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# Effect of educational intervention on quality of life of asthma patients: A systematic review

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## ABSTRACT

**Background:** Asthma is a chronic inflammatory disorder that causes shortness of breath, wheezing and chest tightness. It affected 262 million people globally in 2019 and resulted in 455,000 deaths. In Europe, only 6% of the population was affected. Various treatments, including SABA (Short-Acting Beta Agonists) for adult asthma patients and inhaled corticosteroids for maintenance are used to manage and prevent the worsening of asthma. **Methodology:** This review examines the impact of educational interventions on the quality of life of asthma patients in Europe. It uses electronic databases such as Science Direct, PubMed, ProQuest and Google Scholar for manual searching and follows preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. From the pool of 22269 studies, 30 studies met inclusion criteria. These studies specifically focused on assessing the quality of life among asthma patients. **Results:** The studies show that asthma patients' quality of life significantly improved after intervention, with pharmacist led interventional programs and physician guidelines played a significant role. Stress management and smoking cessation are essential for managing asthma symptoms, but anxiety and depression are major co-founders. **Conclusion:** The review reveals that educational interventions significantly enhance the quality of life for asthma patients, providing valuable insights for healthcare providers in both pharmacological and non-pharmacological asthma management.

**Keywords:** Asthma, Intervention, Quality of Life, European Countries

## 1. INTRODUCTION

In the past ten years, asthma has been a heterogeneous illness with numerous different phenotypes (Ilmarinen et al., 2019). Asthma is classified by the World Health Organization (WHO) as a chronic inflammatory respiratory disease that is characterized by repeated bouts of dyspnea, wheezing, coughing, and tightness in the chest Becker and Abrams, (2017) GINA (Global Initiative for Asthma)

defines it as heterogenous chronic respiratory disorder described by varying symptoms of airflow obstruction, bronchial hyperresponsiveness, and Inflammation (Bousquet et al., 2007). Numerous individuals are still not adequately controlled and have not yet benefited from the advancements in asthma care, which severely restricts their quality of life and increases their risk of morbidity and mortality from asthma-related conditions (Kroegel, 2009).

Asthma is a common long-term respiratory disease affecting more than 300 million people worldwide, usually first presenting in childhood or teenage years. Asthma not only places a significant strain on individuals, families, and society in terms of caregiving obligations, but it also has significant economic ramifications (Yang et al., 2023). Approximately 26 million people in the United States have asthma which has been diagnosed by a doctor. An estimated USD 81.9 billion was lost to the US economy due to asthma in just 2013 alone (Yaghoubi et al., 2019). A US survey found that 3.6% of all patients with "mild" asthma had been admitted to the hospital due to flare-ups, while 16.1% and 28.4% of patients with intermittent and mild persistent asthma, respectively, had needed emergency care in the previous years. Moreover, it is estimated that 5–10% of people with asthma suffer from severe asthma, yet reports of a wide prevalence range (1.8–38%) exist.

Hungary's asthma prevalence was determined to be 7.6%, which is comparable to the average for Europe (Tomisa et al., 2019). The frequency of bronchial asthma in the general population in Russia is 5-8%, with 20% of individuals experiencing severe symptoms, according to the European Community of Pulmonologists. Asthma of the bronchi causes death, a reduction in quality of life, and lifelong impairment (Nalina and Chandra, 2015). In Brazil, it impacts 19.0% of teenagers and 24.3% of school-age children (Matsunaga et al., 2015). Asthma symptoms often manifest in early childhood. However, it's important to note that only over half of preschool-aged children who frequently experience viral infections go on to develop typical asthma later in life. Young individuals who wheeze regularly or chronically are more likely to exhibit signs of airway remodeling, inflammation, poor lung function and symptoms that persist into adulthood (Asher et al., 2020).

Asthma tends to progress through recurrent episodes. While pharmacological treatment remains essential, a multimodal approach that includes non-pharmacological techniques is crucial for better asthma management, even when optimal medications are administered. Consequently, many asthma sufferers now explore alternative and integrative methods such as breathing exercises, yoga, herbal remedies, acupuncture and homeopathy to alleviate their symptoms (Bousquet et al., 2010). The quality of life (QOL) of the population is one of the factors used to assess how well medical treatment is working for the public. This criterion has gained popularity in recent years (Nalina and Chandra, 2015). The concept of quality of life refers to how people view their place in life in respect to their goals, aspirations, standards, and worries as well as the culture and value system in which they live.

A person's quality of life might vary depending on their surroundings, their past experiences, how they react to specific illnesses, and other factors (Plaza et al., 2015). Accordingly, it becomes crucial to assess the quality of life of patients suffering from chronic illnesses like asthma, as these conditions can lower quality of life in a variety of biopsychosocial domains and have an impact on the day-to-day activities of the affected population. Children and adolescents also require special consideration, as asthma affects not only the affected individuals but also their caregivers, changing the daily routine and the quality of life for everyone involved (Matsunaga et al., 2015). Surveys measuring health-related quality of life (HRQOL) are frequently used to gauge how a patient feels about their condition and how it affects their day-to-day activities (Hämmerlein et al., 2011).

Asthma control is currently defined as the lack of the main asthma symptoms and indicators, such as dyspnea or coughing during the night or during exercise, exacerbations, and needing emergency medical attention, as well as the lack of activity or quality of life degradation due to asthma. The Asthma Control Questionnaire is a commonly used instrument to assess asthma control (ACQ) (Andreasson et al., 2019). Asthma intervention includes drug management, lifestyle modifications, and education to control and manage asthma symptoms. The majority of asthma management programs, offered now are given by doctors or in a hospital setting. However, because of their knowledge of medications and regular interactions with patients on prescription refills, community pharmacists, may also be able to help manage asthma.

Pharmacists can help patients with asthma and their doctors to achieve and sustain asthma control by giving patients the right information and training regarding asthma medication, teaching proper inhalation technique, asking the patient if they understand the purpose of their asthma medications, clarifying the necessity of inhaled corticosteroids, addressing the patient's concerns regarding possible side effects, and supporting patients in staying consistent with their prescribed controller medication (Mehuys et al., 2008). Treatment outcomes for both short- and long-term interventions can be improved by using both simple interventions and complex

strategies. Simple interventions include following up with patients who miss appointments, trying to keep them under care, and streamlining treatment regimens.

Complex strategies involve combining multiple interventions through close monitoring, family therapy, supervised self-monitoring, patient instructions and reminders, and telephone follow-up. Caregiver' capacity to strictly adhere to instructions and recommendations, and a positive doctor-patient relationship are prerequisites for all those measures (Gillissen et al., 2007). Insufficient inhalation is a significant issue for asthma sufferers as it results in inadequate dosage of the recommended medication, thereby reducing the effectiveness of asthma treatment and control. In order to improve a patient's condition, it is imperative that they receive proper inhaler technique counseling.

This has several benefits, including increased medication delivery to the lungs, higher local concentrations of inhaled drugs, and a significantly lower risk of systemic side effects (Gillissen et al., 2007). The goal of non-pharmacological treatment for asthma is to better control the condition by reducing airway inflammation through dietary changes, physical activity, and weight loss, especially in case of obese patients. The present study intended to find out the effect of patient demographics on the use of complementary and alternative medications for management of different lifestyle diseases in community and hospital pharmacies.

## 2. MATERIALS AND METHOD

Various search engines were used as the main source of guidance for this systematic review. The included search engines are, electronic databases that were used for study search, including Science Direct, Pub Med, Web of Science, Scopus, Directory of Open Access Journals and ProQuest. Additionally, Google Scholar were used for manual search. Moreover, all of these study protocols are according to PRISMA flow statement guidelines. The keywords used for finding the research studies included, Asthma, Intervention, Quality of Life and European Countries. The search was restricted to the English language only.

### Inclusion Criteria

The inclusion criteria were as follows:

The study encompassed a general population.

The research originated from European countries.

The focus of the studies was on examining the impact of interventions on Asthma and Chronic Obstructive Pulmonary Disease (COPD).

The design of the incorporated studies was both observational and cross-sectional.

The studies were presented in the English language.

The studies underwent publication in peer-reviewed journals.

### Exclusion Criteria

The exclusion criteria were as follows:

Studies not conducted on human subjects.

Studies not published in the English language.

Studies without peer review.

Studies not focusing on asthma or COPD interventions.

Studies with a sample population outside Europe.

### Data Extraction

The extracted data from the included studies encompassed details such as author information, study year, country, study design, duration, sample size, target population, quality of life (QOL) measurement, mode of intervention, intervention type, intervention impact, and consideration of confounding factors. The predominant questionnaires employed in the studies were AQLQ, PAQLQ, and MAQL. The AXIS tool was utilized to evaluate and mitigate potential biases in the studies.

### 3. RESULTS

This electronic database search yielded 22,269 original research articles. After removing duplicates and irrelevant records, 4954 studies remained. Of these, 3875 were excluded due to mismatched keywords. 1097 reports were shortlisted. Within these, 641 were found as conference abstracts only, unavailable in full-text form, leading to their exclusion. This left 456 studies for further evaluation, after excluding irrelevant studies and those not in English. Only 30 studies met the inclusion criteria for the systematic review (Table 1). Detailed information is provided in the PRISMA flow diagram (Figure 1). Various interventions targeting asthma patients across multiple studies demonstrated significant positive outcomes. Educational programs led by various healthcare professionals such as doctors, pharmacists, and nurses played a crucial role. These programs focused on understanding asthma, taking medications properly, using inhalers correctly, and being aware of how asthma affects daily life.

Lifestyle changes, like exercise and dietary adjustments, also showed positive effects on both physical and mental well-being in asthma patients. These interventions led to an overall enhancement in the quality of life (QOL), encompassing physical, mental, and emotional well-being. Pharmacist-led programs and physician-guided sessions improved medication adherence and inhalation techniques. Stress management programs showcased a reduction in stress levels among patients. Longer-duration programs had a greater positive impact on asthma patients' quality of life. The studies also identified hurdles impacting the QOL improvement, such as non-compliance with treatment plans, incorrect use of inhalers, heightened stress levels, insufficient self-management, and limited knowledge about asthma posed significant barriers.

The pharmacist's involvement in interventions, providing counseling and personalized guidance, emerged as a crucial element in improving patients' QOL. The review examined various criteria in 30 studies published between 1999 and 2021. These criteria included sample size (n), duration of study, target population, Questionnaire used, QOL Measurement, QOL Results (Baseline), Mode of Intervention, Intervention by, Intervention, Impact of Intervention, and cofounders influencing outcomes. These studies predominantly originated from multiple European countries, such as the Netherlands, Belgium, Bulgaria, Switzerland, Germany, Italy, the UK, Norway, Greece, and Turkey. The studies consistently showcased clear goals and purposes, strong research plans and suitable population size.

Results were presented consistently and without any conflicts of interest. Especially among European studies, objectives were well-defined, and transparency about funding and possible biases was evident, ensuring unbiased interpretations. Furthermore, a significant portion of these studies precisely outlined the groups studied and followed ethical guidelines, securing necessary permissions and participant agreement. All studies focused on understanding the quality of life and the impact of educational intervention on asthma patients, lasting mostly from one month to a maximum of one year.

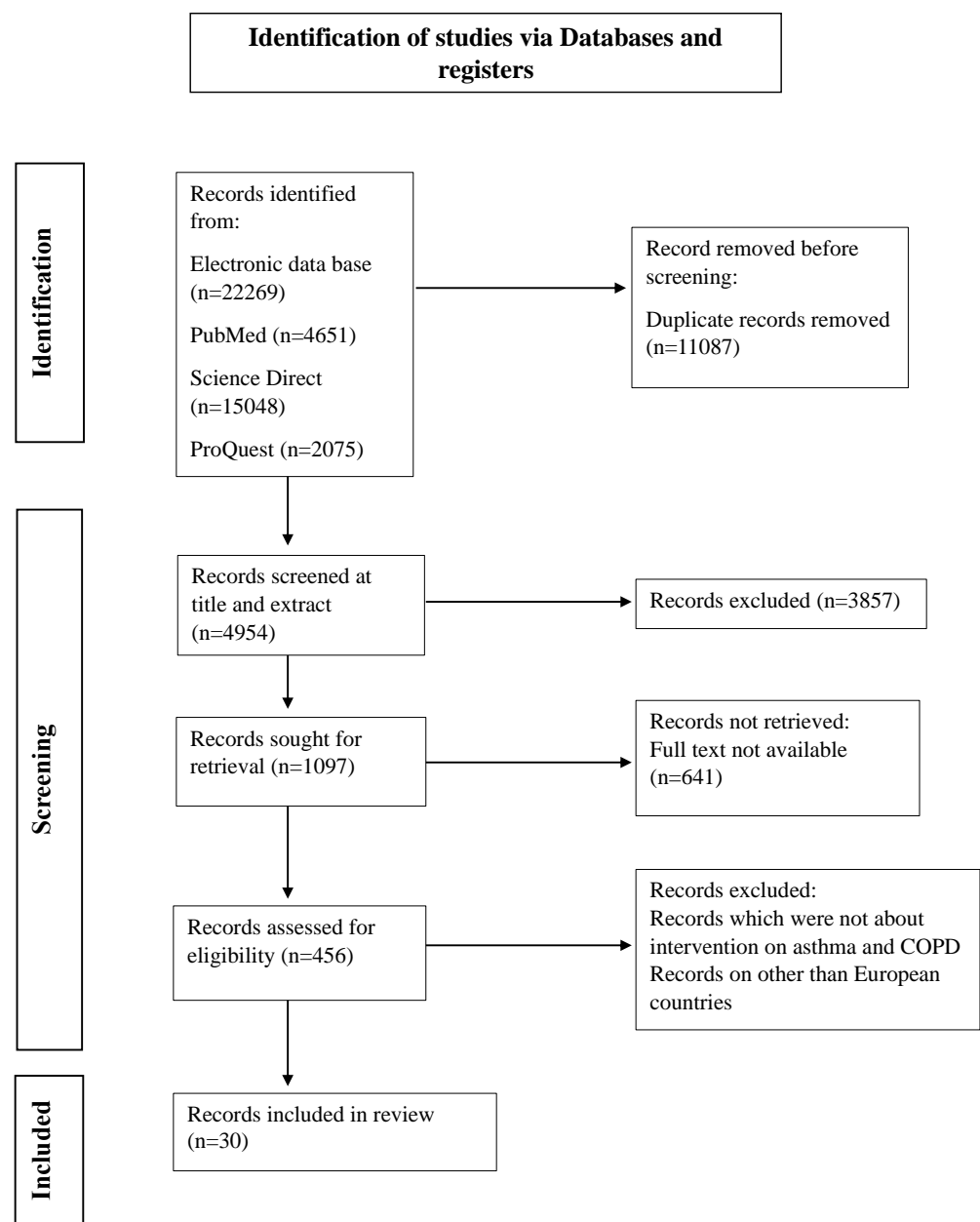


Figure 1 PRISMA flow diagram for systematic review

Table 1 Study characteristics of the included studies

Study	Author	Countr y of study	Study design	Sample size (n)	Duratio n of Study	Target population	Questionnaire used	QOL Measur ement at Baselin e	Mode of Intervention	Intervention by	Intervention	Impact of Intervention	Cofounders
Study 1	E. Mehuy s/2008 (Mehuys, Van Bortel et al., 2008)	Belgiu m	Random ized controll ed trial	200	6 months and 2 weeks	Asthma patients	AQLQ	Poor	Education	Pharmacist	Medicine adherence Inhalation technique	QOL Improved	Poor inhalation technique
Study 2	Valantina Petkona/ 2005 (PETKOV A, 2005)	Bulgar ia	Observa tional study	45	5 months	Asthma patients	QOLS	Poor	Education interview	Pharmacist	Inhalation technique	Hospital admission was reduced	No self- management
Study 3	Frøde	Norwa y	Random	140	12 months	Asthma & COPD	MAQLQ	Moderate	Education	Physician	Booklet	Improved	Smoking

	Gallefoss /1999 (Gallefoss et al., 1999)	y	ized controll ed trial		months	COPD patients		te		Pharmacist Physiotherapist		QOL	
Study 4	Georgia Georga/ 2018 (Georga et al., 2019)	Greece	Random ized controll ed trial	49	8 weeks	Intermitte nt & mild asthma patients	MAQLQ	Moderate	Program	Physician	Stress management	Improved QOL	Overthinking
Study 5	Katielidou D/ 2014-15 (Katielidou et al., 2017)	Greece	-	100	30 days	Asthmatic Patients	Mini AQLQ	Good	Leaflet	Health care provider	Informational Intervention	Beneficial	Use of medical device
Study 6	Momqwe O.M Van De Van/ 2011 (Van-De-Ven and Engels, 2011)	Netherlands	Coping strategy	405	2 months	Asthmatic adolescents	AAQOL	Fair	Questionnaire	Health care provider	Observational Intervention	Beneficial	Physiological
Study 7	Ri Chelle C kosse (Kosse et al., 2019)	Netherlands	Random ized control	234	6 months	Asthmatic adolescents	ADAPT CARAT PAQLQ	Poor	Mobile health	Pharmacist	Educational Intervention	Improved	Emotional & Psychological effects
Study 8	A. cano Garcinuno (Cano-Garcinuno et al., 2007)	Spain	Random ized controll ed trial	245	6 months	Asthma children	PACLO PAQLQ	Poor	Questionnaire	Health care provider	Observational Intervention	Beneficial	No self management
Study 9	Ann-Charlotte Dalheim-Englund/ 2003 (Dalheim-Englund et al., 2004)	Sweden	Prospective cross-sectional	371	1 year	Parents of children with asthma	PACQLQ	Fair	Survey	Nurse	Lifestyle Intervention	QOL Improved	Disease specific effects
Study 10	C. Broquet Ducret/ 2013 (Ducret et al., 2013)	Switzerland	Prospective longitudinal study	27	6 months	Children and their parents	PAQLQ	Fair	Educational Intervention	Physician	Awareness Intervention	QOL Improved	Non - compliance
Study 11	Gulyeter Erdogan Yuce/ 2019 (Yuce and Tasçi, 2020)	Turkey	Random ized, active controll ed, single blind	55	1 month	Asthma patients ≥ 18 years	AQLQ ACT	Fair	Exercise (Yoga) Intervention	Instructor	Lifestyle Intervention	QOL Improved	Physical & mental health
Study 12	Louise Lindhardt Toennesen (Trial)	UK	Random ized controll ed trial	149	8 weeks	Non obese adult asthma patients	ACQ AQLQ	Fair	Exercise & diet intervention	Training Instructor with degree in sports science/ Dietician	Behavioral & lifestyle Intervention	QOL Improved	Diet & exercise
Study 13	Anne Bwkon/2 017 (Bruton et al., 2018)	UK	Random ized controll ed trial	655	12 months	Asthma patients	AQLQ	Poor	Education & Life style modification	Nurse	Booklet physiotherapy	QOL Improved	Lack of health care physician
Study 14	Philip o. Anum/ 2017 (Cambach et al., 1997)	UK	Prospective cohort study	92	12 weeks	Asthma patients	AQLQ	Poor	Life style modification	Physiotherapist	Exercise	QOL Improved	Lack of physical activity
Study 15	W. Comb ack/1996 (Anum et al., 2017)	UK	Random ized Controll ed trial	130	6 months	Asthma patients	CRDQ	Poor	Education	Pharmacist	Counselling	QOL Improved	Inadequate inhaler use
Study 16	Arlotte E Hesselink/2004 (Hesselink et al., 2004)	Netherlands	Random ized control trial	663	1 year	Asthma patients	Respiratory illness questionnaire	Poor	Education	General practitioner	Counselling	QOL Improved	Non - compliance
Study 17	Javior Bernito Fernandez /2012 Benito- Fernández et al., 2013)	Spain	Prospective cohort study	164	9 months	Pediatrics	PACTQ	Poor	Education	Physician	Medication adherence	QOL Improved	Non - compliance
Study 18	Konrad Schuttz/ 2017 (Schultz et al., 2017)	Germany	Random ized controll ed trial	504	1 year	Asthma patients	SGRQ AQLQ	Poor	Education & Life style modification	Physician	Rehabilitation Physiotherapy	QOL Improved	Lack of education
Study 19	Claudia Terzano/2 012	Italy	Observational study	612	1 year	Asthma patients	Euro QOL 5D Questionnaire	Poor	Education	Physician	Patient counselling	QOL Improved	Poor adherence

	(Terzano et al., 2012)												
Study 20	Yolling Yong/2021 (Yang et al., 2022)	UK	Observational study	612	6 months	Children	PAQLQ	Poor	Education	Nurse	Inhalation technique	QOL Improved	Poor Inhalation technique
Study 21	E.F. Juniper/ 2003 (Juniper et al., 2004)	Canada	Randomized (double blind manner)	763	12 weeks	≥12years Asthma patients	AQLQ	Moderate	Education	Clinician	Medication	QOL Improved	Poor adherence
Study 22	Veronica Sanz Santiago MD/2020 (Sanz-Santiago et al., 2020)	Spain	Randomized controlled trial	60	12 weeks	Children & Adolescent	ACT PAQLQ	Poor	Exercise Intervention	Physiotherapist	Exercise	QOL Improved	Poor activity
Study 23	Pinja Ilmarinen /2019 (Ilmarinen et al., 2019)	Finland	Cohort study	257	12 years follow up study	≥15years	ACT AQ20 15- D	Poor	Program	Health care provider	Effect of asthma control	HRQOL Improved	Current or ex-smoker
Study 24	Anna Rask Anderson/ 2022 (Rask-Andersen et al., 2022)	Sweden Iceland Norway	ECRHS	2270	3 years	29-55 years	HAD IULTD	Moderate	Sleeping habits modification	Health care provider	Insomnia & depression treatment	QOL Improved	Anxiety and depression
Study 25	Vicente plaza/2015 (Plaza et al., 2015)	Spain	Randomized controlled trial	250	2 years and 5 months	Mild to moderate uncontrolled asthma patients	MAQLQ	Poor	Education	Physician Registered nurse	Life style modification pharmacotherapy	QOL Improved	Lack of education
Study 26	Catharina M. Veninga/ 1999 (Veninga et al., 1999)	Norway Netherlands Sweden Slovakia	Randomized controlled trial	Nor 32 grp Neth 24 grp Swed 36 grp Slo 20 grp	3 months in every country	Asthma patients	Knowledge and attitude questionnaire	Poor	Education	Physician	Medication adherence	QOL Improved	Lack of education
Study 27	Sibel Basarian/ 2005 (Basarian et al., 2006)	Turkey	Randomized controlled trial	62	12 months	Pediatrics with asthma	PAQLQ	Mild to moderate	Life style modification	Trainer	Exercise	Moderate improve	Lack of physical activity
Study 28	Fuluio Braidio/ 2016 (Braidio et al., 2016)	Europe	Observational study	8111	12 months	Asthma patients	ACQ	Poor	Education	Physician	Medication adherence	QOL Improved	Smoking
Study 29	Dr Martin Schulez/ 2009 (Hämmerlein et al., 2011)	Berlin	Randomized controlled trial	757	4-6 weeks	Asthma & COPD patients	MAQLQ	Good	Program	Pharmacist	Inhalation technique	QOL Improved	Poor Inhalation technique
Study 30	Sonia Romano/ 2021 (Rodrigues et al., 2021)	Portugal	Randomized controlled trial	760	6 months	Asthma & COPD Patients	ACT Score	Poor	Education	Pharmacist	Inhalation technique	QOL Improved	Poor Inhalation technique

Table 2 Appraisal tool for Cross-Sectional Studies (AXIS tool)

30	(Rodrigues et al., 2021)	✓			✓
29	(Hämmerlein et al., 2011)	✓			✓
28	(Braidó et al., 2016)	✓			✓
27	(Basaran et al., 2006)	✓			✓
26	(Veninga et al., 1999)	✓			✓
25	(Plaza et al., 2015)	✓			✓
24	(Rask-Andersen et al., 2022)	✓			✓
23	(Ilmarinen et al., 2019)	✓			✓
22	(Sanz-Santiago et al., 2020)	✓			✓
21	(Junipe et al., 2004)	✗			✓
20	(Yang et al., 2022)	✓			✓
19	(Terzano et al., 2012)	✓			✓
18	(Schultz et al., 2017)	✓			✓
17	(Hesselink et al., 2004)	✓			✓
16	(Hesselink et al., 2004)	✗			✓
15	(Arum et al., 2017)	✓			✓
14	(Cambach et al., 1997)	✓			✓
13	(Bruton et al., 2018)	✓			✓
12	(Trial)	✓			✓
11	(Yüce and Taşçı, 2020)	✓			✓
10	(Ducret et al., 2013)	✓			✓
9	(Dalheim-Englund et al., 2004)	✗			✓
8	(Cano-Garcinuño et al., 2007)	✓			✓
7	(Kosse et al., 2019)	✓			✓
6	(Van-De-Ven and Engels, 2011)	✓			✓
5	(Konstantakopoulou et al., 2017)	✗			✓
4	(Georga et al., 2019)	✓		✗	✓
3	(Gallefoss et al., 1999)	✓			✓
2	(PETTKOVA, 2005)	✓			✓
1	(Mehuys et al., 2008)	✓			✓
Introduction					
Were the aims/objectives of the study clear					
Methods					
Was the study design appropriate for the stated aim(s)?					
Was the sample size justified?					
Was the target/reference population clearly defined?					



Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓
Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	N / A	N / A	N / A	✓	✓	✓	✓	✓
Were measures undertaken to address and categorize non-responders?	✓	✓	x	x	x	✓	✓	✓	✓	✓	x	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	x	✓	✓	✓	✓
Were the risk factor and outcome variables measured appropriate to the aims of the study?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	x	x	✓	✓	✓	✓	✓

Were the risk factor and outcome variables measured correctly using instruments/measurement s that had been trialed, piloted or published previously?	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	x	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Is it clear what was used to determined statistical significance and/or precision estimates? (e.g. p-values, confidence intervals)	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x	x	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓
Were the methods (including statistical methods) sufficiently described to enable them to be repeated?	✓	x	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	x	✓	x	x	✓	x	x	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	x
Results																														

Were the basic data adequately described? Does the response rate raise concerns about non-response bias?	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
Does the response rate raise concerns about non-response bias?	<	<	✗	✗	<	✗	✗	<	✗	<	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	<	✗	✗	<
If appropriate, was information about non-responders described?	✓	✓	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✗	✓	✓
Were the results internally consistent?	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✓	✓	✓	✗	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓
Were the results presented for all the analyses described in the methods?	✓	✓	✗	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✗	✗	✗	✓	✗	✗	✓	✓	✗	✓	✗	✓	✓	✓	✓
Discussion																													
Were the authors' discussions and conclusions justified by the results?	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
Were the limitations of the study discussed?	✓	✗	✗	✗	✗	✓	✓	✗	✗	✗	✓	✓	✗	✓	✓	✗	✓	✗	✗	✓	✗	✗	✓	✗	✗	✓	✓	✗	✓

Other																											
Were there any funding sources or conflicts of interest that may affect the authors' interpretation of the results?	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Was ethical approval or consent of participants attained?	x	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	x	✓	x	x	✓	✓

4. DISCUSSION

The present review depicts that smoking is a cofounder of poor quality of life in asthma patients in Europe. A study conducted in Korea using AQLQ to measure the quality of life of asthmatic patients suggested that smoking causes inflammation of bronchioles and reduces lung function. Non-smoking asthma patients have higher FEV1 than smoking patients. It concluded that asthmatic patients who quit smoking had less airway obstruction, highlighting the importance of smoking cessation for asthma management (Jang et al. 2010). A study conducted in Europe on adult asthmatic patients through AQLQ concludes that smoking is the reason behind the aggravation of asthma symptoms and sleep disturbances, with smokers being more affected by nocturnal symptoms than non-smokers (Tan et al., 2012). However, another questionnaire-based study conducted in Europe using ACT and SGRQ claims that smoking does not have any effect on the quality of life of asthma patients; lower BMI and self-control better manage asthma.

The general findings of this study suggest that breathing exercise has a profound impact on improving the quality of life of asthma patients. A randomized controlled study conducted in Egypt also suggests that breathing exercise improves health-related quality of life in bronchial asthma patients. A supervised training program of 6 weeks leads to significant improvements in physical limitations and a decrease in the frequency of symptoms (Refaat and Gawish, 2015). However, a previous review conducted in Australia, comprising 43 published papers including longitudinal and cross-sectional studies, claims that there is no significant effect of physical training on the lung function of asthma patients. More research is required to determine the frequency and duration of training sessions required (Joschtel et al., 2018).

This review showed that asthma control in patients was positively affected by the correct inhalation technique. Different studies indicated different methods to correct the use of inhalers and prevent misuse. Almost all studies indicated that the quality of life of asthmatic patients improved after improved inhalation techniques through educational intervention. A randomized controlled parallel-group, a single-blind study conducted in Australia, demonstrated that a physical demonstration of verbal and written instruction is more effective, as asthmatic patients who received verbal instructions did not come for follow-up (Bosnic-Anticevich et al., 2010). Another randomized study conducted in Australia to improve inhaler technique improvised that a simple educational intervention by a pharmacist about inhaler technique was feasible for the asthma management. Patients who had poor inhalation technique showed improvement within 6 months (Basheti et al., 2008).

Educational interventions, such as pharmacist counseling, have improved asthma control compared to usual care. An Australian study conducted a pragmatic cluster randomized trial, using pharmacists as units of a cluster. The study found that a strategy of 3 or 4 consultations with a pharmacist over a 6-month period resulted in significant benefits for asthma control. Notably, patients with poor asthma control experienced substantial improvement after counseling (Armour et al., 2013). In a separate controlled study conducted in New Zealand, researchers emphasized the importance of adequate pharmacist training to positively influence asthma-related quality of

life (QOL) within the community. Interestingly, this effect was more pronounced in younger age groups, while older age groups exhibited significantly worse QOL (Kheir et al., 2001). However, an interventional study carried out in India yielded different findings.

It concluded that counseling remains effective for the majority of cases, but in situations involving older age and greater disease severity, there was no significant difference. This suggests that asthma QOL is influenced by various lifestyle factors beyond counseling alone (Rathan-Shyam et al., 2013). The findings of this study closely align with those of another randomized controlled trial conducted in China, specifically regarding medication adherence. Both studies emphasize that medication adherence is the key factor in improving quality of life for asthma patients however COPD patients showed more significant improvement (Jia et al., 2020). Additionally, a prospective cross-sectional study in Kuwait sheds light on factors influencing medication adherence. It revealed that patients with lower levels of education and negative beliefs about medication tend to exhibit poor adherence during long-term therapy (Lemay et al., 2018).

Furthermore, a cross-sectional study conducted in Baghdad highlights the impact of age on medication adherence. As individuals grow older, they face challenges such as difficulty understanding their medications, multiple co-morbidities, and polypharmacy, all of which contribute to decreased adherence (Salih and Ismail, 2022). The findings of the present review depict that stress is a cofounder that aggravates the symptoms of asthma and leads to poor quality of life in asthma patients. A cross-sectional study conducted on adult asthma patients in Korea also revealed that the severity of stress causes an increase in wheezing sounds, shortness of breath, and waking up at night function (OH et al., 2004). The underlying mechanism proposed in these studies suggests that stress triggers inflammation in the bronchioles, thereby worsening asthma symptoms. However, a study conducted on a non-general population of asthma patients at the Public Health University of Finland claims that there is no relation between asthma and stress.

Interestingly, stressed men who experience respiratory dysfunction may even exhibit a decreased risk of developing asthma (Huovinen et al., 2001). Moving beyond stress, poor sleep quality emerges as another cofounder that exacerbates asthma symptoms. Sleep cycle modification can improve the quality of life in asthma patients. A cross-sectional study conducted on adult asthma patients using AQLQ in the USA also concludes that patients with non-severe asthma and severe asthma have poor sleep quality which leads to poor asthma control and quality of life (Luyster et al., 2012). A possible reason might be circadian variability that causes resistance in airways. However, a contrasting study conducted in Japan on adult asthma patients using AQLQ concludes that sleep quality is not related to the quality of life of asthma patients and respiratory function. Instead, other comorbidities may play a more significant role in causing sleep disturbances (Yamasaki et al., 2014).

The findings of this review align closely with another meta-analysis conducted in Japan, emphasizing the prevalence of depression among asthma patients. Depression is implicated in the release of interleukins, which play a pathological role in asthma. Additionally, depression negatively affects the autonomic nervous system, potentially exacerbating asthma symptoms. Factors such as obesity and smoking, often associated with depression, further contribute to symptom severity (Gao et al., 2015). Treatment of asthma using antidepressant therapy would lead to a better quality of life in asthma patients. However, a randomized study conducted in Sweden challenges the direct link between depression and asthma. According to their findings, the exacerbation of symptoms may be attributed to poor asthma control or other co-morbidities rather than depression itself (Eisner et al., 2005).

Education of asthma patients plays a major role in the improvement of the quality of life of asthma patients. The findings of this review are quite similar to a prospective randomized control study conducted on moderate to severe asthma patients in Quebec City that education not only decreases the night symptoms but also increases the number of symptom-free days in asthma patients leading to significant improvement in the quality of life of asthma patients (Côté et al., 2000). Education increases the knowledge of patients about the disease and treatment which leads to better management of the disease. However, a randomized controlled trial conducted for 2 years in Italy concluded that QOL improved for 1 year but this improvement was not sustained in the subsequent 12 months. These divergent results highlight the need for tailored educational approaches that address both short-term and long-term management. Education remains a cornerstone in optimizing asthma outcomes and enhancing patients' well-being (Marabini et al., 2005).

## 5. CONCLUSION

The review's findings revealed that educational intervention plays a significant role in improving the quality of life in asthma patients. The majority of the population studied consisted of adults with asthma. Several factors contribute to the poor quality of life

experienced by these patients, including smoking, incorrect inhalation techniques, non-compliance with treatment, lack of self-management, and the presence of depression, anxiety, and stress. The QOL in asthma patients can be remarkably improved by providing education about the correct use of inhaler techniques, self-management strategies, counseling, breathing exercises, medication adherence, stress management. Healthcare professionals, including pharmacists, physicians, nurses, and physiotherapists, play a noticeable role in delivering effective interventions. The findings from the current systemic review can help healthcare providers to provide better therapeutic care to asthma patients.

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### Limitations of the study

The current study is a systematic review of QoL of Asthma patients from the regions of Europe. Therefore, it lacks the worldwide prospective.

### Authors' Contributions

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

### Ethical Approval

The current systematic review was conducted after getting ethical approval from the university's ethical review board with ethical protocol number: ERB-PHRMD-DPP/4612-A

### Informed consent

Not applicable

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This study has not received any external funding.

### Conflict of interest

The authors declare that there is no conflict of interests.

### Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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