximizes knowledge acquisition.

## Conclusion

Pharmacist-led training sessions for nurses improves nurses' inhaler technique and enhances their knowledge and confidence level with using and educating patients about these devices. Improved nurse knowledge of inhaler use may in turn lead to improvements in patient education, inhaler technique, and medication adherence with the goal of reducing respiratory exacerbations and improving

patient quality of life.

Shih-Ting (Tina) Cheng has completed her PGY1 pharmacy residency. Andy Starzinski and Emma Stofflet are Clinical Pharmacists at Marshfield Clinic Health System in Marshfield, WI. Melissa Mikelson is the Director of Care Management for the Institute for Quality, Innovation, and Patient Safety at Marshfield Clinic Health System in Marshfield, WI. Sara Griesbach is the PGY1 Pharmacy Residency Program Director and Director of Clinical

**PR** This article has been peer-reviewed.  
The contribution in reviewing is greatly appreciated!

Pharmacy Services at Marshfield Clinic Health System in Marshfield, WI.

*Acknowledgements: The authors acknowledge Emily A. Andreae, PhD, for manuscript review. Part of the background and method sections were presented at ASHP Midyear poster session in Las Vegas on 12/11/2019.*

*The project was presented virtually at 2020 PSW Educational Conference/Wisconsin Pharmacy Residency Conference on 4/12/2020.*

*Disclosure: The author(s) declare no real or potential conflicts or financial interest in any product or service mentioned in the manuscript, including grants, equipment, medications, employment, gifts, and honoraria.*

*Shih-Ting Cheng had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.*

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## Supplement 1

### Inhaler Technique Scoring Rubric

Metered-Dose Inhaler (MDI)	Score (0 for a step performed incorrectly and 1 for a step performed correctly)
1. Remove the cap from the inhaler mouthpiece. (Steps 1 & 2 can be switched.)	
2. Shake the canister well before each use.	
3. Sit up straight or stand up.	
4. Hold the inhaler upright, and exhale normally.	
5. Place the mouthpiece between your lips with lips sealed.	
6. Begin to inhale slowly. While breathing in <b>slowly and deeply</b> through your mouth, discharge one puff from the inhaler. Continue to inhale slowly for 3 to 5 seconds.	
7. Hold your breath for 10 seconds.	
8. Exhale slowly, away from the inhaler.	

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