# The effect of educational intervention on inhaler technique of patients in Asian countries- A systematic review


**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 this 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.

**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 use of metered dose inhalers. The primary outcome of most the studies was the improvement in inhaler technique assessment and enhanced quality of life.

**Keywords:** Asthma, South Asia, ZEE tool, educational intervention, Asthma, COPD, Inhalers.

## 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 continues to rely majorly on the inhaled route [2]. However, inhaling technique plays a major role in medication deposition and the success of treatment [3]. Several inhaling devices are already available, and more are being developed with the goal of making the required handling easy and thus enhancing treatment safety [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]. 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 increasing their 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 introduction explores the outcomes of pharmacist-led initiatives aimed at improving inhaler technique in South Asia, delving into the context of respiratory health in the region and the transformative potential of such interventions [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.

## METHODOLOGY:

### Study Design:

The main source of guidance for this systematic review was Cochrane Handbook. Additionally, the study protocols followed the PRISMA flow statement recommendations. 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

### 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.

**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.

**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.

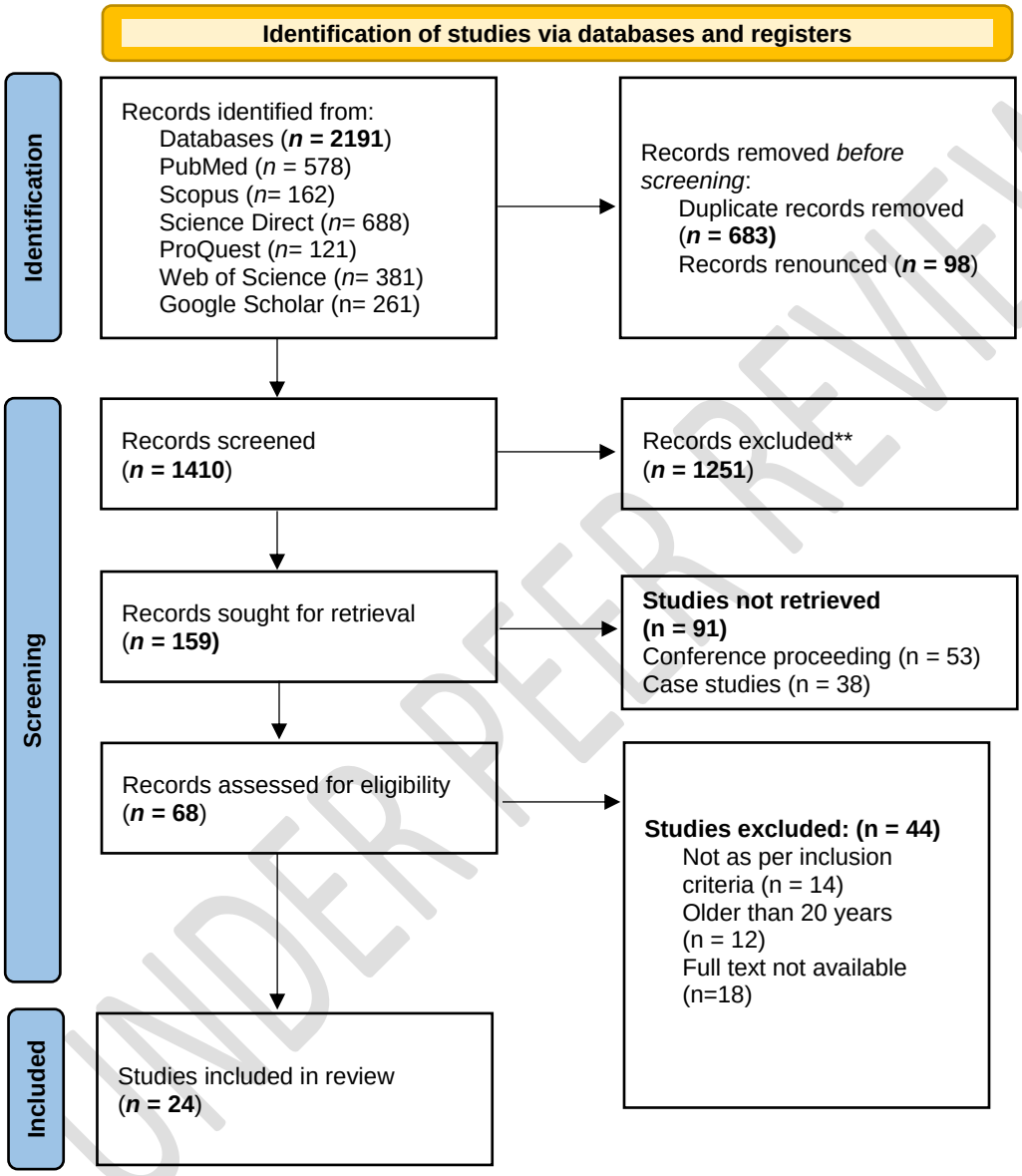
## RESULTS:

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- Figure 1.

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.

**Figure-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 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) | ✓ | ✓ | × | ✓ | ✓ | × | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

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| 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? | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**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** [26] | 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, | Mar 2016- Sep 2017 (1.5 years) | 78 | Pharmacist | Validated checklist | Educational intervention | Individual and caregiver assisted intervention | Improved inhaler technique |

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | controlled trial | | | | | | | |
| **Study 12** [20] | 2021 | India | Prospective observational study | (6 months) | 120 | Healthcare professional | Standard questionnaire | Patient counseling | Survey | Improved adherence to inhaler |
| **Study 13** [7] | 2018 | Saudi Arabia | Cross sectional observational study | Aug 2016-Apr 2017 (9 months) | 180 | Pharmacist | Checklist | Educational intervention | Training session | Established proper practice of inhaling 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 |

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|---|---|---|---|---|---|---|---|---|---|---|
| **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 |

**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].

**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.

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