Mindfulness (2020) 11:1848–1867
https://doi.org/10.1007/s12671-020-01348-z

REVIEW

Mindfulness-Based Programs for People with Chronic Obstructive Pulmonary Disease: a Mixed Methods Systematic Review

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Published online: 20 March 2020

Abstract

Objectives To identify, summarize, and aggregate the quantitative and qualitative evidence on the use of mindfulness-based programs in people with chronic obstructive pulmonary disease (COPD), to describe the possible barriers and facilitators and derive recommendations for the implementation of mindfulness-based programs in people with COPD.

Methods A mixed methods review was conducted following the Joanna Briggs Institute methodology. After a systematic search in eight relevant databases, seven papers presenting five studies were included. Two researchers independently extracted the data and assessed the methodological quality of the studies.

Results No significant changes in levels of anxiety, stress, respiratory symptoms, or other physiological outcomes were found, despite the perception of most participants that mindfulness had a positive influence on their psychological and physical well-being. Only one study showed the effectiveness of mindfulness-based programs in reducing depressive symptoms when combined with pulmonary rehabilitation. Participation in and completion of mindfulness-based programs were hampered by personal beliefs, psychological factors, and practical aspects. Furthermore, the characteristics of the mindfulness-based protocols and the different methods of provision could encourage or discourage program attendance.

Conclusions The limited published studies to date have not demonstrated the efficacy of mindfulness-based programs in COPD. Further methodologically sound studies with bigger sample sizes and with consistent outcome measures are needed to verify their effectiveness. Due to the fluctuations in symptoms of the disease, and patients' difficulties in leaving the house, home-based, web-delivered, and shorter protocols could be further tested as they could facilitate the adherence of people with COPD to mindfulness practice.

Keywords Barriers · Chronic obstructive pulmonary disease · Facilitators · Meta-synthesis · Mindfulness-based intervention · Systematic review

Chronic obstructive pulmonary disease (COPD) is a group of pulmonary diseases characterized by persistent respiratory symptoms and airflow limitations (Global Initiative for Chronic Obstructive Lung Disease 2019). COPD includes different conditions: emphysema characterized by damage of the lung alveoli with air space enlargement, chronic bronchitis due to the destruction of bronchial tubes and cilia, and small airway disease presenting with a reduction in number and caliber of the small bronchioles (Silverman et al. 2018). Other obstructive lung diseases, such as bronchiectasis and asthma, share a few similarities with COPD; however, they present different pathophysiological processes, risk factors, symptoms, and treatments. Clinically, these pathogenic processes account for significant differences in signs and symptom presentation that affects disease management (Brusselle and Bracke 2014).

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s12671-020-01348-z) contains supplementary material, which is available to authorized users.

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COPD has a high morbidity and mortality rate worldwide. Its prevalence in people aged 30 and over is 11.7% and it is constantly growing (Adeloye et al. 2015) due to the increasing number of tobacco smokers, environmental pollution, professional exposure to irritants, and life expectancy (Global Initiative for Chronic Obstructive Lung Disease 2019). COPD is the third cause of death worldwide (World Health Organization 2019). Moreover, COPD is one of the main causes of Emergency Department visits, hospital admissions and re-admissions, with total costs for health systems continuously increasing (World Health Organization 2019). In Europe alone, the cost of the treatment of COPD for healthcare systems is about 40 million euros per year, 3% of the total European budget (Chapman et al. 2006).

COPD presents physiological manifestations, such as dyspnea, cough, fatigue, and susceptibility to infections as well as psychological and emotional suffering (Global Initiative for Chronic Obstructive Lung Disease 2019). On this aspect, anxiety and depression are widely reported with a mean prevalence of 36% (range 6–74%) and 40% (8–80%), respectively (Yohannes et al. 2010). The psychological and emotional suffering, which is also triggered by physical causes, has a negative impact on the physiological status and on the perception of quality of life of those affected (Habraken et al. 2011). Beside pharmacological treatments, non-pharmacological interventions have been suggested to prevent and treat global distress in people suffering from COPD, including cognitive behavioral therapies (Baraniak and Sheffield 2011) and mindfulness-based programs (MBPs) (Harrison et al. 2016). Cognitive behavioral therapy focuses mainly on changing negative thoughts and behavioral activation, emphasizing the detection and the modification of maladaptive beliefs, whereas MBPs are centered on individuals' psychological and emotional issues caused by the disease, promoting an active involvement with their thoughts, and the recognition and active acceptance of the disease in order to develop appropriate behaviors (Harrison et al. 2016).

The MBPs with the longest consolidated tradition and most robust evidence are the Mindfulness-Based Stress Reduction (MBSR) program and Mindfulness-Based Cognitive Therapy (MBCT) (Crane et al. 2017). The MBSR was created to reduce stress in people affected by chronic pain (Kabat-Zinn 1982) and has subsequently been applied to people with other medical conditions (Bohlmeijer et al. 2010). MBSR is aimed at developing mindfulness regarding the health conditions and at modifying the relationship with the disease, the automatic reactions and unwholesome habits, the judgment on themselves, and the inappropriate strategies that lead to increased distress. The MBSR protocol entails eight weekly classes, with each class lasting about two and a half hours, and daily individual practice at home. During the class, the individuals are guided to bring their attention, with a kind, nonjudgmental attitude, on their bodies, their ways of breathing, their physical sensations, and their own feelings. Also, in the class, individuals are asked to share their experiences connected with the proposed practices with the group of peers, to create a body of shared experiences and lead to observations and comprehensions encouraged by the mindfulness instructor.

The MBCT, derived from the MBSR, was developed to prevent depressive relapse in people with depression (Segal et al. 2013) and subsequently has also been used to reduce depression and anxiety caused by other medical conditions (Cullen 2011; Sipe and Eisendrath 2012). Unlike MBSR, MBCT is aimed at changing the individuals' identification with their own thoughts and how the thoughts act on their negative feelings (Kuyken et al. 2010). The MBCT is performed over eight weekly classes lasting 2 h, and it is a combination of mindfulness practices and mindful yoga similar to those proposed in MBSR protocol. Furthermore, cognitive therapy principles and exercises are taught through short theoretical lessons about the different aspects of mood disorders (Segal et al. 2013). Other MBPs have been derived from the traditional MBSR and MBCT and have been tailored to manage different psychological and physical health problems in specific populations; however, they are in earlier development stages, and research on their effectiveness is still scarce (Crane et al. 2017).

While there is evidence on the effectiveness of traditional MBPs in many chronic illnesses (Gotink et al. 2015; Leung et al. 2015; Noordali et al. 2017; Zhang et al. 2016), only a few studies have been conducted to test their effectiveness in COPD people. MBPs can be more appropriate for people with COPD than other psychosocial interventions as instead of modifying cognitions, they promote the modification of individual thoughts and an accepting mode of response, especially useful during dyspnea attacks and the associated anxiety that may occur (Baraniak and Sheffield 2011; Coventry et al. 2013). A literature review conducted to identify the effect of MBPs on people with respiratory disease, including asthma, respiratory failure, and COPD, found that, due to wide differences in the interventions and measured outcomes, no conclusion could be drawn on their effectiveness (Harrison et al. 2016). Another review, carried out to assess the effectiveness of different psychosocial interventions on health outcomes in people with COPD, reported an improvement in physical outcomes after mind-body interventions, but no specific subanalysis for MBP on COPD was carried out (Farver-Vestergaard et al. 2015).

As in recent years, interest in the application of MBPs in COPD has increased, a systematic review is needed updating the latest evidence on the effectiveness of MBPs on health outcomes. However, addressing MBP effectiveness alone could lead to important information being missed on the experiences and perceptions of people involved in the interventions, on how and why the interventions achieve or do not

achieve their effects, and what promotes or discourages people's participation in the program. Such knowledge can be explored only through qualitative studies. A few qualitative studies have been conducted exploring the experience of MBPs from the point of view of COPD subjects, but, to our knowledge, they have never been summarized in a review.

Combining and integrating the qualitative and quantitative findings of studies on this topic could be useful to inform health-care professionals and researchers on what could encourage people with COPD to get involved in a MBP or prevent them from doing so, and on which benefits are to be expected from this kind of program. Thus, we conducted a mixed method review aiming (i) to identify and summarize the qualitative and quantitative evidence on the application of MBPs to people with COPD and (ii) to aggregate the qualitative and quantitative evidence to understand whether MBPs could be effective and appropriate in people with COPD and under which conditions and modes, describing favorable and unfavorable implementation factors.

Methods

Design

A mixed methods review was conducted following the Joanna Briggs Institute (JBI) methodology. This methodology allows a synthesis of quantitative and qualitative evidence to provide a better understanding of the phenomenon under study and to inform evidence-based practice (Lizarondo et al. 2017). A convergent segregated approach was used that entails a separate synthesis of the qualitative and quantitative studies, a conversion of the quantitative into qualitative data or qualitative into quantitative data, and then an aggregation of the findings to draw up recommendations to inform clinical practice and policy (Lizarondo et al. 2017). The JBI System for the Unified Management, Assessment and Review of Information (SUMARI) software was used to support the review process. The review protocol was registered on the international prospective register of systematic reviews (PROSPERO) (CRD 42018104818).

Search Strategy

A three-step search according to the JBI approach was conducted to retrieve all relevant studies. Firstly, a preliminary explorative research was performed on PubMed and PsycINFO to retrieve the most suitable keywords and thesaurus terms related to the phenomenon under study. Afterwards, a systematic research using the keywords and thesaurus terms identified was conducted on PubMed, CINAHL, EMBASE, PsycINFO, Web of Science, Scopus, the Joanna Briggs Institute evidence-based practice database, and the Cochrane Library. Lastly, the references of all identified papers were evaluated to identify further pertinent papers. No limits were set regarding the year of the study publication and the last research was performed October 28, 2019. The search was limited to papers in English, Italian, Spanish, or French published in peer-reviewed journals. Conference proceedings, theses, dissertations, and other unpublished literature were excluded from the research. The terms used were COPD, chronic obstructive pulmonary disease, chronic obstructive lung disease, mindfulness, mindfulness-based stress reduction, and mindfulness-based cognitive therapy. The search on the databases was conducted by a reviewer in collaboration with an expert librarian to ensure process rigor. The search strategies used in all the identified databases are illustrated in Online Resource Table S1.

Inclusion and Exclusion Criteria

Quantitative Study Review

Type of Patients Studies considering people aged 18 years and over in which COPD was the principal diagnosis, as defined by Global Initiative for Chronic Obstructive Lung Disease (2019), at any disease stage, were included in our review. The severity of airflow limitations derived from the spirometric values is classified as mild (stage I), moderate (II), severe (III), and very severe (IV) COPD. People in whom the main diagnosis was another chronic lung disease, such as asthma, lung cancer, pulmonary hypertension, pulmonary fibrosis, bronchiectasis, were excluded, since these diseases are characterized by different age of onset, risk factors, etiology, symptoms, treatments, and psychological profiles, thus comprising heterogeneous populations. Including all these populations together would negatively affect the generalizability of results. Studies including individuals with different lung diseases were included if a subgroup analysis on a COPD sample was conducted, or if it was possible to extrapolate data from the COPD individuals. No limit was set to the presence/number of comorbidities.

Type of Interventions Programs based on mindfulness, including MBSR and MBCT, following the traditional approach with a scheduled 8-week program were included (Crane et al. 2017). MBPs adapted specifically for people with COPD were also considered if they followed the key components of the traditional programs (Crane et al. 2017). Both face-to-face and tele-delivered programs were included. Other mind/body interventions, such as yoga and meditation, used as single components of the program, were excluded, as well as single short session of MBPs.

Type of Comparators For experimental studies, the control intervention could consist of no treatment, or other types of

treatment, such as pulmonary rehabilitation, support groups or any other type of mind-body practices.

Type of Outcomes All the psychological and physiological health outcomes evaluated in the studies were considered, including but not limited to stress, anxiety, depression, quality of life, dyspnea, and other physiological and psychological variables.

Type of Studies Randomized controlled trials (RCT), non-randomized controlled trials (nRCT), quasi-experimental studies, observational and descriptive studies were included.

Qualitative Study Review

Type of Patients Besides the inclusion and exclusion criteria identified for the quantitative component of the review, papers including the experiences of other individuals, such as caregivers or healthcare professionals, were considered only if it was possible to extrapolate the findings related to people with COPD.

Phenomena of Interest COPD people's experiences, feelings, and perceptions about the MBPs, the influence of the programs on their life, their relationship with the disease, and their experiences with the mode of delivery of the MBP were considered. The MBPs could be by face-to-face, tele-delivered, or provided by any other mode.

Context All healthcare settings in which the MBP could be provided were considered, including people with COPD from any country and ethnic group.

Type of Studies All kinds of qualitative study designs, including but not limited to descriptive qualitative research, phenomenology, grounded theory, action research, ethnography, and mixed methods studies were included. In the case of mixed methods studies, the qualitative and quantitative components were analyzed separately and included in the qualitative and quantitative parts of the review, respectively.

Study Quality Appraisal

The methodological quality of qualitative and quantitative studies was assessed using the Critical Appraisal Tools (CATs) developed by JBI for the specific study design (Joanna Briggs Institute 2017). The CAT for RCT includes 13 criteria: (1) randomization of the treatment group, (2) allocation concealment, (3) baseline comparability among study groups, (4) participants' blindness to treatment, (5) blindness to treatment delivery, (6) outcome assessor blindness, (7) same baseline treatment between groups, (8) follow-up analysis, (9) intention-to-treat analysis, (10) same outcome measure between groups, (11) reliable outcome measures, (12) appropriate statistical analysis, and (13) trial design. The CAT for quasi-experimental studies comprises nine criteria: (1) clear temporal relationship between variables investigated, (2) comparability of participants, (3) presence of other treatment/care other than the exposure, (4) presence of a control group, (5) outcome measurements pre- and post-intervention/exposure, (6) complete follow-up analysis, (7) outcomes measured in the same way between groups, (8) reliable outcome measures, and (9) appropriate statistical analysis. The CAT for descriptive studies includes eight criteria: (1) clear inclusion/exclusion criteria, (2) description of study subjects and setting, (3) valid and reliable exposure measurement, (4) objective criteria for condition measurement, (5) identification of confounding factors, (6) adjustment for confounding factors, (7) valid and reliable outcome measurement, and (8) appropriate statistical analysis.

The CAT for qualitative studies considers the following 10 criteria: the congruity between (1) philosophical perspective and research methodology, (2) methodology and aims, (3) methodology and data collection methods, (4) methodology and data analysis, and (5) methodology and interpretation of results. (6) Identification of the researcher's location regarding theory, (7) identification of the mutual influence between the researcher and the research, (8) adequate representation of participants' voices, (9) proof of conformity with ethical criteria, and (10) correct derivation of the conclusion from the results.

For the mixed methods research, each component of the study was assessed using the CAT corresponding to the design used. Two reviewers assessed separately the methodological quality of the studies. Any disagreement about quality assessment was solved by discussion. Studies that did not reach a score of 50% for the criteria for each CAT (e.g., 4 out 8 for CAT of descriptive studies) were considered of poor methodological quality and excluded. The results of the quality assessment of the studies are reported in Online Resource Table S2.

Data Extraction

Data on population characteristics, study design, aims, intervention characteristics, measures, and main results were extracted from the articles included. For the quantitative studies, the specific data extraction tool displayed in SUMARI was used, and likewise for the qualitative studies; for the qualitative and quantitative component, the data from mixed methods studies were extracted according to the appropriate JBI extraction tool. In qualitative studies, themes and categories were considered as results, while in quantitative studies, descriptive statistics, p values, and effect sizes for mean score differences were considered as results. Two reviewers

independently extracted data and a third reviewer checked for accuracy of the data extraction.

Data Synthesis

For the quantitative findings, due to the heterogeneity of the study interventions, outcomes and measurements, no statistical meta-analysis pooling of the quantitative data was possible; therefore, quantitative results were reported in a narrative form and synthesized descriptively. For the qualitative findings, a meta-synthesis was undertaken according to JBI methodology. It encompassed a three-step process. Firstly, findings of the primary studies were rated according to their credibility. Only findings rated as unequivocal (meaning that there was no reasonable doubt that authors' findings were supported by original data) and credible (findings were plausibly or could be logically inferred from study data) were included. Study findings assessed as unsupported (no identifiable relationship between findings and data could be found) were excluded (Joanna Briggs Institute 2017). Afterwards, findings were grouped to produce a preliminary set of findings, and aggregated in categories based on similarity in meaning. Lastly, categories were meta-aggregated to create a set of synthesized findings.

Summary of Findings

The results of the quantitative and qualitative components were then aggregated following the JBI mixed methods review methodology. Firstly, the quantitative findings were converted into a narrative form. The newly identified narrative results were then categorized and summarized to create subcategories comparable with qualitative meta-synthesis findings. The sub-categories derived from the quantitative data were fit together with the qualitative meta-synthesis findings to generate a new set of synthesized findings organized as a set of recommendations or conclusions. Relationships and patterns between findings were traced, and the different sources of data were compared for critical data analysis.

Appraisal of Level of Evidence

The level of evidence for quantitative studies was assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system (Ryan and Hill 2016), that rates evidence in four grades: very low, low, moderate and high. To rank the results, an a priori rank is assigned to all findings based on the study design from which they are derived and then downgraded based on the risk of bias, inconsistency, indirectness, imprecision and publication bias of the studies included. The ConQual system was used to establish the confidence for qualitative evidence (Munn et al. 2014). Similarly to the GRADE system, qualitative evidence is ranked as very low, low, moderate, and high. After an initial ranking based on the type of paper included, the level of confidence is downgraded considering the dependability (appropriateness of the conduct of the research with research aims and purpose) and the credibility (findings classified as unequivocal, credible, or unsupported included in the synthesized findings) of the results (Joanna Briggs Institute 2017).

Results

A total of 321 citations were retrieved from the search carried out from the eight databases. Two papers were identified through the references lists of the included papers. Of the 323 records identified, 174 papers were duplicated and therefore excluded. The remaining 149 papers retrieved were independently screened by two reviewers and 125 were excluded after reading the title and abstract. The 24 articles considered as relevant were read full-text to look for consistency against the review aims and inclusion/exclusion criteria. After full-text reading 16 papers were excluded because COPD was not the main diagnosis, they addressed not standardized MBPs, or were not research papers (a list of the excluded papers with reasons is presented in Online Resource Table S3). The inclusion of papers was discussed between reviewers and disagreement was solved by the consultation of a third independent reviewer. Eight articles were then evaluated for final inclusion. After quality appraisal, one study was excluded due to poor methodological quality, not reaching the minimum score in the specific CAT (Benzo 2013). Finally, seven papers were included in the review. The literature search process is described in Fig. 1.

Characteristics of the Studies and Participants

Five studies were reported in the seven articles, published between 2009 and 2018. Of the five studies, one study was conducted in the United Kingdom (Malpass et al. 2015; 2018), two in Denmark (Farver-Vestergaard et al. 2018a; b), and two studies, reported in three papers, were from the US (Chan et al. 2015; Chan and Lehto 2016; Mularski et al. 2009).

Of the included papers, three were quantitative (Chan et al. 2015; Farver-Vestergaard et al. 2018a; Mularski et al. 2009), two qualitative (Malpass et al. 2015; 2018), and two mixed methods studies (Chan and Lehto 2016; Farver-Vestergaard et al. 2018b). The two mixed methods studies contributed separately to both the quantitative and qualitative data synthesis. Regarding the quantitative studies, three studies were RCTs (Chan et al. 2015; Farver-Vestergaard et al. 2018a; Mularski et al. 2009), one a pre-post intervention (Farver-Vestergaard et al. 2018b), and one an observational component of a mixed methods study (Chan and Lehto 2016).

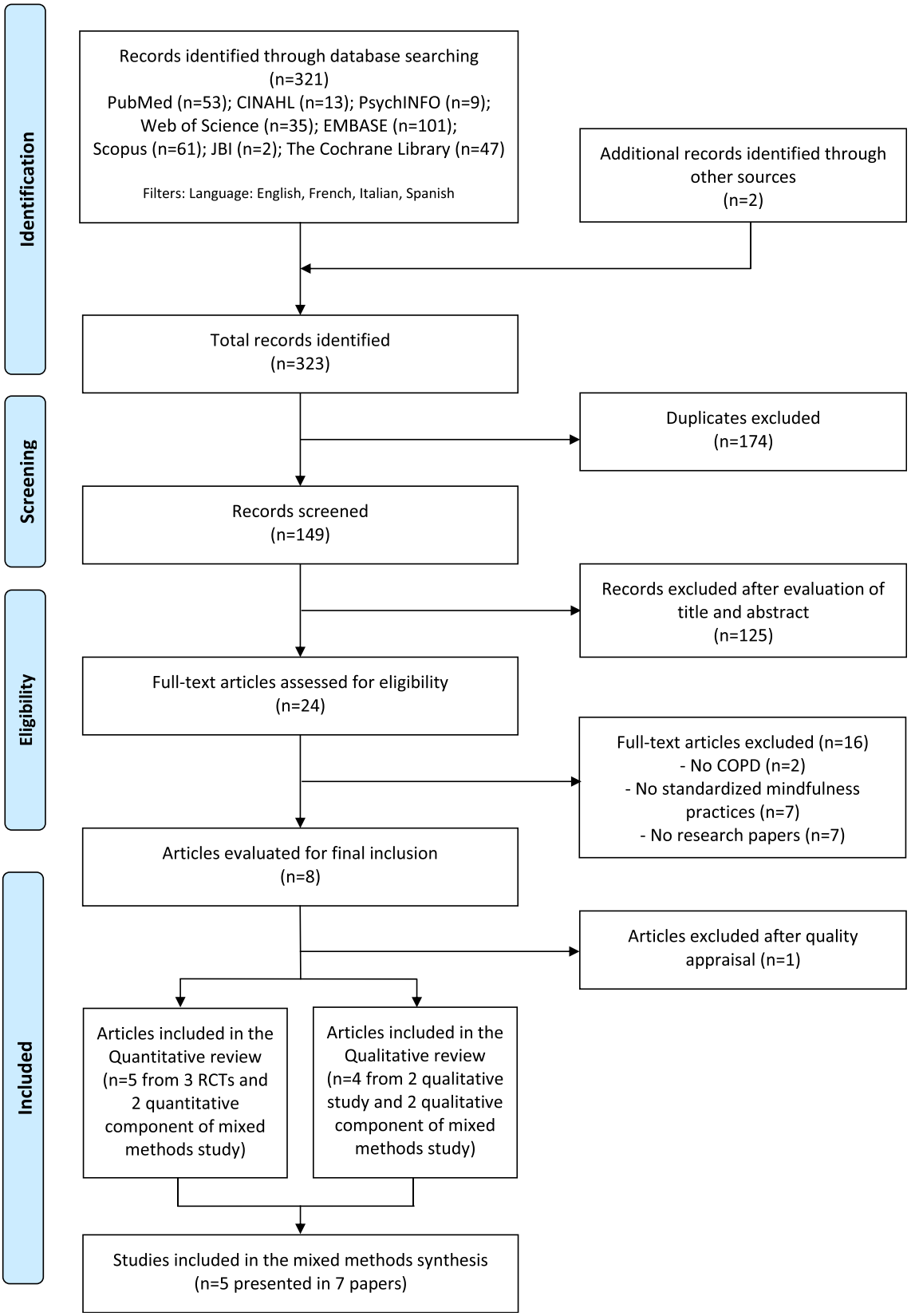

Fig. 1 Literature identification process

Among the four qualitative studies, three papers used a qualitative descriptive approach (Chan and Lehto 2016; Farver-Vestergaard et al. 2018a; Malpass et al. 2018) and one study used a phenomenological design (Malpass et al. 2015), which is a qualitative research approach that focuses on the meaning attributed by people to their own lived experiences (Creswell 2013).

A total of 264 subjects affected by COPD were studied, 219 subjects in the quantitative component of the review (sample range 8–86) and 45 in the qualitative meta-synthesis (sample range 5–32). Sparse information about participants' characteristics was reported. Most of the studies included male patients from moderate to very severe COPD, aged over 65; only a few studies reported the number of active smokers. All the studies were conducted in primary care settings.

Types of Mindfulness-Based Programs

In the studies identified, different MBPs were investigated. MBCT programs adapted to COPD were used in three studies. In one study, 8 weekly group meetings of 120 min each and 30 min of daily home practice were proposed, offering alternative meditation exercises to those based on breathing (Malpass et al. 2015; 2018). In another study the session time was reduced to 105 min as the program was provided as an add-on to a rehabilitation program (Farver-Vestergaard et al. 2018a). Finally, a tele-MBCT program was tested in one study consisting of eight weekly 120-min group-based videoconferences with daily home practice (Farver-Vestergaard et al. 2018b). Modified MBSR programs were used in the other two studies. In one study, the weekly class time was reduced to 60 min to take into consideration the fatigability of people with COPD, and a non-threatening focus on breath during the meditation exercises, together with Ujjayi breathing, QiGong, labyrinths and spiritual mantras were introduced into the program (Chan et al. 2015; Chan and Lehto 2016). Mularski et al. (2009) included relaxation training in the first 2 weeks of the standard 8-week MBSR program.

The MBPs were provided by trained mindfulness therapists (Malpass et al. 2018; 2015; Mularski et al. 2009), nurses (Chan et al. 2015; Chan and Lehto 2016), and clinical psychologists (Farver-Vestergaard et al. 2018a; b).

A detailed summary of the quantitative and qualitative studies included is presented in Table 1 and Table 2, respectively.

Effectiveness of Mindfulness-Based Programs in COPD

In the RCTs identified, the effect of MBPs was evaluated on several health outcomes, including psychological, such as anxiety, sensitivity to anxiety, depression, stress, quality of life and level of mindfulness, as well as physiological outcomes, such as dyspnea and respiratory symptoms, functional limitations, number of exacerbations and inflammatory response of biomarkers. In these studies, the MBP was compared with a passive control group (waiting list) (Chan et al. 2015), or active control group, including pulmonary rehabilitation (Farver-Vestergaard et al. 2018a) and support groups (Mularski et al. 2009). The characteristics of people attending or not attending the programs and the reasons for dropping out were also investigated in these studies as well as in an observational component of a mixed methods study (Chan and Lehto 2016).

Effects on Anxiety

Two studies considered the effect on anxiety. No statistically significant reduction of patients' anxiety was found in the groups following the MBPs (Farver-Vestergaard et al. 2018a; b). Also, no statistically significant effect on anxiety sensitivity, defined as the fear of anxiety-related sensations, was reported (Chan et al. 2015).

Effects on Depression

Among the two studies analyzing the effect on depression, only one study reported a statistically significant reduction of depressive symptoms in people attending a MBP associated to a pulmonary rehabilitation program, with greater depression reduction in younger people (Farver-Vestergaard et al. 2018a). No statistically significant effect on depression was found in the group treated with tele-delivered MBCT (Farver-Vestergaard et al. 2018b).

Effects on Stress

One study evaluated the effect on stress, reporting no reduction of its levels in the intervention group (Mularski et al. 2009).

Effects on Health-Related Quality of Life

Four studies assessed the effect of MBPs on health-related quality of life using general (Short Form-36), specific disease-related (COPD Assessment Test [CAT], St. George's Respiratory Questionnaire [SGRQ], and Chronic Respiratory Questionnaire [CRQ]), and symptom-related measurements (Memorial Symptom Assessment Scale [MSAS]). No statistically significant effect on quality of life was found (Chan et al. 2015; Farver-Vestergaard et al. 2018a; b; Mularski et al. 2009), except for the improvement of the management of emotions measured by CRQ in people with COPD attending more than six sessions of the MBP (Chan et al. 2015).

Table 1 Description of quantitative studies (in chronological order)

Article, country	Study design	Aim	Participants	Outcomes (instruments)	Interventions	Results	Narrative synthesis	**Quality appraisal**
Mularski et al. (2009) USA	RCT	To test the efficacy of MBBT intervention on improving symptoms and quality of life of people with COPD	COPD subjects = 86 (IG = 44, CG = 42) M = 85, F = 1 Age (mean ± SD) = 67.3 ± 9.6 Active smokers = 21 subjects (IG = 7, CG = 14) COPD GOLD stage: moderate = 36%, severe = 64%.	*Primary:* -Dyspnea (mBDS after 6MWT) -Disease-related quality of life (SGRQ) *Secondary:* -Symptom experience (MSAS) -Functional limitations (6MWT) -Health-related quality of life (VR-36) -Stress (PSS) -Level of mindfulness (5FMQ) -Exacerbation rates	*Intervention group:* MBBT program (8-weekly meetings and home daily practice derived from MBSR) conducted by trained instructors. *Control group:* support group (one-weekly meeting for 8 weeks with home-work). *Follow-up*: 8 weeks after the end of the MBBT program.	No significant differences in dyspnea (0.3, 95% *CI* = − 1.1; 1.7), disease-related quality of life (− 3.7, 95% *CI* = − 10.5; 3.1), symptom experience (− 0.3, 95% *CI* = − 9.2; 10.5), functional limitations (21.1, 95% *CI* = − 33.9; 81.3), stress (0.2, 95% *CI* = − 3.1; 3.6), mindfulness level (0.7, 95% *CI* = − 9.2; 10.5), and exacerbation rate ($p = 0.69$). 48% drop out in IG and 31% in CG (32% never attended and 18% dropped after the first session in IG; 24% never attended and 2% dropped after first session in CG). Reasons for dropout: transport difficulty (35%), competing time commitments (42%), worsening health status (29%), sessions considered weird (4%), not believing in mind/body technique (15%).	MBBT had no effect in improving respiratory function, quality of life, symptom experience, functional limitations, stress, exacerbation rates and mindfulness level. The participation was hampered by personal commitments, transport difficulties, worsening of health conditions, and program perceived as weird and unhelpful.	9/13
Chan et al. (2015) USA	RCT with wait list control group	To investigate the effect of a mindful meditation intervention adapted for persons with COPD on breathing parameters	COPD subjects = 41 (IG = 19, CG = 22) M = 14, F = 27 Age (mean ± SD) = 69.5 ± 7.9 COPD GOLD stage: mild = 2%, moderate = 37%, severe = 41%, very severe = 20%.	-Breathing parameters (plethysmographer) -Anxiety Sensitivity (ASI-3) -Symptom burden (CRQ = dyspnea, fatigue, emotional function, mastery in self-care scales) -Level of mindfulness (FMI) -Feasibility and acceptability (weekly journals)	*Intervention group:* mindful meditation program (8 weekly 60-min classes of meditation and mindful movement activities based on MBSR) conducted by expert nurse. *Control group*: waiting list *Follow-up*: 1 week after the end of the program.	Higher respiratory rate ($\eta^2 = 0.13$, $p = 0.05$) and lower mindfulness level in IG ($\eta^2 = 0.15$, $p = 0.02$). No differences in expiratory time†, variability of respiratory rate†, anxiety sensitivity†, CRQ dyspnea and fatigue scales†, CRQ emotional burden ($\eta^2 = 0.12$, $p = 0.06$) and CRQ self-care mastery ($\eta^2 = 0.11$, $p = 0.06$). In people attending ≥6 sessions ($n = 12$) no differences in respiratory rate† and other breathing parameters†, anxiety sensitivity†, and level of mindfulness†;	Mindful meditation program had no effect on respiratory parameters, anxiety sensitivity and COPD symptom burden. There was a slight effect on emotional burden in people attending more than six sessions. Participation in the program was hampered by worsening of health conditions and	8/13

Table 1 (continued)

Article, country	Study design	Aim	Participants	Outcomes (instruments)	Interventions	Results	Narrative synthesis	**Quality appraisal**
						improvement in CRQ emotional function in IG ($\eta^2 = 0.19$, $p = 0.03$). 37% dropouts. Reasons for dropout: health problems ($n = 3$), vacation ($n = 1$).	personal commitments.	
Chan and Lehto (2016) USA	Observational[a]	To examine emotional experiences in the adoption of a meditation-focused mind/body practice among persons with COPD.	COPD subjects = 41 M = 14, F = 27 Age (mean ± SD) = 69.5 ± 7.9 COPD GOLD stage: mild = 2%, moderate = 37%, severe = 41%, very severe = 20%.	-Symptom burden (CRQ = dyspnea, emotional function, fatigue and mastery in symptoms subscales) -Anxiety sensitivity (ASI-3)	Mindful meditation program (8 weekly 60-min classes of meditation and mindful movement activities based on MBSR) conducted by expert nurse	Non-attenders (≤ 1 class $n = 7$) at the program had significantly less mastery in managing symptoms ($p = 0.01$), emotional function ($p = 0.001$), reported more fatigue ($p = 0.02$), and higher social anxiety sensitivity ($p = 0.03$) than attenders (≥ 2 classes $n = 32$). Reasons for not attending: social activities that conflicted with class time, family obligations, and feeling that mind/body practice was not helpful.	COPD subjects who did not attend the program had more symptom burden and higher anxiety sensitivity. Attendance at the sessions was hampered by personal and family commitments and perception of mindfulness as unhelpful.	11/13
Farver-Vestergaard et al. (2018a) Denmark	Cluster RCT	To test the efficacy of MBCT as an add-on to a PR program in improving psychological distress and physical health impairment in COPD.	COPD subjects = 84 (IG = 45, CG = 39) M = 36, F = 48 Age (mean ± SD) = 67.2 ± 7.7 Active smokers = 28.4% FEV_1 (mean ± SD) = 37.7 ± 11.8	*Primary:* -Anxiety and depression (HADS) -Physical health status impairment (CAT) *Secondary*: -Daily physical activity (triaxial accelerometer) -Inflammatory cytokines (blood level of TNF-α, IL-6, IL-8, IL-17E and 18 s)	*Intervention group*: MBCT program (8-weekly 105-min group sessions) adapted to COPD, conducted by a clinical psychologist + PR program *Control group*: PR program (2 weekly sessions over an 8-week period) *Follow up*: end of the program; 3 and 6 months after the end of the program	Statistically significant reduction of depression in IG (HADS-D: Cohen $d = 0.26$, $p = 0.009$) up until 6 months. Moderating effect of age indicating a reduction of psychological distress in younger subjects (HADS-D: $d = 0.38$, $p = 0.01$). No significant reduction of anxiety (HADS-A: $d = 0.51$, $p = 0.136$). No improvement of physical health status (CAT: $d = 0.42$, $p = 0.06$) and physical activity level[†]. Significant increase only for TNF-α in CG ($p < 0.05$). Average IG attendance rate: 4.0 ± 2.74; 30.8% attended	MBCT combined with PR reduced depression, especially in younger people. No effect was found on physical health status and physical activity level, inflammatory response. Attendance was limited by lack of motivation, too demanding physical program, and conflict with personal commitments.	10/13

Table 1 (continued)

Article, country	Study design	Aim	Participants	Outcomes (instruments)	Interventions	Results	Narrative synthesis	**Quality appraisal**
						< 3. Reasons for non-attendance: conflicting schedule ($n = 3$), too physically demanding ($n = 5$), lack of motivation ($n = 2$), not enough participants ($n = 2$).		
Farver-Vestergaard et al. (2018b) Denmark	Quasi-experimental (pre-post intervention)[a]	To measure the effect of a tele-MBCT intervention on psychological distress and health status; to measure attendance rates; and perception of therapeutic working alliance	COPD subjects = 8 M = 4, F = 4 Age (mean ± SD) = 72.6 ± 9.9 COPD GOLD stage: moderate = 12.5%, severe = 62.5%, very severe = 25%.	-Anxiety and depression (HADS) - Physical health status impairment (CAT) - n. sessions attended - Perception of instructor-patient working alliance (WAI)	*Intervention*: tele-MBCT program (8-weekly 120-min group-based videoconference sessions, 20–30-min per day individual home practice) conducted by a psychologist. *Follow up*: at the end of program.	No significant reduction of anxiety and depression ($t(7) = 0.90$, $p = 0.399$) and improvement in physical health status ($t(7) = 1.587$, $p = 0.156$). WAI = 68.88 ± 10.72. No dropout. Average attendance rate = 7.5 ± 0.8.	Tele-MBCT produced no modification in anxiety, depression and physical impairment. The perception of working alliance was comparable to a face-to-face intervention. All participants completed the program with high attendance rate.	8/9

[a] Quantitative component of a mixed methods study

[†] *p* values not reported

5FMQ 5-Factor Mindfulness Questionnaire, *6MWT* 6-min walk test, *ASI-3* Anxiety Sensitivity Index-Revised, *CAT* COPD Assessment Test, *CI* confidence interval, *CG* control group, *COPD* chronic obstructive pulmonary disease, *CRQ* Chronic Respiratory Disease Questionnaire, η^2 eta square, *F* female, FEV_1 forced expiratory volume in the 1st second, *FMI* Freiburg Mindfulness Inventory, *GOLD* Global Initiative For Chronic Obstructive Lung Disease, *HADS* Hospital Anxiety and Depression Scale, *IG* intervention group, *M* male, *MBBT* mindfulness-based breathing therapy, *MBCT* mindfulness-based cognitive therapy, m*BDS* modified Borg Dyspnea Scale, *MBSR* mindfulness-based stress reduction, *MSAS* Memorial Symptom Assessment Scale, *PR* pulmonary rehabilitation, *PSS* Perceived Stress Scale, *RCT* randomized controlled trial, *SD* standard deviation, *SGRQ* Saint George Respiratory Questionnaire, *VAS* Visual Analog Scale, *VR-36* Short Form-36 for Veterans, *WAI* Working Alliance Inventory

Table 2 Qualitative included studies characteristics (in chronological order)

Article, country	Study design	Aim	Participants	Data collection	Data analysis	Mindfulness intervention	Study findings[a]	**Quality appraisal**
Malpass et al. (2015) UK (A)	Phenomenology	To explore the experiences of a MBCT course for patients living with COPD and asthma[c].	COPD subjects = 5 M = 4, F = 1 No COPD stages reported Setting: community	Individual interviews after 2 months from the end of the program.	Thematic analysis	MBCT program adapted to COPD (8 weekly 120-min sessions and 30-min home daily practice derived from MBSR) conducted by qualified teachers.	Greater acceptance and reduced sense of disease-related stigma (A1) Noticing subtle bodily sensations to detect early warning signs of breathlessness (A2) Linking pulmonary rehabilitation advice and mindfulness (A3) Greater sense of control (A4) Being creative around limitations (A5) Removing psychological barriers to being more active (A6)	8/10
Chan and Lehto (2016) USA (B)	Qualitative descriptive[b]	To examine emotional experience in the adoption of a meditation-focused mind/body practice among persons with COPD.	COPD subjects = 32 No sociodemographic and clinical data reported Setting: community	Personal journals and/or individual interviews conducted at the end of the program	Thematic analysis	Mindfulness meditation program (8 weekly 60-min classes of meditation and mindful movement activities using MBSR format) conducted by expert nurse	Barriers to practices: unable to suspend disbelief (B1); difficulties with self-care (B2); complexities of mindfulness (B3). Learning style: adapting (B4); accepting (B5); rejecting (B6). Emotional experiences: awareness of negative emotions (B7); awareness of positive emotions (B8); descriptions of emotional transitions (B9). Benefits of practicing meditation-focused mind/body skills: transformative (B10); improved physical symptoms (B11); improved self-care (B12).	7/10
Malpass et al. (2018) UK (C)	Qualitative descriptive	To characterize mindfulness attention that impacts on dyspnea perceptions and relate to the multidimensional model of dyspnea in COPD and asthma.[c]	COPD subjects = 5 M = 4, F = 1 No COPD stages reported Setting: community	Enquiry data from weekly sessions, individual interviews after 2 months from the end of the program.	Framework analysis	MBCT program adapted to COPD (8-weekly sessions and 30-min home daily practice) conducted by qualified teachers	Informative bare attention: being with the detail of sensory experience (C2) Re-directing attention to alternate sensory experience (C3)	6/10
Farver-Vestergaard et al. (2018b) Denmark (D)	Qualitative descriptive[b]	To explore the participants' individual experiences with tele-MBCT	COPD subjects = 8 M = 4, F = 4 Age (mean ± SD) = 72.6 ± 9.9 COPD GOLD stage: moderate = 12.5%, severe = 62.5%, very severe = 25%. Setting: community	Individual interview (face to face or by phone)	Thematic analysis	Tele-MBCT program (8 weekly 120-min group--based videoconference sessions and 20–30-min individual home practice), conducted by clinical psychologist	Changes in relating to unpleasant symptoms: attentional flexibility (D1); taking a pause (D2); acceptance (D3). Practical aspects of attendance: need for planning (D4); willingness and ability to participate (D5). Relational aspects: negative aspects of tele-based format (D6); positive aspects of tele-based format (D7).	8/10

[a] Only the credible and unequivocal study findings are listed

[b] Quantitative component of a mixed methods study

[c] Only data about COPD patient were extracted

COPD chronic obstructive pulmonary disease, *F* female, *M* male, *MBCT* mindfulness-based cognitive therapy, *MBSR* mindfulness-based stress reduction, *CAT* critical appraisal tool, *SD* standard deviation, *GOLD* Global Initiative For Chronic Obstructive Lung Disease

Effects on Level of Mindfulness

Two studies investigated increase in the level of mindfulness acquired through the practice of mindfulness, using two different instruments, the Freiburg Mindfulness Inventory (Chan et al. 2015) and the 5-Factor Mindfulness Questionnaire (Mularski et al. 2009), but no statistically significant modifications were found in the intervention group.

Effects on Respiratory Symptoms and Pulmonary Function

Two RCTs tested the effect of mindfulness on the patients' respiratory symptoms and pulmonary function, assessing dyspnea through the modified Borg scale or breathing parameters through a plethysmograph. The effectiveness of MBPs was not supported (Chan et al. 2015; Mularski et al. 2009).

Effects on Functional Limitations

Daily physical activities and movement limitations were assessed in two studies using the triaxial accelerometer or the 6-min walk test, and no modifications were reported in people attending the programs (Farver-Vestergaard et al. 2018a; Mularski et al. 2009).

Effects on Exacerbations and Markers of Inflammation

One study assessed the possible influence of MBPs on the occurrence of exacerbations showing no effect (Mularski et al. 2009). Another study explored the effect on pro-inflammatory cytokine response and found no modification induced by MBP (Farver-Vestergaard et al. 2018a).

Program Attendance and Dropout

Rates of attendance to mindfulness classes and dropouts were evaluated in all studies. Dropout rates varied from 37% (Chan et al. 2015) to 48% (Mularski et al. 2009), except for the tele-delivered program where all the eight participants completed the program (Farver-Vestergaard et al. 2018b). The main reasons for not completing the program or skipping classes were: the worsening of participants' health conditions (Chan et al. 2015; Mularski et al. 2009); personal and family commitments not compatible with the time required for the program attendance and the daily home practice (Chan et al. 2015; Chan and Lehto 2016; Farver-Vestergaard et al. 2018a; Mularski et al. 2009); perception of weirdness and unhelpfulness of the MBPs (Chan and Lehto 2016; Mularski et al. 2009). Practical issues, such as difficulty in reaching the site where the program was delivered (Mularski et al. 2009), lack of motivation, and the programs perceived as too physically demanding were also reported as reasons for non-attending (Farver-Vestergaard et al. 2018a).

Meta-synthesis

From the four qualitative papers included in the review, 29 study findings were extracted. Two study findings were excluded as they did not address COPD subjects. The remaining findings were classified as unequivocal or credible (see Online Resource Table S4). The 27 study findings were aggregated in 14 categories that were merged into the following four synthesized findings: (1) people with COPD perceive that mindfulness-based programs improve their psychological and emotional well-being; (2) people with COPD perceive that mindfulness can promote a sense of control over physical manifestations of the disease; (3) people with COPD can present cultural, practical, and psychological barriers against practicing mindfulness; and (4) the modes of delivery of the mindfulness-based program can influence participation in and adherence to the practice by people with COPD (Table 3).

People with COPD Perceive That Mindfulness-Based Programs Improve Their Psychological and Emotional Well-being

MBPs were perceived by people affected by COPD as helpful in improving their psychological and emotional well-being, leading to a reduction of the manifestation of distress and difficult emotions linked to the disease, such as stress and anxiety, and an increased ability to cope with them (Chan and Lehto 2016). Also, they report that mindfulness practice helped them to develop a feeling of compassion towards themselves as well as towards other people (Chan and Lehto 2016). Moreover, they believed that mindfulness promoted active acceptance of their disease (Chan and Lehto 2016; Farver-Vestergaard et al. 2018b; Malpass et al. 2015). The coping skills acquired through mindfulness practice also contributed to improve their perception of mental and emotional well-being (Chan and Lehto 2016; Malpass et al. 2015).

People with COPD Perceive That Mindfulness Can Promote a Sense of Control over Physical Manifestations of the Disease

People with COPD reported that mindfulness helped them to feel less burdened and threatened by their breathing difficulties, resulting in a general benefit. The practice of mindfulness was perceived as useful in providing tools to control respiratory issues and improve dyspnea management (Chan and Lehto 2016; Farver-Vestergaard et al. 2018b; Malpass et al. 2015). Furthermore, they reported that MBP improved the awareness of their physical sensations and helped them promptly identify signs and symptoms of dyspnea and to reduce the trigger of negative emotions, resulting in an improvement of the management of acute events (Farver-Vestergaard et al. 2018b; Malpass et al. 2015; Malpass et al. 2018). People stated that mindfulness training helped them remove the

Table 3 Synthesized findings, categories, and findings extracted from the included studies

Synthesized findings	Categories	Study findings
People with COPD perceive that mindfulness-based programs improve their psychological and emotional well-being. This synthesized finding describes the psychological and emotional benefits perceived by people with COPD from the mindfulness practice (such as reduction of distress, improvement of positive emotions, positive coping skills and disease acceptance).	Mindfulness-based program helps COPD people perceive lower psychological distress	Benefits of practicing meditation-focused mind/body skills: improved self-care (Chan and Lehto 2016; B12)
		Learning style: accepting (Chan and Lehto 2016; B5)
	Mindfulness-based program promotes compassion for self and others	Emotional experiences: awareness of positive emotions (Chan and Lehto 2016; B8)
		Benefits of practicing meditation-focused mind/body skills: Transformative (Chan and Lehto 2016; B10)
	Mindfulness-based program contributes to increase the perception of COPD acceptance	Changes in relating to unpleasant symptoms: acceptance (Farver-Vestergaard et al. 2018b; D3)
		Emotional experiences: descriptions of emotional transitions (Chan and Lehto 2016; B9)
		Greater acceptance and reduced sense of disease-related stigma (Malpass et al. 2015; A1)
	Mindfulness-based program increases the perception of ability in coping	Being creative around limitations (Malpass et al. 2015; A5)
		Learning style: adapting (Chan and Lehto 2016; B4)
People with COPD perceive that mindfulness can promote a sense of control over physical manifestations of the disease. This synthesized finding describes the perception of have a greater control in recognition and management of symptoms (such as dyspnea, physical activity and symptoms recognition) that derives from practicing mindfulness.	Mindfulness-based program helps to perceive a sense of control on respiratory symptoms	Changes in relating to unpleasant symptoms: taking a pause (Farver-Vestergaard et al. 2018b; D2)
		Benefits of practicing meditation-focused mind/body skills: improved physical symptoms (Chan and Lehto 2016; B11)
		Greater sense of control (Malpass et al. 2015; A4)
	Mindfulness-based program improves the perception of being able to be physical activity	Removing psychological barriers to being more active (Malpass et al. 2015; A6)
	Mindfulness-based program improves symptoms awareness	Noticing subtle bodily sensations to detect early warning signs of breathlessness (Malpass et al. 2015; A2)
		Changes in relating to unpleasant symptoms: attentional flexibility (Farver-Vestergaard et al. 2018b; D1)
		Informative bare attention: being with the detail of sensory experience (Malpass et al. 2018; C2)
People with COPD can present cultural, practical, and psychological barriers against practicing mindfulness. This synthesized finding describes the barriers perceived by people with COPD that interfere with attending mindfulness programs and practicing mindfulness. The barriers can be related to negative emotions elicited by the practice, difficulty in understanding mindfulness meaning and the interference of the practice with daily activities.	Psychological barriers to practice mindfulness-based program	Emotional experiences: awareness of negative emotions (Chan and Lehto 2016; B7)
		Learning style: rejecting (Chan and Lehto 2016; B6)
	Cultural barriers to understand mindfulness meaning	Barriers to meditation-focused mind/body practices: complexities of mindfulness (Chan and Lehto 2016; B3)
		Barriers to meditation-focused mind/body practices: unable

Table 3 (continued)

Synthesized findings	Categories	Study findings
		to suspend disbelief (Chan and Lehto 2016; B1)
	Practical barriers to practice mindfulness-based program	Barriers to meditation-focused mind/body practices: difficulties with self-care (Chan and Lehto 2016; B2)
The modes of delivery the mindfulness-based programs can influence participation in and adherence to the practice by people with COPD. This synthesized finding describes the characteristics of different ways of provision of mindfulness-based programs that can be perceived as obstacles or incentives in attending the program and practicing mindfulness.	Mindfulness-based program combined with pulmonary rehabilitation can facilitate the implementation of practice	Linking pulmonary rehabilitation advice and mindfulness (Malpass et al. 2015; A3)
	Web-based mindfulness program presents advantages	Practical aspects of attendance: need for planning (Farver-Vestergaard et al. 2018b; D4)
		Relational aspects: positive aspects of tele-based format (Farver-Vestergaard et al. 2018b; D7)
		Practical aspects of attendance: willingness and ability to participate (Farver-Vestergaard et al. 2018b; D5)
	Web-based mindfulness program presents disadvantages	Relational aspects: negative aspects of tele-based format (Farver-Vestergaard et al. 2018b; D6)
	Specific techniques of mindfulness are preferred by COPD patients	Re-directing attention to alternate sensory experience (Malpass et al. 2018; C3)

A = Malpass et al. 2015; B = Chan and Lehto 2016; C = Malpass et al. 2018; D = Farver-Vestergaard et al. 2018b. The number beside the capital letter indicates the order in which the study findings were reported in the original article

psychological barriers that impeded them from performing physical activities, such as walking for long distances (Malpass et al. 2015).

People with COPD Can Present Cultural, Practical, and Psychological Barriers Against Practicing Mindfulness

People with COPD described different factors that could hamper attendance at mindfulness classes and the daily practice at home. The practice of mindfulness could elicit negative emotions in people with COPD, such as feelings of guilt or connections with past unresolved issues (Chan and Lehto 2016). Also, they could present cultural preconceptions against mind/body practice or non-pharmacological complementary treatments in general, questioning the real effectiveness or usefulness of MBPs (Chan and Lehto 2016). Some people reported having developed this skepticism during the course of the program, due to the lack of the immediate results they had expected, or to their perception of not being able to meditate correctly, and for this reason they gradually abandoned the classes (Chan and Lehto 2016). Moreover, patients reported difficulties in reproducing at home the practices proposed during the group sessions, increasing their sense of inadequacy and frustration, and leading them to believe they were wasting their time, and to consider mindfulness useless outside of the class (Chan and Lehto 2016). The mindfulness practice also could interfere with their personal and family commitments, leading them to postpone or interrupt the practice or the classes (Chan and Lehto 2016).

The Modes of Delivery the Mindfulness-Based Program Can Influence Participation in and Adherence to the Practice by People with COPD

People with COPD reported that the ways the MBP was offered, and its conditions, could encourage or discourage the attending of mindfulness classes. They believed, for example, that offering a MBP together with a pulmonary rehabilitation program could promote participation in and acceptance of the mindfulness program as well as improving the mastery of the breathing exercises taught in the rehabilitation program (Malpass et al. 2015). The duration of each mindfulness class (120-min) and the length of the whole program (8 weeks) could present obstacles to complete attendance (Malpass et al. 2015). People with COPD believed that web-based MBPs could improve class participation and adherence to practice. The possibility of remaining at home, but at the same time being in contact with other people was greatly appreciated (Farver-Vestergaard et al. 2018b). On the other hand, due to technical problems occurring during the sessions, people often

perceived a disturbed interaction with instructors and other people in the group that impeded the creation of a trusting atmosphere (Farver-Vestergaard et al. 2018b). For the creation of such atmosphere, some people preferred a program delivered face-to-face with direct interaction between instructor and other participants, to contact mediated by technology (Farver-Vestergaard et al. 2018b). Lastly, people with COPD appreciated the pratice of re-directing attention from their chest to another part of the body, since focusing on their breathing could intensify their experience of disconfort (Malpass et al. 2018).

Level of Evidence

The quality of evidence informing the outcomes of the experimental and quasi-experimental studies was assessed using the GRADE system. All outcomes received a ranking of 'very low' or 'low' level of evidence due to risk of bias, insufficient sample size to meet optimal information size in the studies considered; and, in the case of depression, due to a statistical heterogeneity between positive and negative treatment effects (Table 4). The quality of evidence for three synthesized findings assessed using the ConQual grading system received moderate ranking due to the downgrading of the dependability criterion by one level, and one synthesized finding was ranked low due to the downgrading of the dependability and credibility criteria (Table 4).

Mixed Methods Synthesis

A single study with a very low level of evidence showed the effect of a MBP incorporated in a pulmonary rehabilitation program on depressive symptoms, especially in younger people. No evidence of measurable changes in the level of anxiety, stress, respiratory functions and other physiological outcomes was found. Thus, to date, no recommendation on the use of MBPs could be derived. Despite the absence of evidence of the effectiveness of MBPs, people with COPD attending the programs perceived that mindfulness gives them greater sense of control over the psychological, emotional and physiological manifestations of the disease. Participation in and completion of the MBP appeared to be particularly challenging due to several cultural, practical, and psychological obstacles, such as prejudices against mindfulness, interference with personal and family commitments and difficulty in practicing mindfulness. Furthermore, the characteristics of the mindfulness-based protocols and the different conditions of the specific program and modes of delivery could impede or encourage program attendance. In particular, the length of the 2-month programs and 120-min classes could hamper the attendance of people with unstable health conditions and functional limitations due to the long-term commitment and the effort of traveling to the sites where the program is offered. MBPs delivered via the web seem more favorable to facilitating participation by people with COPD.

Discussion

The present mixed methods review synthesized and combined quantitative evidence on the effectiveness of MBPs with qualitative evidence on the experiences of mindfulness practice in people affected by COPD. MBPs were developed to help people manage their psychological issues and their emotional self-regulation (Tang and Leve 2016). These programs have also been proposed to reduce the repercussions of chronic illnesses at the psychological and emotional level, which can lead to distress, anxiety and depression (Demarzo et al. 2015). Indirect positive effects on physiological outcomes are also expected, as psychological and emotional distress can influence physiological functions.

Previous literature has shown conflicting evidence on the effectiveness of MBPs on psychological and physiological outcomes in chronic conditions (Abbott et al. 2014; Lauche et al. 2013; Simpson et al. 2014; Veehof et al. 2016) and in respiratory diseases in particular (Harrison et al. 2016). In our review, no evidence was found of reduction of anxiety levels in people with COPD. Only a single randomized clinical trial showed that a MBP added to pulmonary rehabilitation was associated with reduced depression score compared to pulmonary rehabilitation alone, but the MBP was not associated with any improvement in other outcomes (Farver-Vestergaard et al. 2018a). Despite the increased interest in MBPs, our review showed that the number of RCT studying the effects of MBPs in the COPD population is surprisingly low. This could be due to the difficulty in recruiting this population and obtaining long-term participation in the program. Further research with large samples should be conducted to reveal the effectiveness of MBPs on COPD as well to compare the effects of MBPs on different chronic lung diseases, such as asthma and bronchiectasis. Also, further research comparing short and long interventions is needed in order to understand the benefits of MBPs of different lengths for COPD people.

In the qualitative studies identified in our review, a few participants reported to perceive some benefit from mindfulness practice on anxiety, stress and breathlessness. In people with COPD, anxiety and dyspnea are strictly interconnected as an episode of dyspnea can generate anxiety and anxiety can increase breathlessness (Coventry et al. 2013). This favorable perception could be explained as mindfulness training permits people with COPD to recognize the signs of dyspnea promptly and develop an ability to stay in the present moment, which leads to a disidentification from the strong emotions that occur with an improvement in the capacity to manage the breathlessness, facilitating a return to normal breathing (Pooler and Beech 2014). Common instruments used to measure anxiety,

Table 4 Summary of grade of evidence derived from quantitative findings and qualitative synthesis

Outcome	N. participants (significant studies)	N. participants (not significant studies)	GRADE	Comments
Anxiety	–	92 (1 RCT, 1 QE)	●○○○ VERY LOW	Findings not derived only from RCT. Downgraded one level due to[a, c]
Anxiety sensitivity	–	41 (1 RCT)	●●○○ LOW	Downgraded one level due to[a, c]
Depression	84 (1 RCT)	8 (1 QE)	●○○○ VERY LOW	Findings not derived only from RCT. Downgraded one level due to[a, b, c]
Stress	–	86 (1 RCT)	●●○○ LOW	Downgraded two levels due to[a, c]
Level of mindfulness	–	127 (2 RCTs)	●●○○ LOW	Downgraded two levels due to[a, c]
Health-related quality of life	–	219 (3 RCTs, 1 QE)	●○○○ VERY LOW	Findings not derived only from RCT. Downgraded two levels due to[a, c]
Respiratory function	–	41 (1 RCT)	●●○○ LOW	Downgraded two levels due to[a, c]
Dyspnea	–	86 (1 RCT)	●●○○ LOW	Downgraded two levels due to[a, c]
Functional limitations	–	170 (2 RCTs)	●●○○ LOW	Downgraded two levels due to[a, c]
Number of exacerbations	–	86 (1 RCT)	●●○○ LOW	Downgraded two levels due to[a, c]
Inflammatory response	–	84 (1 RCT)	●●○○ LOW	Downgraded two levels due to[a, c]
Synthesized findings	**Dependability**	**Credibility**	**ConQual score**	**Comments**
People with COPD perceive psychological and emotional improvements from mindfulness-based programs	Moderate	Downgrade one level	●●○○ LOW	Dependability downgraded one level as only 2–3 criteria were positive. Credibility downgraded one level due to mix of unequivocal/credible findings.
People with COPD perceive positive effects of mindfulness-based programs over physical manifestations of the disease.	Moderate	High	●●●○ MODERATE	Dependability downgraded one level as only 2–3 criteria were positive.
People with COPD can present cultural, practical, and psychological barriers in practicing mindfulness.	Moderate	High	●●●○ MODERATE	Dependability downgraded one level as only 2–3 criteria were positive.
The modes of implementation of mindfulness-based programs can influence participation by people with COPD	Moderate	High	●●●○ MODERATE	Dependability downgraded one level as only 2–3 criteria were positive.

[a] Most information used to generate the summary estimate of effect from studies at 'uncertain' rather that 'low' risk of bias

[b] Statistical heterogeneity between positive and negative treatment effects

[c] Insufficient sample to meet optimal information size criteria

RCT randomized control trial, *QE* quasi experimental study, *COPD* chronic obstructive pulmonary disease

even if well validated, might not capture such modifications on level of anxiety. The symptoms of anxiety are heterogeneous and variable over the time, and in people with a chronic disease, symptoms of anxiety can overlap with those of people with anxiety disorders (Rose and Devine 2014). For this reason, qualitative evidence could be more sensitive in capturing

these emotional manifestations than objective instruments. Future research should consider combining subjective experiences with objective instruments in order to measure more accurately the changes in anxiety symptoms (Bandelow et al. 2017). The absence of measurable effects on pulmonary function assessed through respiratory parameters after participation in an MBP can be justified by the fact that the level of airway obstruction in COPD is not modifiable, but mindfulness practice can help people implement different ways of responding to dyspnea events, deactivating the vicious circle dyspnea-anxiety-dyspnea (Hartley and Phelps 2012).

The appreciation of MBPs on the part of people with COPD, in the absence of evidence supporting their effectiveness, can also derive from the mental predisposition of the people attending the course. Malpass et al. (2015) noticed that the ability to be mindful was not influenced by the number of sessions attended by participants. This reinforces the idea that mindfulness practice is more suitable for people with a natural predisposition to meditation and introspection. In the studies identified in our review, participants reported that they did not understand what mindfulness really was or had preconceptions towards mindfulness. Understanding what people think about mindfulness before program implementation could offer to researchers the opportunity to provide more appropriate information about MBPs to increase people's participation (Harrison et al. 2017).

One of the most problematic issues in the RCTs identified in our review was the small sample sizes and higher dropout rates that reduced their statistical power. Several personal barriers led people to drop out from or limit attendance at mindfulness classes. The most frequently reported one was the big investment of time required by the weekly sessions and the daily mindfulness practice at home. Consequently, shorter MBPs could lead to higher participation rates and adherence to practice sessions. There is evidence that even a brief mindfulness practice of at least 10 min can change underlying brain processes (Moore et al. 2012). Although shorter programs could be more easily accepted by individuals with chronic conditions, longer guidance would always be necessary to support the regular daily practice (Howarth et al. 2016). Home support for people with COPD, who are usually old, with a high comorbidity and exacerbation rate, can help them maintain mindfulness practice over time. Even though shorter programs could be more feasible and acceptable, they might be less effective, particularly in improving long-term outcomes, such as self-management, in people with long-term conditions (Gawande et al. 2019). Self-management is of great interest in COPD, since it could improve health-related quality of life, dyspnea, and reduce hospital admissions (Zwerink et al. 2014). Studies should be conducted to assess the long-term effects of mindfulness, as well as studies evaluating different modes of mindfulness implementation, such as apps for promoting mindfulness based on evidence-based framework (Owens et al. 2018).

Furthermore, it could be useful to consider the best timing for proposing MBPs. Individuals with COPD after an exacerbation could be more motivated to participate in MBPs and consequently obtain greater benefits from their participation (Jin et al. 2008). Also, a MBP could be a meaningful addition at a pulmonary rehabilitation program, as patients after an exacerbation could find the physical exercises challenging; thus, MBPs could help to increase pulmonary rehabilitation success (Puhan and Lareau 2014). It is also important to identify the right outcome at the right time-point: for example, stress reduction could be a more appropriate outcome immediately after an exacerbation, whereas depression decrease could be achievable in a more stable phase of the disease.

In the studies included, no distinction was made between individuals with COPD that were tobacco smokers (actual or former) and those who had never smoked, and thus, no information on the effects of MBPs on the smoker COPD population could be derived. Tobacco smokers present different psychological profiles and lower self-regulation with respect to non-smokers, and thus MBPs could have different effects on these two populations. Research has showed, for example, that mindfulness training is able to increase long-term abstinence rates in smokers (Oikonomou et al. 2017). Further research could be relevant to understand if COPD tobacco smokers are those with a lower retention rate in the programs, and are more willing to attend short programs due to their higher impulsivity.

It is important to point out that modified versions of MBSR and MBCT standard protocols were used in the programs comprised in this review. The heterogeneity of the programs investigated and the different adaptations of the original protocols to COPD prevent any direct comparison of one intervention with another. In addition, the changes made to the protocols have not led to the hoped-for effects. People have often criticized the length of the original protocol, but the changes made often meant a further increase in the length or burden of the session, as, for example, joining an MBP session onto pulmonary rehabilitation sessions (Farver-Vestergaard et al. 2018a). Further studies should be done, comparing these modified protocols with the original MBSR and MBCT protocols, and investigating which protocols are most suitable for this population.

This review has some limitations. First, the studies identified were conducted in the US and Northern Europe, limiting the generalizability of our results to other countries. Secondly, due to the limitations of the databases screened and languages selected, papers offering further results could have been excluded. The mutual influence between dyspnea and psychological and emotional status was not evaluated in some of the studies included and, when assessed, these two factors were investigated separately. For this reason, it was not possible to determine the connection between mindfulness and the psychosomatic aspects of COPD.

This systematic review showed that there is no evidence of effectiveness of MBPs in people suffering from COPD. Several conditions can obstacles the implementation and the attendance of MBPs. Further methodologically sound studies with bigger sample sizes and with coherent outcome measures are needed to verify the effectiveness of mindfulness in COPD populations as well as further qualitative studies, to understand the experiences of people with COPD attending MBPs. Due to fluctuations in COPD symptoms and difficulties in leaving the house, alternative modes of offering mindfulness training, such as shorter overall program duration, or the duration of each session, and web-based formats, should be tested to facilitate attendance at the program. Moreover, follow-ups could be introduced to help people with COPD to maintain mindfulness practice over time and promote MBPs effectiveness.

Acknowledgments This review was supported by the *Centro di Eccellenza per la Cultura e la Ricerca Infermieristica* (CECRI) of Rome, Italy.

The authors thank the librarian Barbara Martin (University of Torino) for the help provided in the literature search as well as Enrica Borla for the help provided in database checking. We are also grateful to Dr. Simone Scarlata for the suggestion provided for the description of chronic lung diseases.

Authors' Contributions MC was responsible for the conception, design of the review, analysis and interpretation of data, and drafted the manuscript. AC contributed to data analysis and interpretation. RF contributed to the data acquisition and interpretation. AR revised the paper critically in terms of theory and argument. MM contributed to the design of the review, data interpretation, and drafting of the manuscript. All authors approved the final version of the manuscript for submission.

Compliance with Ethical Standards

Ethical Approval This article does not contain any studies with human participants performed by any of the authors.

Conflict of Interest The authors declare that they have no conflict of interest.

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