



The Effect of Educational Intervention on Inhaler Technique of Patients in Asian Countries: A Systematic Review

Sara Shahid ^a, Laiba Nadeem ^{a++}, Maria Faisal Khan ^{a++},
Wasta Aslam Gill ^{a++}, Minahil Nasir ^{a++},
Syed Taimoor Tayyab ^{a++}, Mavra Siddique ^{a++},
Maryam Ayesha ^{a++} and Muhammad Zahid Iqbal ^{a*}

^a Department of Pharmacy Practice, Faculty of Pharmaceutical Sciences, Lahore University of Biological and Applied Sciences, Lahore, Pakistan.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2024/v36i67527

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/116855>

Systematic Review Article

Received: 28/02/2024

Accepted: 03/05/2024

Published: 09/05/2024

ABSTRACT

Background: Inhalation therapy is the main line of treatment for the management of various respiratory diseases due to localized delivery and rapid onset of action. Incorrect inhaler technique is very common and subsequently leads to poor disease management. Pharmacist can have a positive impact on patient's education about proper inhaler technique that can lead to a significant improvement of asthma and COPD management.

Objective: The objective of this study was to determine the effectiveness of pharmacist education program on inhaler technique of asthmatic and COPD patients in South Asian countries. The outcome regarding inhalation technique was reviewed and summarized.

⁺⁺ Research Student;

^{*}Corresponding author: E-mail: dmmziqbal@gmail.com;

Methodology: The outcome regarding inhalation technique was reviewed and summarized. For this systematic review, basic electronic academic databases (Scopus, Science Direct, ProQuest, Web of Science and PubMed) were used for the search, along with a manual search on Google Scholar. This systematic review was conducted by following the “Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)” guidelines. Moreover, utilizing the framework of the PECO-S (Population Exposure Comparison Outcome Study design), various observational studies were recruited for this review. The ZEE tool was utilized to minimize the risk of bias among extracted cross-sectional studies. Inclusion criteria included studies on inhaler using patients of all ages from South Asian countries along with the influence of educational intervention outcomes.

Results: Out of 2191 studies, 24 studies meeting the inclusion criteria were included in the current review. All of the included studies were about pharmacist intervention on inhaler technique in South Asian countries.

Conclusion: The systematic literature review summarizes the impact of educational intervention provided to inhaler using patients from South Asian countries. It was assessed that patient education and counselling produced improvement in inhalation technique of various devices especially metered dose inhalers. The primary outcome of most the studies was the improvement in inhaler technique assessment and enhanced quality of life. Therefore, inhaler technique education to patients should be made compulsory by the Health-care authorities to enhance compliance and effectiveness of inhalational therapy by avoiding irrational use of inhalers.

Keywords: Asthma; South Asia; ZEE tool; educational intervention; COPD; inhalers.

1. INTRODUCTION

Inhalation therapy is most often used for the disease management of the inflammatory respiratory conditions such as asthma and COPD involving drugs such as: Corticosteroids along with long and short acting beta anti-cholinergic agents [1]. Therapy for bronchial diseases mainly depends upon the inhalation therapy [2]. However, inhaling technique plays a major role in medication deposition and success of the treatment [3]. Several inhalation devices are available currently worldwide and many more efficient devices are being developed [4].

Asthma is a worldwide health issue that impacts the entire community [5]. It has an impact on 334 million individuals globally in 2014 [6]. With approximately 107 million patients, it is more prevalent in South-east Asia and the Western Pacific regions of Asia [7]. COPD is among the top 4 causes of death globally, additionally the prevalence is expected to increase [8]. COPD is widely prevalent in the Asia-Pacific territories, indicating a significant socioeconomic impact [9] [10]. Pakistan is a low socio economic country with low healthcare budget [11] and self-medication practices are comparatively common in Pakistan, and overall in South Asian countries [12]. A systematic analysis found that the pooled prevalence of COPD in South Asia is 11.1% having considerable regional variations while, surveys in North India (19.4%) and Bangladesh (13.5%) found greater prevalence rates [8].

Pressurized metered-dose inhalers (MDIs) are traditionally used for the administration of these drugs [13]. Nonetheless dry powder inhalers (DPIs) use has increased recently and are being used more often especially in the United States [4]. In the past 5–15% of the administered dose used to get deposited in the lungs by MDIs [14]. Though their efficiency is comparable current DPIs have several advantages over MDIs such as being breath-actuated which means it takes less coordination to use them than a traditional press-and-breathe MDI [4]. Moreover, DPIs don't contain chlorofluorocarbon propellants which have been linked to the depletion of atmospheric ozone [14].

Asian countries utilize inhalers for asthma and COPD therapy at much lower rates than Western countries as the people from Asian countries prefer oral therapies than inhalers [15]. There are several reasons behind this phenomenon, including economic, cultural and misconceptions [12]. Presently, the research on inhaler use has focused on patients with asthma who use MDI devices, while various studies have identified a number of risk factors such as low health literacy using multiple devices and inadequate instruction that contribute to high rates of inhaler misuse [16]. International guidelines for Asthma and COPD recommend evaluating and improving inhaler technique of patients for effective disease management [17].

Proper use of inhaler devices is essential for managing asthma and helping patients to achieve the best possible results, because for maximum drug delivery to the airways the right inhalation technique is essential [13].

Ensuring proper inhaler technique is crucial for effectively managing respiratory conditions like asthma and COPD [12]. It guarantees that the medication reaches the lungs, maximizing its therapeutic benefits while minimizing potential side effects [4]. Correct inhaler technique involves coordinating inhalation with actuation, ensuring the medication reaches the airways directly [17]. Incorrect technique can result in inadequate dosing, leading to uncontrolled symptoms and exacerbations [11]. Patient education and training on inhaler use are essential to enhance adherence to treatment regimens and improve disease management [8]. Mastering correct inhaler technique empowers patients to optimize medication efficacy, leading to better symptom control, improved quality of life, and reduced healthcare utilization [3].

It is discovered that high percentage of patients with asthma who are admitted to hospital emergency have poor MDI techniques which may indicate a link between subpar techniques and emergency visit [18]. Inappropriate technique decreases the efficiency of drug and worsen the symptoms [17]. Ninety percent of effective asthma management depends upon education and only ten percent on medication [19]. Inaccurate inhalation occurs when patients are not taught proper inhalation technique that results in enhanced risk of morbidity and death [13]. An essential part of managing asthma is patient education as it has been demonstrated that educational initiatives increase the accuracy of the inhalation technique [18]. Patients who receive asthma education are better equipped to control their condition and become more aware of potential complications [17]. Verbal and written instructions hands-on instruction digital presentation and virtual demonstration are some of the various ways that the MDI administration technique is taught [4].

Awareness and education on respiratory conditions like asthma self-care have become increasingly pivotal in recognition of the obligation to elevate asthma management, lowering morbidity and cutting healthcare expenses [20]. Organize programs of personalized self-management education with written action plans for modification [17].

Effective treatments that lower the risk of asthma are dependent on how well the condition is controlled, escalation of indirect expenses and costs as well as an improvement in life quality [19]. Inhalation technique has an advantage of localized action because the bronchodilator drugs reach the bronchioles in minimum time with minimum side effects and greater efficacy as compared to the oral route of administration [2].

A multitude of interventions have been developed to address challenges in achieving and maintaining correct inhaler usage [16]. However, correct instructions and regular testing of inhaling technique are still required to maximize therapy effectiveness [20]. Video, web-based platforms, and tele-counselling are some of the educational tools that can be employed for this purpose [17].

In the context of respiratory health, particularly in South Asia, where conditions like Asthma and chronic obstructive pulmonary disease (COPD) pose significant public health challenges, the impact of pharmacist interventions on inhaler technique has gained prominence [17]. This study explores the outcomes of pharmacist-led initiatives aimed at improving inhaler technique of patients from South Asia [13]. Therefore, the current systematic review has been designed with the aim to evaluate the effect of educational intervention on patient's inhaler technique, focusing on the outcomes of intervention in terms of inhaler technique.

2. METHODOLOGY

2.1 Study Design

The main source of guidance for this systematic review was Cochrane Handbook. Additionally, the study protocols followed the PRISMA flow statement recommendations [21]. To find appropriate research studies we used these keywords such as "intervention", "inhaler technique", "cross sectional study", "South Asia", "healthcare workers", "pharmacist".

The following electronic databases for our research studies were employed; "ScienceDirect, PubMed, Medline, web of science, Scopus and ProQuest and manual search on google scholar". Various cross sectional interventional studies enlisted. Only English language articles were included in the research. From a total of 2191 studies, only 24 studies fall into the inclusion criteria of this systematic review.

Table 1. ZEE tool for cross-sectional studies assessment (Appraisal tool)

	Study 1 [22]	Study 2 [20]	Study 3 [23]	Study 4 [24]	Study 5 [25]	Study 6 [13]	Study 7 [17]	Study 8 [26]	Study 9 [27]	Study 10 [28]	Study 11 [1]	Study 12 [20]	Study 13 [7]	Study 14 [29]	Study 15 [30]	Study 16 [31]	Study 17 [32]	Study 18 [33]	Study 19 [34]	Study 20 [35]	Study 21 [36]	Study 22 [37]	Study 23 [3]	Study 24 [38]
Are study objectives specific?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Is study design suitable for aims?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Is study sample size justified?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Is study population specified?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Is study data taken from the appropriate population that was under investigation?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Was the selection process likely to select subjects that were representative of the target population under investigation?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Were measures taken to address and categorize the non-responders?	✓	✓	✓	×	×	✓	✓	×	×	×	✓	✓	×	×	×	×	×	×	×	×	×	×	×	×
Were the risk factor and outcome variables appropriate to the aims of the study?	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	✓	×	✓	×	×	×	✓	×	×	×	×
Were the risk factor and outcome variables evaluated correctly by using instruments/measurements that had been trialed, piloted or published previously?	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	✓	×	✓	×	×	×	✓	×	×	×	×
statistical significance and/or precision estimates were significant or not? (e.g. p-values, confidence intervals)	✓	✓	×	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Were the methods (including statistical methods) sufficiently described to enable them to be repeated?	✓	✓	×	×	✓	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Was the basic data adequately described?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Does the response rate raise concerns about non-responders?	×	×	×	×	✓	×	×	×	×	✓	✓	×	×	×	×	×	×	×	×	×	×	×	×	×
If required, does information about non-responders described?	✓	✓	×	×	×	✓	×	×	×	✓	✓	×	×	×	×	×	×	×	×	×	×	×	×	×
Were results internally consistent?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Were the results presented for all the analyses described in the methods?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Are discussion & conclusions justified by results?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Were the limitations of the study discussed?	✓	✓	×	✓	✓	×	✓	✓	✓	×	×	×	✓	✓	✓	×	✓	✓	✓	✓	✓	✓	×	×
Is there any conflict of interest that might affect study findings?	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
Is ethical approval attained?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

2.2 Inclusion Criteria

The inclusion criteria are as following: The studies conducted in South Asia on adult patients with asthma and COPD, published in English Language. Moreover, the included study design was cross sectional interventional study.

2.3 Exclusion Criteria

The studies conducted in countries outside of South Asian were excluded. The studies other than cross sectional interventional study design, published in languages other than English language and comprising of the target population other than asthmatic and COPD conditions were excluded from the current systematic review.

2.4 Data Extraction

The data were extracted from 2191 studies containing the following features: author, country of study, study design, study duration, sample size, intervention provider, inhaler assessment techniques, intervention method, and outcome. The shortlisted studies were appraised through the appraisal tool- ZEE tool [21] for cross-sectional studies assessment, as mentioned in Table 1.

The ZEE tool is an appraisal tool for the critical evaluation of the cross-sectional studies and is an indicator of unbiased standards [21].

3. RESULTS

The electronic databases search yielded 2,191 initial research articles, of which 1410 were screened after deletion of duplicate records and denunciation of records. Of the 1410 studies screened, 1251 were excluded because they did not meet the inclusion criteria. 159 study reports were then shortlisted. Out of the 159 shortlisted study reports, 53 were identified as conference proceedings (abstracts) only when searched for full-text research articles. These were published as abstracts in the special edition/issue journals and were not accessible as full-text. After deletion of these records, 68 studies were retained for further review. 44 studies were then excluded as they did not relate to parental hesitations toward the vaccine. studies conducted in countries other than South Asia was then also excluded. At the end of the screening process, 24 studies met inclusion criteria, and were retained for this systematic review. Further details are provided in the PRISMA flow diagram Fig 1.

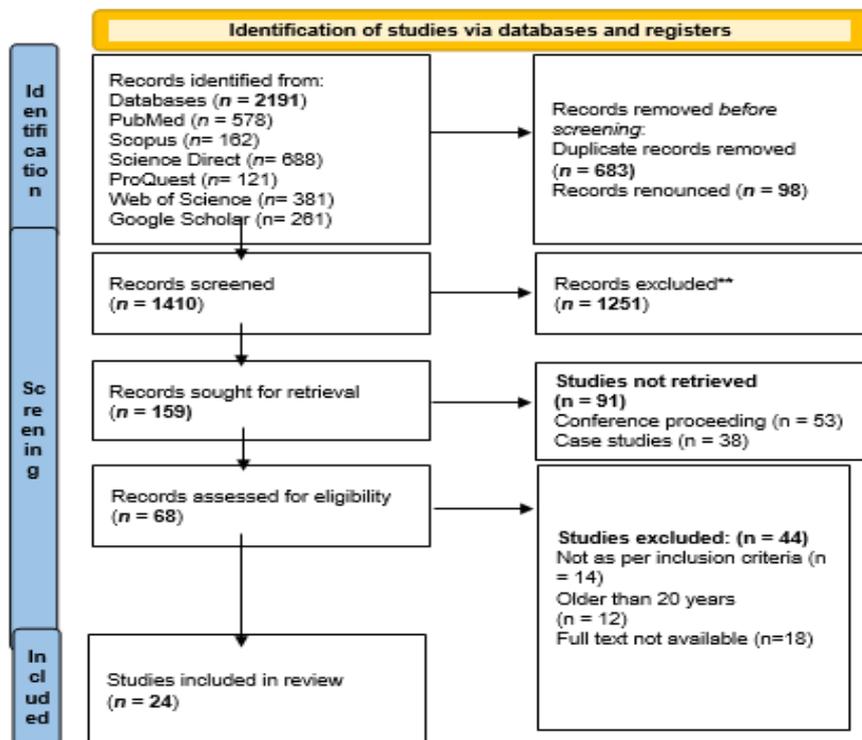


Fig. 1. PRISMA flow diagram for systematic review

The PRISMA 2020 statement: an updated guideline for reporting systematic reviews; For more information, visit: <http://www.prisma-statement.org/>

Table 2. Study characteristics of the included studies

Study	Year of Publication	Country of study	Study design	Study duration	Sample size (N)	Intervention provided by	Inhaler assessment techniques	Intervention method	Mode of intervention	Outcome
Study 1 [22]	2019	India	Prospective observational study	Mar 2018 - Sep 2018 (6 months)	223	Pharmacist	Checklist and questionnaire	Educational intervention	Patient counselling practical demonstration	After intervention, patient health outcomes improved
Study 2 [20]	2021	India	Cross sectional observational study	Oct 2019- Mar 2020 (6 months)	120	Pharmacist	Checklist	Educational intervention	Patient counselling physical demonstration	Improved efficacy and therapeutic outcome
Study 3 [23]	2016	Nepal	Descriptive study	May 2011- Jun 2011 (1 month)	50	Nurses	Checklist	Practical demonstration	9 steps were presented for correct use of MDI	Inhaler technique was improved
Study 4 [24]	2020	Nigeria	Pre-post interventional design	(6 months)	24	Pharmacist	Semi structured questionnaire	Educational and patient counselling	Seminar with didactic lecture and demonstration	Response rate was 81%, improved technique
Study 5 [25]	2008	Nepal	Prospective interventional study	3 studies with 1-week gap (1 year)	143	Healthcare professional	Questionnaire	Educational intervention	Information leaflets which describe 10 steps for correct use	Substantial improvement in inhaler technique
Study 6 [13]	2022	Pakistan	Prospective interventional study	2 phases with 1-month gap (6 months)	207	Pharmacist	Questionnaire	Educational intervention	Brochures	Substantially improvement
Study 7 [17]	2022	Pakistan	Interventional study	(6 months)	100	Pharmacist	Questionnaire	Educational intervention	Literature brochures	Improvement in inhaler technique
Study 8 [26]	2000	Oman	Interventional study	(1 year)	150	Healthcare providers	Questionnaire and checklist	Educational intervention	Patient counselling	Inhaler technique improvement
Study 9 [27]	2021	Jordan	Pre-post interventional study	Feb 2017- Jul 2017 (6 months)	103	Pharmacist	Checklist	Educational intervention	Patient counselling	Improved inhaler technique
Study 10 [28]	2022	Iraq	Prospective cohort study	(4 months)	51	Pharmacist	Checklist	Educational intervention	Pharmacist education program	Improved inhaler technique
Study 11 [1]	2020	Nigeria	Single blinded prospective, randomized, controlled trial	Mar 2016- Sep 2017 (1.5 years)	78	Pharmacist	Validated checklist	Educational intervention	Individual and caregiver assisted intervention	Improved inhaler technique
Study 12 [20]	2021	India	Prospective observational study	(6 months)	120	Healthcare professional	Standard questionnaire	Patient counseling	Survey	Improved adherence to inhaler
Study 13	2018	Saudi Arabia	Cross sectional observational study	Aug 2016- Apr 2017	180	Pharmacist	Checklist	Educational intervention	Training session	Established proper practice of inhaling

Study	Year of Publication	Country of study	Study design	Study duration	Sample size (N)	Intervention provided by	Inhaler assessment techniques	Intervention method	Mode of intervention	Outcome
[7]				(9 months)						devices to manage better quality of life
Study 14 [29]	2016	Nigeria	Cross sectional study	Sep 2016- Nov 2016 (2 months)	41	Pharmacist	Checklist	Educational intervention	Training programs	Maximization of treatment outcomes
Study 15 [30]	2016	India	Cross sectional study	(6 months)	107	Pharmacist	Checklist	Educational intervention	Practical demonstration	Inadequate inhaler technique
Study 16 [31]	2005	Iran	Observational descriptive cross-sectional study	(6 months)	173	Pharmacist	Verbal Questionnaire and checklist	Educational intervention	Practical demonstration with placebo inhalers	Improved inhaler technique
Study 17 [32]	2019	Nepal	Interventional study	1 month	72	Pharmacist	Questionnaire	Educational intervention	Leaflet and video aided material	Improved inhaler technique
Study 18 [33]	2005	Nepal	Prospective interventional study	(6 months)	93	Pharmacist	Close ended questionnaire	Pharmaceutical intervention	Demonstration with placebo inhalers	Increase in patient compliance
Study 19 [34]	2016	Nepal	Prospective interventional study	(6 months)	174	Pharmacist	Checklist	Educational intervention	Assessment and Teaching of inhaler technique with placebo inhalers	Improvement in inhaler technique of patients
Study 20 [35]	2023	Pakistan	Prospective Interventional study	(6 months)	60	Pharmacist	Checklist	Educational intervention	Teaching of inhaler technique verbally and by leaflets	Improved inhaler technique with enhance adherence
Study 21 [36]	2019	Jordan	Prospective Interventional study	(4 months)	200	Healthcare professional	Questionnaire	Interventional workshop	Leaflet and video aided material	Improved inhaler technique
Study 22 [37]	2018	Vietnam	Prospective Interventional study	(2 months)	300	Pharmacist	Checklist	Educational intervention	Assessment and Teaching of inhaler technique	Inhaler technique was improved
Study 23 [3]	2020	South Korea	Prospective Cohort study	(6 months)	261	Nurse	Checklist	Educational intervention	Teaching of inhaler technique face to face	Inhaler technique errors were improved
Study 24 [38]	2014	Iran	Randomized controlled trial	(1 month)	90	Healthcare professional	Checklist	Educational intervention	Teaching of inhaler technique verbally and by leaflets	Improved inhaler technique with enhance adherence

Among 24 studies, the majority of studies had clear aims and objectives. The studies published during the time capsule 2000- 2023 were included in the present systematic review.

Among the recruited studies from South Asian countries, majority of the studies i.e., of Nepal consisting of 5 studies, 4 from India, 3 studies from Pakistan, 3 from Nigeria, 1 from Oman, 1 from South Korea, 1 from Saudi Arabia, 1 from Vietnam, 1 from Iraq, 2 from Iran and 2 from Jordan. The study duration for most of the studies were around 6-months followed by 3 months, 1 month and 1 year. The details of the shortlisted study characteristics are mentioned in Table 2.

4. DISCUSSION

The current review focuses on the impact of educational intervention in improving the inhaler technique of respondents. A total of 24 interventional studies from the Asian countries with focus on inhaler technique assessment as the result of the educational intervention were shortlisted and included in the present review.

The results of the present systematic review indicates that the educational interventions focusing on inhaler technique are effective, at least in the short term as most of the studies conduct follow up assessment after 2-3 months post-intervention. All studies demonstrated improvements, with 95% indicating statistical significance in improvement of inhaler technique as the result of educational intervention. From the included studies, the mean intervention time was 30 minutes, with an average follow-up of five-six months. Moreover, the included studies have presented several key characteristics influencing the intervention's effectiveness. The primary predictors for success were low baseline performance, outpatient setting conditions and most importantly short follow-up time [38]. The setting was only significant when outcomes were assessed in terms of the correct number of inhalation steps based on inhaler technique checklist. Other factors predicting effectiveness were a higher number of steps evaluated and a higher age group [17]. The duration of the intervention, the interventional group category (group or individual), the intervention provider (pharmacist, nurse, or other healthcare professional) and the disease (asthma or COPD) were not associated with the intervention effectiveness. Notably, a trend was observed that

interventions were more effective in adults than in geriatrics; however, relatively few studies specifically targeted children. Majority of the included studies presented that the educational intervention was provided by Registered Pharmacist [17], whereas, a few studies reported training or workshop session provided by other healthcare professionals like nurses [23] [3]. Inhaler technique could be assessed through a few methods, either by questionnaire or through inhaler technique assessment checklist by assessing the inhaler technique of respondent practically. In the present systematic review, most of the studies reported that inhaler technique was assessed by investigator through checklist upon practical demonstration by the study subjects.

Most of the studies included in the present systematic review presented that educational intervention was individually provided to patients, however a few studies reported intervention provided in the group for as a workshop and seminar [7] [27]. These outcomes of the included studies states that educational intervention was effective in enhancing the inhaler technique of study subjects substantially. Moreover, majority studies reported that in addition to enhanced inhaler technique, the compliance and adherence of Asthma and COPD patients to the inhalation therapy was improved post-intervention [7][35]. However, it was proved individual patient counselling and personalized intervention provision through placebo inhaler technique demonstration is more effective approach to improve inhaler technique and enhance compliance with the therapy as compared to the group-based intervention in the form of seminars or workshops [27]. Multiple factors were directly associated with the improvement of inhaler technique. The patient's good inhaler technique at baseline was directly associated with positive outcomes in terms of inhaler technique assessment as the result of educational intervention.

The inaccuracy in inhaler technique is a major issue in the disease management. A cross sectional study conducted in Spain to evaluate the use of inhaler in asthma patients revealed that mostly all of the asthma patients had poor efficiency in inhaler technique at baseline. But after the educational intervention by pharmacist, it was substantially improved [39]. This signifies the effectiveness of the education intervention by pharmacist on inhaler technique in asthma patients [40].

The results of this study comply with the research study that was conducted in United States of America where only 6% of asthma patient presented improper inhaler technique. The majority of the patients were in poor knowledge category but after intervention there was a positive trend of migration to fair knowledge [41]. It is important for all the hospital pharmacist to have great knowledge about correct use of inhalers in respect to counsel the patients [1].

A cross sectional study conducted in China upon adult asthmatics presented low inhalation therapy knowledge and poor inhaler technique at baseline, But inhalation techniques, adherence and compliance with the prescribed therapy is enhanced substantially with proper patient education and counselling, imposing the importance of educational intervention [42]. Superior results are accomplished by providing verbal instructions along with video recordings [43].

In asthma patients step 5 which is "EXHALE SLOWLY" was the worst step in demonstration i.e 5.9%, 2 studies conducted in Iran showed that step 7 was the most common occurred error in patients [44] [31]. This study showed that most of the patients skipped step 9 but after educational intervention by the pharmacist it was improved to about 60.4% [44]. This explains the importance of inhaler technique education.

Pharmacist who had experience of personally using and counselling the asthmatics had high scores of knowledges about MDI [13]. Experience of years by working in hospitals greatly influenced the counselling of asthmatics by pharmacist [1].

Counselling by the pharmacist about the correct use of inhalers greatly improved the ability of the asthmatic patients to correctly use the inhaler which resulted in effectiveness of the treatment [45]. Therefore, improved inhaler technique in asthma patients resulted in better and improved control of asthma [3].

5. CONCLUSION

The present systematic review provides the summarized results of 24 research studies from the region of Asia, publish in the time duration 2000-2023. Inhaler technique at baseline was poor according to majority of the studies. However, educational interventions on inhaler

technique in asthma and COPD patients are effective in the short term. Key predictors for success are the patient's initial technique and the time elapsed since intervention. Periodic intervention reinforcement and longer follow-up studies, including clinically relevant endpoints and cost-effectiveness, are recommended.

6. LIMITATIONS AND RECOMMENDATIONS

The present review comprises of cross-sectional studies upon interventional methods on inhaler technique of patients from the South-Asian countries. A meta-analysis of the studies from all over the world should be conducted to grab the worldwide impact of the educational intervention.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Amorha K, Okonta JM, Ukwé CV, Prevalence CS. Impact of pharmacist-led educational interventions in asthma techniques. *African J. Pharmaceutol.* 2020;12(3):266–276.
2. Represas-Represas C, et al. Evaluation of suboptimal peak inspiratory flow in patients with stable COPD. *J. Clin. Med.* 2020;9(12):1–10. DOI: 10.3390/jcm9123949
3. Ahn JH, et al. The effects of repeated inhaler device handling education in COPD patients: A prospective cohort study. *Sci. Rep.* 2020;10(1):1–9. DOI: 10.1038/s41598-020-76961-y
4. Steiropoulos P, et al. Effectiveness and quality of life in asthmatic patients treated with budesonide/formoterol via Elpenhaler® device in primary care. The 'SKIRON' real world study. 2022;60(6):1104–1114. Available: <https://doi.org/10.1080/02770903.2022.2132957>

- DOI: 10.1080/02770903.2022.2132957
5. Gemicioglu B, Gungordu N, Can G, Alp Yıldırım FI, Uydeş Doğan BS. Evaluation of real-life data on the use of inhaler devices, including satisfaction and adherence to treatment, by community pharmacists in partnership with pulmonary disease specialists. 2022;60(7):1326–1335.
Available: <https://doi.org/10.1080/02770903.2022.2144355>
DOI: 10.1080/02770903.2022.2144355
 6. Burney P, Jarvis D, Perez- Padilla R. The global burden of chronic respiratory disease in adults. *Int. J. Tuberc. Lung Dis.* 2015;19(1):10–20.
DOI: 10.5588/ijtld.14.0446
 7. Alghamdi FA, Alsufyani MO, Althobaiti AA. Evaluation of inhaler use techniques among asthmatic patients in king faisal medical complex, taif, saudi arabia. *Egypt. J. Hosp. Med.* 2018;71(1):2387–2393.
DOI: 10.12816/0045317
 8. Respiratory E, Annual S. European Respiratory Society Annual Congress 2010. *Analysis.* 2010;3:10–11.
 9. Shahid S, et al. Confounders effecting quality of life of copd patients in european union: A systematic review. *J. Pharm. Res. Int.* 2024;36(2):55–75.
DOI: 10.9734/jpri/2024/v36i27501
 10. Shahid S, et al. A systematic review of prescription patterns and cost of treatment in Asthma management in Asian countries. 2024;3328.
 11. Iqbal MZ, et al. Impact of sociodemographic determinants on control in hypertension patients: A community pharmacy-based cross-sectional study. 2024;3301:1–9.
 12. Shahid S, et al. Systematic review of the self- medication practice among medical students across South Asian countries. 2024;3314:1–19.
 13. Shahid S, et al. The Impact of Theoretical and Practical Guidance Regarding Metered Dose Inhaler Technique on Asthma Patients. 2022;14(3):327–332.
DOI: 10.5530/jyp.2022.14.64
 14. Ali HD, Worku GS, Alemayehu AA, Gebrehiwot WH. Immunology Competence in metered dose inhaler technique among dispensers in Mekelle. 2014;1–5.
 15. Shahid S, Jaan G, Nadeem A, Fatima K, Sajjad A, Javed F. Effect of educational intervention on quality of life of asthma patients: A systematic review. 2024;3300(2017):1–17.
 16. Shahid S, et al. Knowledge and attitude of self-medication among healthcare and non-healthcare students of lahore, pakistanz. *J. Pharm. Res.* 2023;7(6):9–13.
DOI: 10.22270/ujpr.v7i6.863
 17. Shahid S, et al. IntJPharmInvestigation-12-3-380 The Impact of an Educational Intervention on the Skill of Community Pharmacists in the Use of a Pressurized Metered-dose Inhaler: A Covert Simulated Patient Approach in Pakistan; 2022.
DOI: 10.5530/ijpi.2022.3.64
 18. Shahid S. The effect of pharmacist involvement upon the satisfaction with inhalers (fsi-10) among asthma patients. *J. Young Pharm.* 2024;16(1):115–123.
DOI: 10.5530/jyp.2024.16.15
 19. Dawes MG, Kaczorowski J, Swanson G, Hickey J, Karwalajtys T. The effect of a patient education booklet and BP 'tracker' on knowledge about hypertension. A randomized controlled trial. *Fam. Pract.* 2010;27(5):472–478.
DOI: 10.1093/fampra/cm048
 20. Thakkar K, Patel R, Abraham R, Shah A, Rajput H, Chandrakar V. A study on effectiveness and outcomes of educational inhaler technique counselling in respiratory department by clinical pharmacist. *Indian J. Pharm. Pract.* 2021;14(4):251–258.
DOI: 10.5530/ijopp.14.4.52
 21. Ayesha M, Zamir M, Fazal M. Systematic review of the impact of collaborative care on the progression of disease complications in the management of Hypertension in Asia. 2024;3325:1–21.
 22. Vidhya PV, Jeena S, Sambathkumar R, Venkateswaramurthy N. Assessment and Educational Interventions in Inhalation Technique among Asthma and Copd Patients at a Tertiary Care Hospital In Erode (Tamilnadu- India). *Int. J. Life Sci. Pharma Res.* 2019;9(3).
DOI: 10.22376/ijpbs/lpr.2019.9.3.p61-69
 23. Rajbanshi L, KC S. Onurses' competency on use of metered dose inhaler. *Rajbanshi L S KC* 21. 2016;6(34):33 37.
 24. Aje AA, Aina OA. An intervention study of pharmacists' knowledge and patient counseling on metered dose inhalers and nebulizers. *African J. Biomed. Res.* 2020;23(3):313–319.
 25. Pr S. Correct Use of a Metered Dose Inhaler: A Prospective. 2008;2(2):720–726.
 26. Baddar SA, et al. Metered-dose inhaler

- technique among healthcare providers practising in Oman. Sultan Qaboos Univ. Med. J. 2000;3(1):39–43.
27. Altawalbeh SM, Hijazi B, Kufoof L, Basheti IA. Health expenditures of asthma-COPD overlap in Northern Jordan. Plos One. 2021;16(9):1–12.
DOI: 10.1371/journal.pone.0257566
 28. Okab AK. 1, 2 . 2022;62(07):1737–1755.
 29. Nduka S, Anetoh M, Amorha K, Henry O, Okonta M. Use of simulated patient approach to assess the community pharmacists' knowledge of appropriate use of metered dose inhaler. J. Basic Clin. Pharm. 2016;7(4):116.
DOI: 10.4103/0976-0105.189435
 30. Das A, Uppe A, Sinha K, Jayalakshmi T, Nair G, Nagpal A. The adequacy of inhaler technique in patients with chronic obstructive pulmonary disease and asthma attending a tertiary care hospital in Navi Mumbai. Indian J. Allergy, Asthma Immunol. 2016;30(2):95.
DOI: 10.4103/0972-6691.195253
 31. Nadi E, Zeraati F. Evaluation of the metered-dose inhaler technique among healthcare providers. Acta Med. Iran. 2005;43(4):268–272.
 32. Yadav A, Thapa P. Pharmacist led intervention on inhalation technique among asthmatic patients for improving quality of life in a private hospital of Nepal. Pulm. Med. 2019;2019.
DOI: 10.1155/2019/8217901
 33. Ansari M, Rao BS, Koju R, Shakya R. Impact of Pharmaceutical Intervention on Inhalation Technique. Kathmandu Univ. J. Sci. Eng. Technol. 2005(1):1–10.
 34. Poudel RS, Piryani RM, Shrestha S, Prajapati A. Benefit of hospital pharmacy intervention on the current status of dry powder inhaler technique in patients with asthma and COPD: A study from the Central Development Region, Nepal. Integr. Pharm. Res. Pract. 2016;6:7–13.
DOI: 10.2147/iprp.s119202
 35. Gul S, et al. Can pharmacists' counseling improve the use of inhalers and quality of life? a prospective 'pre' and 'post' education analysis in mardan, pakistan. J. Asthma Allergy. 2023;16:679–687.
DOI: 10.2147/JAA.S405943
 36. Basheti IA, Qunaibi EA, Hamadi SA, Reddel HK. Inhaler technique training and health-care professionals: Effective long-term solution for a current problem. Respir. Care. 2014;59(11):1716–1725.
DOI: 10.4187/respcare.02671
 37. Nguyen TS, et al. Effectiveness of a short training program for community pharmacists to improve knowledge and practice of asthma counselling – A simulated patient study. Respir. Med. 2018;144:50–60.
DOI: 10.1016/j.rmed.2018.10.003
 38. Rahmati H, Ansarfard F, Ghodsbin F, Ghayumi MA, Sayadi M. The Effect of Training Inhalation Technique with or without Spacer on Maximum Expiratory Flow Rate and Inhaler Usage Skills in Asthmatic Patients: A Randomized Controlled Trial. Int. J. community based Nurs. Midwifery. 2014;2(4):211–9.
Available: <http://www.ncbi.nlm.nih.gov/pubmed/25349864> <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC4201214>
 39. Pereyra FG, et al. Impact of asthmatic patient satisfaction with the inhaler upon adherence, disease control and quality of life. Results of the ASCONA study. Eur. Respir. J. 2017;50(61):PA528.
DOI: 10.1183/13930003.CONGRESS-2017.PA528
 40. Muchão FP, et al. Metered-dose inhaler for asthma patients: Knowledge and effects of a theoretical and practical guidance for pediatricians. Einstein (São Paulo). 2011;9(3):337–342.
DOI: 10.1590/s1679-45082011ao2115
 41. Thind A, Liu Y, Maly RC. Patient satisfaction with breast cancer follow-up care provided by family physicians. J. Am. Board Fam. Med. 2011;24(6):710–716.
DOI: 10.3122/jabfm.2011.06.100288
 42. Huang K, et al. Prevalence, risk factors, and management of asthma in China: A national cross-sectional study. Lancet. 2019;394(10196):407–418.
DOI: 10.1016/S0140-6736(19)31147-X
 43. Axtell S, Haines S, Fairclough J. Effectiveness of various methods of teaching proper inhaler technique: The importance of pharmacist counseling. J. Pharm. Pract. 2017;30(2):195–201.
DOI: 10.1177/0897190016628961
 44. Al-jahdali H, Ahmed A, Al-harbi A, Khan M, Baharoon S, Bin Salih S. Immunology Improper inhaler technique is associated with poor asthma control and frequent emergency department visits. 2013;1–7.

45. Exarchos KP, Rovina N, Krommidas G, Latsios D, Gogali A, Kostikas K. Adherence and quality of life assessment in patients with asthma treatment with budesonide/formoterol via the Elpenhaler device: The COMPLETE study. BMC Pulm. Med. 2022;22(1). DOI: 10.1186/S12890-022-02049-0

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/116855>