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ORIGINAL ARTICLE

# Knowledge of Inhaler Technique and performing Peak Expiratory Flow Rate among healthcare professionals

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## Background

Healthcare professionals should ensure that patients carry out an adequate inhaler technique. The aim of this audit was to assess the knowledge of healthcare professionals in performing a correct technique with two very commonly encountered devices, that is the metered dose inhaler (with spacer) and the turbohaler. Assessment of peak expiratory flow rate (PEFR) measurement technique was also done, since healthcare professionals should be able to monitor this parameter to aid detection of clinical improvement or deterioration.

## Methods

The healthcare professionals involved equal numbers (25 of each group) of nursing staff, foundation trainees and medical basic specialist trainees. Assessment was performed by two observers with the use of a checklist for each technique.

## Results

The turbohaler technique scored lower than the metered dose inhalers across all three groups, however there was no statistical significance when comparing the results of the three groups for the turbohaler technique. The highest scores were obtained in the medical specialist trainee group; results being statistically significant (p= <0.001) between the three groups with regards to metered dose inhalers and PEFR. The lowest scores were obtained in the nursing staff group.

## Discussion

Education regarding inhaler techniques and PEFR should be a priority. Lack of knowledge from healthcare professionals would reflect on patients and this would lead to deterioration of disease control. Measures such as having printed guidelines in the ward for ease of reference, information leaflets and placebo inhalers can help improve education. If available, designated specialised respiratory nurses can also help in education for both healthcare professionals and patients.

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An adequate inhaler technique is paramount in the management of respiratory conditions mainly obstructive airway disease for optimal symptom control and quality of life.[1] Inadequate techniques are known to result in reduced disease control.[2] and are also associated with recurrent presentations to the emergency department[3] This is unfortunately common in patients suffering from asthma and/or COPD, as evidenced by a cross-sectional study performed by Melani et al, demonstrating that patients with poor inhaler techniques have lack of disease control, an increased risk of hospitalization and recurrent prescription of oral corticosteroids and antimicrobials.[4]

Therefore it is important that healthcare professionals who are prescribing inhalers as well as those providing the treatment itself, especially those who encounter acutely unwell patients in general medical wards, have this essential knowledge. Locally the most common encountered inhaler devices in the general medical wards are metered dose inhalers (with a spacer) and turbohalers.

Peak Expiratory Flow Rate (PEFR) monitoring is useful to assess the severity of an exacerbation of asthma, as well as to guide clinicians in monitoring disease activity.[5] Therefore knowledge on the technique on how to perform this useful bedside tool is crucial among healthcare professional caring for such patients in whom PEFR is being monitored.

## AIMS

The aim of this audit was to assess knowledge on inhaler techniques with different inhaler devices as well as performing a PEFR among healthcare professionals who regularly encounter patients with respiratory conditions in acute medical wards. The secondary aim was to serve as an opportunity to educate these healthcare professionals who are not fully aware of how to use the different inhalers and perform PEFR monitoring.

## MATERIALS AND METHODS

The audit was performed at Mater Dei Hospital the only general hospital in Malta and involved randomly recruiting foundation doctors, basic specialist trainees working in general medicine and nursing staff working in medical wards where patients with acute respiratory conditions are admitted, who agreed to participate in this audit.

Two medical doctors, the investigators, served as observers to score and record data, by providing a placebo inhaler device and a PEFR device to the participants, who were instructed to demonstrate the techniques on themselves. All data was recorded in a private document in an intranet server accessible only to the investigators. All data was anonymized and deleted on completion of the audit.

The inhaler technique assessed utilized the commonly encountered devices in our hospital, namely a metered dose inhalers with a spacer and a turbohaler. Health care professionals were given scores on each technique used. Each step performed correctly was given one point, as follows (adapted from the 'NHS Liverpool Inhaler Technique Checklist'.[6]):

- Metered Dose Inhalers
  with Spacer (Maximum score of 8):

  1. Remove cap, hold inhaler upright and shake well.
  2. Insert inhaler upright into the hole in the spacer.
  3. Breathe out gently as far as is comfortable.
  4. Put mouthpiece on spacer between teeth without biting and close lips to form a good seal.
  5. Hold spacer level and press down firmly on the canister to release one puff: Breathe in slowly and deeply then hold breath for about 10 seconds or as long as comfortable. Breathe in and out normally for 4 breaths.
  6. Remove spacer from mouth and breathe out gently.
  7. Repeat steps above if 2nd dose is required. You need to shake the canister again and ideally wait 1 minute between inhalations.
  8. Remove inhaler from spacer, and replace cap. Check that patient knows how to clean spacer each month (if relevant).

- Turbohalers (Maximum score of 7):
    1. Unscrew and remove the mouthpiece cover.
    2. Keep turbohaler upright whilst twisting the coloured bottom grip in one direction, then the other direction as far as it will go until a click is heard.
    3. Breathe out gently as far as is comfortable.
    4. Place mouthpiece in mouth, between teeth without biting and close your lips to form a good seal.
    5. Breathe in quick and as deeply as possible.
    6. Hold your breath for 10 seconds and then remove Turbohaler from your mouth and breathe out slowly.
    7. Replace cover, if second dose is required repeat steps above.

- The PEFR method (Maximum Score of 5):
    1. The individual should be either sitting down or standing.
    2. The marker on the PEFR meter should be set to zero.
    3. Attach mouthpiece to PEFR meter.
    4. Breathe in as much as possible, then followed by a rapid forced exhalation into the mouthpiece.
    5. This should be repeated for a total of three times, and the best value should be recorded for monitoring the technique.

A student t-test and one-way ANOVA were used for comparison of means. Microsoft excel (2019 version) was used for the former and an online calculator was used to calculate the latter(7). A p-value of <0.05 was taken to be statistically significant.

## RESULTS

A total of 75 participants completed the assessment on the knowledge of how to perform a metered dose inhaler, a turbohaler and a PEFR These included equal numbers of nursing staff who work in general medical wards (n=25), foundation trainees (n=25) and basic specialist trainees in general medicine (n=25). Six participants in each of the foundation trainee group and basic specialist trainee group had experience in a respiratory medicine rotation. Table 1 and Figure 1 shows the results obtained among healthcare professionals for the inhaler and PEFR techniques.

When comparing inhaler technique of the two devices, it is evident that turbohaler technique is less known that the meter dose inhaler technique. However when comparing the scores between the three groups with regards to turbohaler technique, it does not yield statistical significance. When comparing the mean scores of the groups on metered dose inhalers, there is statistical significance (p= <0.001). The lowest PEFR method score was observed in the nursing staff group, with the highest score among the medical basic specialist trainees, the different scores between the three groups are also statistically significant (p= <0.001).

*Table 1* *Mean Scores achieved for inhaler and PEFR techniques.*

| | Nursing Staff (n=25) | Foundation Trainees (n=25) | Medical Basic Specialist Trainees (n=25) | p-values | Range |
|---|---|---|---|---|---|
| **Mean Age(±SD), years** | 32.2(±8.07) | 25.1(±1.57) | 28.6(±1.18) | | 22 - 54 |
| **Mean Metered Dose Inhaler Score(±SD) (Maximum of 8)** | 5.4(±1.36) | 6.4(±1.47) | 7.8(±0.44) | *< 0.001* | 3 - 8 |
| **Mean Turbohaler Score (±SD) (Maximum of 8)** | 3.2(±2.2) | 4.1(±1.71) | 4.3(±1.34) | .099 | 0 - 8 |
| **Mean PEFR Method Score (±SD) (Maximum of 5)** | 2.2(±1.74) | 4.1(±0.83) | 4.9(±0.28) | *< 0.001* | 0 - 5 |

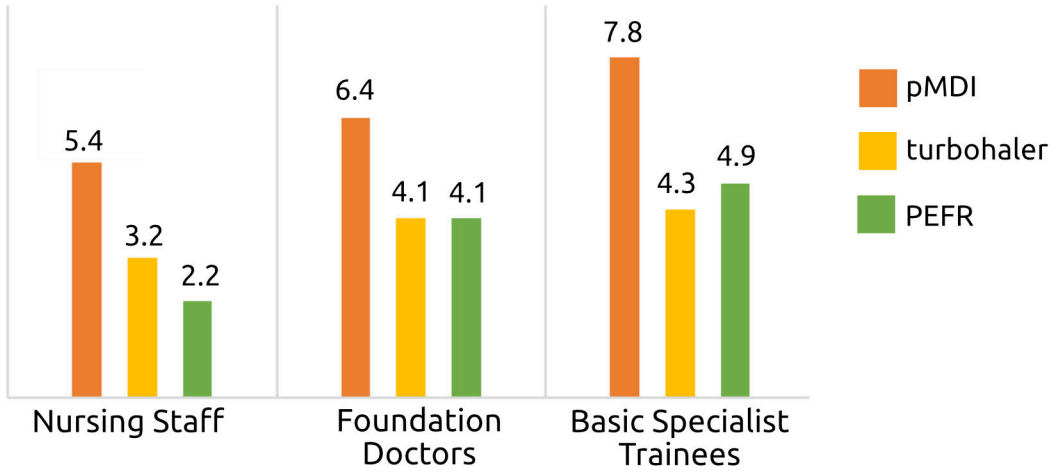


*Figure 1* *Mean scores on inhaler techniques and PEFR measurement techniques between groups*

## DISCUSSION

Patients with asthma are at an increased risk of exacerbations and morbidity if inhaler technique is inadequate. According to Global Initiative for Asthma (GINA) 2021, up to 80% of patients do not have adequate knowledge on proper technique[8] Poor techniques are commoner in older and poorly educated patients, however there is also an association between poor technique and lack of demonstration by healthcare professionals.[9] The latter is avoidable and lack of education prior to discharge may result in increased re-hospitalization rate and recurrent treatment with systemic corticosteroids and antibiotics.

Poor techniques are also unfortunately present in the COPD population, especially with those having a lower level of education.[10] In a cross-sectional study on patients with COPD by Pothirat et al, the poorest technique was with the use of pressurized metered dose inhalers.[10] The latter can also be attributed to a lack of adequate instruction from the prescriber; as evidenced in a multicentric study by Plaza and Sanchis\(1998\).[11] assessing metered dose inhaler technique of 428 physicians, only 28% demonstrated a correct method. When comparing the latter to our audit, the data is also consistent with physicians scoring better in techniques when compared to nursing staff.

A demonstration by a healthcare professional significantly increases the likelihood of an adequate technique[12], for example by utilising placebo inhalers and spacers. Re-education is also very important for both patients and healthcare professionals, since knowledge on techniques could wane over time. This could be aided by providing a pictorial or videographic demonstration of the inhaler techniques of the most common devices as well as the PEFR technique, depending on the patient requirements. Several online sources are available for the demonstrating the method of utilising the particular device, including the official GINA website[8]

Lack of professional healthcare knowledge on inhaler techniques is also a well-known phenomenon. It is estimated that between 39% to 67% of nursing staff and physicians are unable to demonstrate appropriate techniques.[13] The least known technique across all groups in our local cohort was turbohaler use, most likely since it is less commonly prescribed when compared to metered dose inhalers. When comparing knowledge among medical doctors, all techniques improved with increasing seniority, suggesting that training should be encouraged from the start of medical training.

Possible measures leading to enhanced education through healthcare professionals include having available printed guidelines in the ward on the proper techniques, as well as possibly having designated respiratory specialised nurses who would be available to educate both professionals and patients. Availability of placebo inhalers in a ward setting would also be helpful, since this method is known to highly effective.[14] A detailed information leaflet provided to patients could also prove to be beneficial, especially in an outpatient setting.

PEFR measurement is considered an important parameter to monitor in patients who are admitted with exacerbations of obstructive lung disease such as asthma[5], thus the importance of continued education in this commonly performed procedure should be stressed. In our audit, it was also demonstrated that PEFR technique is most lacking in the nursing staff group, and to a lesser extent among

medical doctors. International data is lacking regarding auditing of PEFR measurement, this should be encouraged in order to maintain standardization of an adequate technique.

## CONCLUSION

Our results show that knowledge with regards to inhaler technique and performing a PEFR is lacking among healthcare professionals, particularly among nursing staff. Since most healthcare professionals encounter patients using inhaler treatment on a regular basis, widespread education is necessary for optimal respiratory disease control and quality of life in our patients.


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## SUMMARY BOX

- Inhaler techniques are paramount for management of asthma and COPD, lack of education can lead to deterioration in disease control
- Lack of adequate techniques is well described in literature for both patients and healthcare professionals
- In this audit, it was demonstrated that a lack of knowledge is also present locally in both nursing staff and medical doctors with regards to adequate technique for inhalers and PEFR measurement
- Education should be implemented, with the use of printed guidelines or information leaflets, in order to improve patient care

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