Received: 6 January 2020 | Revised: 4 June 2020 | Accepted: 26 June 2020

DOI: 10.1111/jan.14505

REVIEW

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The effects of nurse-driven self-management programs on chronic obstructive pulmonary disease: A systematic review and meta-analysis

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Funding information
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Abstract

Aims: To analyse the effects of nurse-driven self-management (SM) programs on physical and psychosocial health variables in people with chronic obstructive pulmonary disease (COPD).

Design: A systematic review and meta-analysis.

Data Sources: An exhaustive scanning of PubMed, Cochrane Controlled Register of Trials, CINAHL, ScienceDirect and Medline databases between January 2010–December 2019 was conducted for this meta-analysis.

Review Methods: Randomized controlled trials (RCTs) related to nurse-driven SM programs in COPD population were included. The standardized mean differences with 95% confidence intervals were determined for the main variables and heterogeneity was analysed using the I^2 test. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) was used.

Results: Twelve studies were included. The results indicated that significant difference in physical health scores based on COPD Assessment Tool (CAT) and walking distance according to the 6-min walk distance (6MWD) test in the intervention groups compared with the control groups. About psychosocial health findings, the quality of life increased and the Hospital Anxiety and Depression Scale (HADS) scores decreased following SM programs. All of the studies had good quality (varying from 5–8 points) according to The Modified Jadad Scale.

Conclusion: Nurse-driven SM programs may contribute to prognosis in patients with COPD. Due to methodological weaknesses in the included trials, high-quality RCTs are needed to better determine the effects of nurse-driven SM programs in the management of COPD. Nurse-driven SM programs may be employed as a useful strategy to improve health status and QOL and psychosocial health in the COPD population, as well.

Impact: Current evidence shows that nurse-driven SM programs could be safely integrated into the clinical practice for patients with COPD. Future studies are warranted that evaluating the effects of nurse-driven SM programs on other frequently observed COPD symptoms such as dyspnoea, fatigue and sleep disturbance.

KEYWORDS

meta-analysis, nurse, nursing, pulmonary disease, self-care, self-management

1 | INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is the third cause of death in worldwide, associated with the progressive airflow obstruction that interferes with normal breathing (GOLD, 2019). COPD may develop the influence of individual, genetic and environmental factors including age, alcohol use, occupational exposure, repeated infections, lower income level, whereas the most frequent reason is the smoking (Eisner et al., 2010; Llordés et al., 2015). As the disease progresses, patients with COPD experience important symptom burden including shortness of breath, coughing, fatigue, mucus hypersecretion, eating difficulties due to gastric problems, indigestion, loss of appetite, weakness in muscles, sleep disturbance, anxiety, depression and deterioration in the health status (Gruenberger, Vietri, Keininger, & Mahler, 2017; Kentson et al., 2016; Marvel, Yu, Wood, Higgins, & Make, 2016; Sinha, Nalli, & Toppo, 2017). The repetitive clinical exacerbation restricts the patients' daily living activities, increases their dependence on family members and also deteriorates their quality of life (QOL) in the course of time (Dürr et al., 2014; Gruenberger et al., 2017).

In addition to the conventional treatments, self-management (SM) programs have been used as a complementary method for the management of chronic diseases like hypertension, heart failure, diabetes and kidney failure in recent years (Smeulders et al., 2010; Wong, Chow, & Chan, 2010). In COPD, which is one of the chronic diseases, SM programs have been used to adopt healthy lifestyles, reduce symptom burden and improve QOL of patients (Baker & Fatoye, 2017). Considering the literature search, the authors have found that many systematic review and meta-analysis related to the efficiency of SM programs, however, none of them have not focused on solely nurse-driven SM programs and their effects on COPD population.

1.1 | Background

Self-management programs have become popular in line with the rapid increase in chronic diseases over the world. These programs intend to create behavioural changes in patients and thus, provide contributions for better management of chronic diseases (Effing et al., 2016; Kaptein, Fischer, & Scharloo, 2014). In the literature, self-care, self-efficacy, self-regulation, patient education and counselling terms have also been used instead of SM programs. However, self-care is the actional dimension of SM, whereas self-regulation is related to effective management of the thoughts, emotions or behaviour. Furthermore, SM programs aim to increase the knowledge level of patient by providing detailed information on related chronic disease in clinical practice (Effing et al., 2016; GOLD, 2019). Self-management programs are also used to alleviate symptom burden, physical and psychosocial consequences and to adapt patients about lifestyle changes, as well as developing individual skills and increasing patient's responsibility for healthcare decisions (Effing et al., 2016; Hillebregt, Vlonk, Bruijnzeels, van Schayck, & Chavannes, 2017). These programs employ interventions such as more adherence to conventional medications, regular exercise programs, energy conservation techniques, specific nutrition protocols, individual behavioural counselling for smoking cessation and effective stress management strategies (Hillebregt et al., 2017; Jolly et al., 2018; Walters et al., 2013).

Self-management programs are conducted by a multidisciplinary team including general practitioner, physiotherapist, nurse, social worker and psychologist. Nurses take part in SM programs and fulfil important duties especially in long-term care programs (Coster and Norman, 2009). Moreover, experienced nurses in pulmonary diseases take important responsibilities including preparing content of specific education programs, training the patients about deep-breathing exercises, exacerbation management, observing disease's symptoms and increasing the patients' level of knowledge on disease (Baker & Fatoye, 2018; Billington, Coster, Murrells, & Norman, 2015; Coultas, Frederick, Barnett, Singh, & Wludyka, 2005). Although many systematic review and meta-analysis have evaluated the effects of multidisciplinary team approach on COPD symptoms, none of these studies have conducted on the effects of nurse-driven SM programs on physical and psychosocial health variables in COPD (Gillespie et al., 2013; Trappenburg et al., 2011). Therefore, to our knowledge, this is the first systematic review and meta-analysis that attempted to provide an overview and assessment of the quality of the studies that investigating the effects of nurse-driven SM programs on physical and psychosocial health variables among COPD patients.

2 | THE REVIEW

2.1 | Aim

The aims of this systematic review and meta-analysis (a) to analyse the effects of nurse-driven SM programs on physical and psychosocial health variables in COPD population; and (b) to present an overview and assessment of the quality of the randomized controlled trials (RCTs). To reveal the current evidence related to physical health (health status, maximum speed of expiration, walking distance) and psychosocial health (QOL, anxiety–depression, self-efficacy) among patients with COPD may prove efficacious in the management of COPD symptoms.

2.2 | Design

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Checklist was used as a guideline while preparing the report of review (Moher, Liberati, Tetzlaff, & Altman, 2009). In this meta-analysis, characteristics of participants (mean age, gender, COPD stage); study methods (method of randomization, allocation concealment, blinding); intervention details (content, frequency, duration); and variables (instruments) and results (means, SDs, *t* or *p* values, effect size) were specifically analysed.

2.3 | Search methods

Studies published between January 2010–December 2019 were searched in PubMed, Cochrane Controlled Register of Trials (CENTRAL), Cumulative Index to Nursing and Allied Health Literature (CINAHL), ScienceDirect and Medline. The search strategy was guided by the Population, Intervention, Comparator and Outcome (PICO) framework (Schardt, Adams, Owens, Keitz, & Fontelo, 2007). The framework included patient, population or problem (P), intervention or exposure (I), comparison or control (C) and outcome (O). This meta-analysis focused on 'Chronic Obstructive Pulmonary Disease' and 'nurse'. The studies testing the effects of nurse-driven SM programs in COPD population and had an RCT design were analysed in this meta-analysis. Considering the outcomes (O), this meta-analysis investigated studies reporting physical and psychosocial health variables needed to calculate an effect size such as mean, standard deviations (SDs) and t or p values. After determining the steps in the PICO framework, the following keywords were used for all the databases: (a) 'Chronic Airflow Obstruction' OR 'Chronic Obstructive Airway Disease' OR 'Chronic Obstructive Lung Disease' OR 'Chronic Obstructive Pulmonary Disease' OR 'COPD'; and (b) 'Nurses' OR 'Nursing' AND; (c) 'Self-management' OR 'Self-care' OR 'Self efficacy' OR 'Self-regulation' AND; (d) 'Randomized clinical trial' OR 'Controlled clinical trial' (Supplementary Material 1).

Filters were applied based on study inclusion or exclusion criteria. The first author (AH) evaluated all the abstracts ($N = 521$) in terms of the following inclusion criteria: Studies (a) having a RCT design; (b) involving adult participants are older than 18 years and diagnosed with COPD; (c) examining the effects of nurse-driven SM programs on physical and psychosocial health variables and reporting adequate data to compute an effect size; (d) using home visits, follow-up phone calls, education and counselling programs for patients or their caregivers; and (e) published in English. Studies were not included as follows: (a) focusing on instrument/or measure development; (b) not published in English; (c) involving healthcare providers except for nurses; and (d) reporting grey literature including the academic papers such as thesis, dissertations, research or committee reports, government reports, systematic reviews, letters to the editor, conference papers and ongoing research.

2.4 | Data abstraction

After the studies were identified, two authors (AH and ZGM) independently reviewed titles and abstracts of the studies. Then, the full articles of eligible studies were reviewed and the reasons for exclusion of each study were recorded. Authors were not blinded for authors, institutions or manuscript journals. In case of any discrepancies, the two authors reviewed the original articles and resolved the problems by discussion. The following information was extracted from each study for summary and comparison: (a) characteristics of COPD participants (mean age, gender, COPD stage); (b) study methods (randomization, allocation concealment, blinding); (c) the details of nurse-driven SM programs (contents, frequency, duration, education materials, follow-up procedures); (d) main variable outcomes (instruments), physical and psychosocial health variables of patients with COPD; and (e) results (means, SDs, *t* or *p* values, effect size).

2.5 | Search outcomes

The first search retrieved 521 articles, out of which 179 were duplicate ones. The first author evaluated the titles and abstracts of the remaining 342 articles and 304 of them were excluded because of nonconformity to the inclusion criteria. After full-text review process of the remaining 38 studies, 26 were excluded due to not having a RCT design. Finally, 12 studies were included in the current meta-analysis (Figure 1).

2.6 | Main outcome measures

In line with the aim of this meta-analysis, the effects of nurse-driven SM programs on clinical outcome variables including both the physical and psychosocial health of patients with COPD were analysed. Therefore, we reviewed the instruments assessing the health status, physical function, maximum speed of expiration, walking distance, QOL, anxiety, depression and self-efficacy and analysed the findings of all the scales used in the included studies.

2.6.1 | Physical health

Eight different assessment tools were used to assess the physical health of patients with COPD. These scales are mainly focused on patients' functional status, physical activity, maximum speed of expiration, exercise capacity, dyspnoea severity, fatigue level and walking distance. In this context, related details of the instruments including sub-dimensions, items, items' scoring procedures and interpretations of the scale scores were presented as follows:

1. *COPD Assessment Tool (CAT):* This is a self-administered questionnaire consists of eight items assessing various manifestations of COPD, such as breathlessness, mucus production coughing aiming to provide a simple quantified measure of the impact of COPD on health status. CAT evaluates limitations related to abovementioned symptoms on performing daily activities. Each item is rated on a 6-point Likert scale ranging from 'there is no symptom' to 'the symptom is serious'. The sum of the scores ranges from 0–40, with lower scores indicating better health status (Jones et al., 2009).
2. *The Peak Expiratory Flow (PEF):* The PEF, known as a peak flow or peak flow rate is the maximal rate that a person can exhale during a short maximal expiratory effort after a full inspiration. The PEF per cent predicted correlates reasonably well with the percent-predicted value for the forced expiratory volume in 1 s (FEV) and

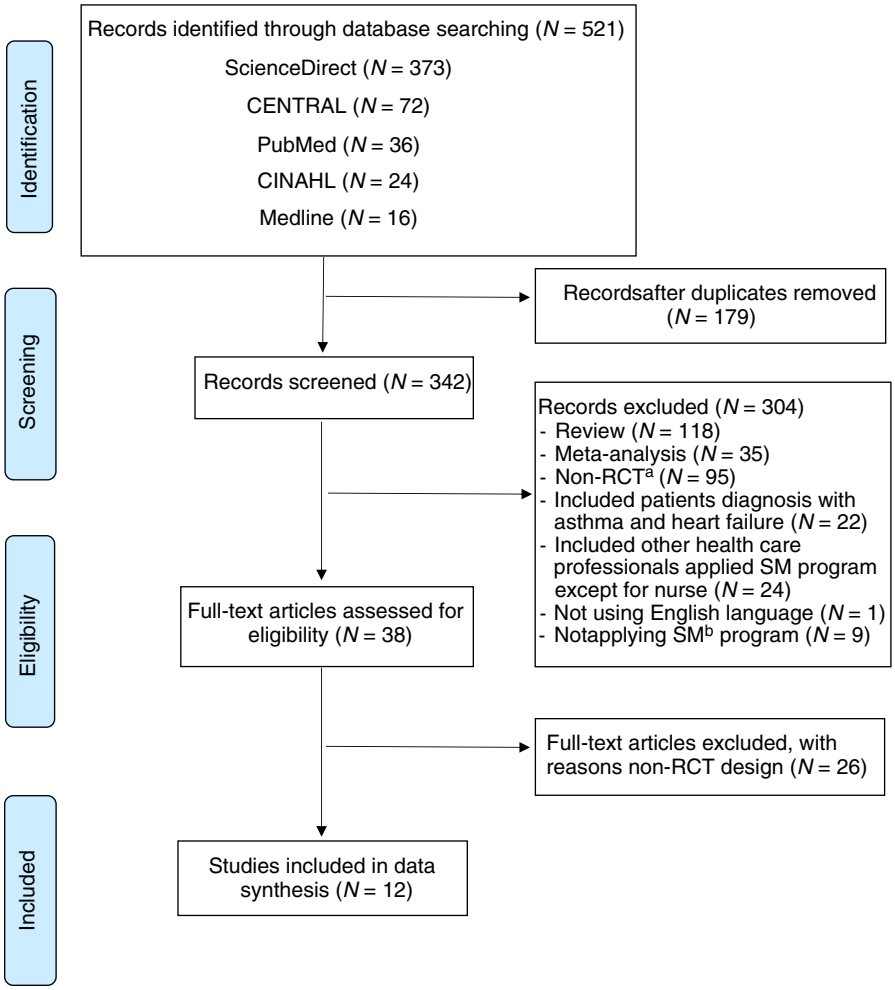

FIGURE 1 Study flow diagram. [a]RCT: Randomized controlled trial, [b]SM: Self-management [Colour figure can be viewed at wileyonlinelibrary.com]

provides an objective measure of airflow limitation when spirometry is not available in patients with COPD. Normal values for PEF depend on gender, age and height, similar to spirometry values for FEV and forced vital capacity (FVC). PEF values are usually expressed as L/min (Perez-Padilla et al., 2009).

3. *The Nijmegen Clinical Screening Instrument (NCSI):* The NCSI measures eight aspects of symptoms, functional impairment and health status: subjective symptoms, dyspnoea emotions, fatigue, behavioural impairment, subjective impairment, general QOL, health-related QOL and satisfaction with relationships. For each sub-domain of the NCSI normative data indicating normal functioning, mild problems and severe problems were collected. Immediately after the patient has completed each part of the questionnaire on the computer, the results are presented on the graphical Patient Profile Chart (Peters et al., 2009).
4. *Clinical Chronic Obstructive Pulmonary Disease Questionnaire (CCQ):* The CCQ consists of 10 questions distributed in three domains: symptoms, mental status and functional status. Observed symptoms are dyspnoea, cough and mucus; mental status includes questions about feeling depressed and concerns about breathing; and functional status describes limitations in different activities of daily living due to the lung disease. The questions assess the status for previous week and use a 7-point scale from 0 to 6. The total scores of the CCQ are calculated by summing all items, with higher scores indicating lower health status. The 0.4 points change in the CCQ scores is considered as clinically meaningful (Kon et al., 2014).
5. *The Borg Dyspnoea Scale:* This scale is a 0–10 rated numerical score used to measure dyspnoea reported by the patient during sub-maximal exercise and is routinely administered during 6-min walk testing (6MWD), one of the most common and frequently used measures to assess disease severity in COPD. Higher scores obtained in the scale show an increase in the dyspnoea severity (Gift & Narsavage, 1998).
6. *The Modified Medical Research Council Dyspnoea Scale (mMRC):* The mMRC quantifies disability attributable to breathlessness and is useful for characterizing baseline dyspnoea in patients with COPD and the lower scores obtained in the scale show a reduction in the dyspnoea severity (Munari et al., 2018).
7. *Six-Minute Walk Distance (6MWD):* The 6MWD is expressed as metres and is an exercise test that entails the measurement of distance walked over a span of 6 min. The age, gender, height and weight of patients affect the scores of the scale. Distances are reported for healthy individuals, whose age between 40 and 85 years, range from 400–700 m (Camarri, Eastwood, Cecins, Thompson, & Jenkins, 2006; Holland et al., 2010).

8. *The Patient Activation Measure (PAM)*: The 13-item PAM determines the physical activity level and skills of patients. The scale is converted total scores ranging from 0–100. Higher scores indicate greater physical activity (Hibbard, Stockard, Mahoney, & Tusler, 2004).

2.6.2 | Psychosocial health

Totally eight different assessment tools were used to assess the psychosocial health of patients with COPD in the studies. These scales are mainly focused on patients' perceived QOL, anxiety, depression and self-efficacy levels and the information levels of patients' about COPD. In this context, related details of the instruments including sub-dimensions, items, items' scoring procedures and interpretations of the scale scores were given below:

1. *St George Respiratory Questionnaire score (SGRQ):* The SGRQ consists of 56 items and evaluates the QOL with the symptom, physical activity and impacts of sub-dimensions in patients with COPD. Higher scores in the SGRQ reflect lower QOL (Meguro, Barley, Spencer, & Jones, 2007).
2. *EuroQol-5 Dimension (EQ-5D):* The EQ-5D measures health-related QOL, with a total score based on weighted scores on mobility, self-care, usual activities and pain/discomfort. Each dimension has five levels including no problems, slight problems, moderate problems, severe problems and extreme problems and lower scores indicate better QOL (Ringbaek, Brøndum, Martinez, & Lange, 2008).
3. *Chronic Respiratory Questionnaire (CRQ):* The CRQ consists of 20 questions and assess health-related QOL, with a total score comprising four domain scores for dyspnoea, mastery, fatigue and emotion. Higher scores of CRQ indicate better QOL. The minimal clinically important difference for the questionnaire has been established at 0.5 points (Wijkstra et al., 1994).
4. *The Hospital Anxiety and Depression Scale (HADS):* The HADS is an instrument to assess psychosocial status with anxiety and depression domain. The scale consists of 14 questions (seven questions for anxiety and seven questions for depression). Responses on the HADS are scored from 0 (lower symptom frequency) to 3 (higher symptom frequency). Total scores range from 0–21 for either anxiety or depression and higher scores indicate greater anxiety or depression (Dowson et al., 2001).
5. *The COPD Self-Efficacy Scale (CSES):* The CSES includes 34 questions and measures individuals' self-confidence in preventing difficulty in breathing when under certain situations, with higher points indicating higher confidence. Evaluation and dimensions of this scale differ between the studies and the higher scores indicate higher self-efficacy (Wigal, Creer, & Kotses, 1991).
6. *Pulmonary Rehabilitation Adapted Index of Self-Efficacy (PRAISE):* The PRAISE comprises of 15 items. Each item is scored from 1–4, with a total range from 15–60, with higher scores indicating higher self-efficacy (Santos, Santos, Santos, Rodrigues, & Bárbara, 2019).
7. *Chronic Obstructive Pulmonary Disease Knowledge Questionnaire (COPD-Q):* This scale comprises of 13 true or false questions and higher scores indicate higher knowledge on the COPD.
8. *The 36-Item Short Form Health Survey (SF-36):* SF-36 is a set of generic, coherent and easily administered QOL measure. It measures rely on patient self-reporting and are widely utilized for routine monitoring and assessment of care outcomes in adult patients. It comprises 36 questions which cover eight domains of health: limitations in physical activities because of health problems, limitations in social activities because of physical or emotional problems, limitations in usual role activities because of physical health problems, bodily pain, general mental health (psychological distress and well-being), limitations in usual role activities because of emotional problems, vitality (energy and fatigue) and general health perceptions. The SF-36 consists of eight scaled scores, which are the weighted sums of the questions in their section. Each scale is directly transformed into a 0–100 scale on the assumption that each question carries equal weight. The lower score means that the more disability (Mahler & Mackowiak, 1995).

2.7 | Quality appraisal

2.7.1 | Evidence level

The Oxford Centre for Evidence-Based Medicine (CEBM) assessment tool (version March 2009) is used to assess evidence level (CEBM, 2009). Clinical evidence is rated on five levels ranging between 1 (the highest level) -5 (the lowest level). The evidence at Level 1 is divided into three categories as Level 1a (Systematic review of RCTs), Level 1b (Individual RCTs with narrow CI) and Level 1c (all or none related outcome). The evidence at Level 2 is divided into three categories as Level 2a (Systematic review of cohort studies), Level 2b (Individual cohort studies) and Level 2c (Outcomes of ecological studies). The evidence at Level 3 is divided into three categories as Level 3a (Systematic review of case–control studies) and Level 3b (Individual case–control study). The evidence at Level 4 includes case-series and the evidence at Level 5 consists of expert opinion without explicit critical appraisal, or based on physiology, bench research or 'first principles'.

2.7.2 | Methodological quality of the studies

The Modified Jadad Scale for assessing the quality of RCTs was used in methodological quality assessment in our meta-analysis (Oremus et al., 2001). This scale consists of eight items and assesses quality variables including randomization, blinding procedure, the rate of withdrawal and dropout, inclusion and exclusion criteria, side effects related to interventions and statistical tests used for analysis. Each item on the scale is scored as 0 (not done/not explained) or 1 (done/explained). The total score is obtained by summing of the item scores. The score for each study ranges between 0 (the lowest

quality) and 8 (the highest quality). Based on this scale, the score 4 or higher is considered as good quality, while the score 3 or lower means low quality (Oremus et al., 2001).

2.7.3 | Risk of bias

One reviewer assessed the risk of bias for each of the included studies using the Cochrane assessment tool (Corbett, Higgins, & Woolacott, 2014). This tool covers six sub-groups of bias: (a) selection bias; (b) performance bias; (c) detection bias; (d) attrition bias; (e) reporting bias; and (f) other bias. Risk of bias is examined as low risk (+), unclear (?) or high risk (−). The second co-author checked all the studies and the disagreements were resolved by discussion (Higgins et al., 2011). Funnel plot was used to visualize and inspect a potential selection or publication bias. Funnel plots are simple scatterplots of the intervention effects estimated from individual studies. The symmetrical funnel plot shows that there is no potential publication bias. We also performed Egger's and Begg's test to evaluate publication bias. Egger's test is used to detect for asymmetry of the funnel plot and evaluates publication bias. The Egger's test is calculated according to a regression model, using the standardized estimate of the size effect and the inverse of the standard error. Egger's test detects funnel plot asymmetry by determining whether the intercept deviates significantly from zero in a regression of the standardized effect estimates versus their precision. Begg's test is the rank correlation test examining the relationship between the standardized intervention effect and the variance of the intervention effect using Kendall's tau. The statistical power (sensitivity) of Egger's test is (0.05 or 0.1), regardless of false positive rates or type of data set used. Both of the tests examine that the null hypothesis about the symmetry of the chart against the alternative hypothesis of its asymmetry. *p* values are calculated to examine the reliability of variables, sensitivity analysis and values smaller than 0.05 indicate chart asymmetry and the presence of bias (Shi et al., 2017).

2.8 | Synthesis

Data extraction was conducted independently by the first author and reviewed by the second author. Data extracted were documented on a standardized form including the following information: authors of the studies, publication date, sample size, participants' characteristics (including age, gender and COPD stage), inclusion criteria, professional staff, intervention procedures, usual or routine care strategies, main variables (scales), assessment time points and main study findings. The age of all participants included in the intervention and control groups were calculated according to reported mean and standard deviation values in the studies. The percentages were used to offer the gender proportion of participants. This meta-analysis examined clinical variables, which indicate the physical health of patients, such as the CAT, PEF, NCSI, CCQ, Borg Dyspnoea Scale and 6MWD. In addition, our meta-analysis assessed the psychosocial health (QOL, anxiety, depression and self-efficacy) of patients with COPD according to SGRQ, EQ-5D, CRQ, HADS, CSES, PRAISE and COPD-Q. When there were missing data, the authors contacted the authors of the paper to obtain the missing information. However, we could not perform further statistical test, when we did not get the missing data. The authors also reviewed the methodological quality of included studies in this meta-analysis. The Modified Jadad Scale, which assesses quality variables including randomization, blinding procedure, the rate of withdrawal and dropout, inclusion and exclusion criteria, side effects related to interventions and statistical tests used for quality analysis. The Modified Jadad Scale scores change between 0–8. The scores higher than 4 in that scale indicate good methodological quality (Aboumatar et al., 2018). For example, scores between 0–4 mean that low quality, while scores 5–8 indicate good quality. The outcomes of the studies were analysed with the Stata Statistical Software (Version 15 I/C). Statistical heterogeneity between studies was analysed using the I^2 statistic. The I^2 statistic indicates the proportion of total variance in the pooled effect size that resulted from heterogeneity among the studies. I^2 statistics of 0%, 25%, 50% and 75% was taken as no, low, moderate and high heterogeneity respectively. A *p* value lower than .05 was used to reject the null hypothesis of homogeneity and a random-effects model was applied to review possible heterogeneity (Higgins, Thompson, Deeks, & Altman, 2003). Criteria from Cohen's *d* were used for interpreting magnitude of effect sizes: 0.2–0.49 = small effect, 0.5–0.79 = moderate effect and 0.8 or greater = large effect. The mean differences (MDs) were used as outcome measures included subjective scores such as walking distance and peak expiratory flow rate. In this meta-analysis, the standardized mean difference (SMD) effect measure was used to present a direct comparison of the effects of nurse-led SM programs on CAT, SGRQ, EQ-5D, HADS and CSES scores. The SMD expresses the size of the intervention effect in each study relative to the variability observed in that study by dividing the pooled *SD* of the differences between the two interventions. The level of significance was set at 0.05 and corresponding 95% CIs were reported. Sub-group analysis was performed to explore sub-dimensions of the HADS and SGRQ.

3 | RESULTS

In the context of this systematic review and meta-analysis, the findings were presented in the following order: (a) characteristics of included studies; (b) nurse-driven SM programs; (c) evidence level and methodological quality assessment; (d) risk of bias; and (e) effects of nurse-driven SM programs on physical and psychosocial health of patients with COPD.

3.1 | Study characteristics

The studies were mostly performed in the United Kingdom ($N = 3$) and in China ($N = 3$), followed by the ones carried out in the Netherlands

(*N* = 2), the United States (*N* = 1), Australia (*N* = 1), Iceland (*N* = 1) and Korea (*N* = 1). The sample size of the studies ranged between 40 (Song, Yong, & Hur, 2014) and 577 (Jolly et al., 2018) participants (totally 2,121 participants). The mean age of included patients was calculated based on 11 studies and found as 61.4 (*SD* = 9.3) years. Because one of the studies did not mention the mean age of the participants. When gender distribution was analysed, 55.6% (1,212) of patients were males. Five studies included patients with stage I-IV COPD (Aboumatar et al., 2018; Billington et al., 2015; Bischoff et al., 2012; Boer et al., 2019; Kuo et al., 2013). Remaining studies (*N* = 7) were confined to COPD patients with stage II-IV (*N* = 2), II-III (*N* = 2), I-III (*N* = 2) or only III COPD (*N* = 1) (Table 1). Patients with severe comorbidities, cognitive impairment and mental disorders were excluded from all the studies.

3.2 | Nurse-driven SM programs

The content of SM programs consisted of detailed information on COPD including anatomical structures of respiratory ways and lung, pathophysiology, common symptoms, progress and disease stages (*N* = 12), conventional medications (*N* = 12), exacerbation management (*N* = 12), daily exercises (*N* = 9) and breathing retraining (*N* = 9). Moreover, seven studies focused on lifestyle changes (Aboumatar et al., 2018; Bischoff et al., 2012; Boer et al., 2019; Bucknall et al., 2012; Chang & Dai, 2019; Jonsdottir et al., 2015; Walters et al., 2013) and seven studies gave training on smoking cessation (Aboumatar et al., 2018; Chang & Dai, 2019; Jolly et al., 2018; Jonsdottir et al., 2015; Kuo et al., 2013; LianHong, Yan, LingYun, Li, & YongMei, 2019; Walters et al., 2013). Moreover, seven studies trained patients about coping with anxiety–stress (Billington et al., 2015; Bischoff et al., 2012; Boer et al., 2019; Bucknall et al., 2012; Jonsdottir et al., 2015; Song et al., 2014; Walters et al., 2013). Only one study included family caregivers and thought the family caregivers on nutritional issues (Jonsdottir et al., 2015). Probably, a single study trained the participants on energy conservation techniques (Aboumatar et al., 2018) (Table 2). With regard to used tools for the training of patients, nurses in the studies provided individual or group training through education booklets (*N* = 5) and written materials (*N* = 4). Considering the details of these training tools, we noted that important differences between the studies, while booklets were developed based on scientifically accepted models such as living well with COPD, social-cognitive theory and self-regulation theory, written materials were formed by the authors based on the literature review. Considering follow-up procedures, eight of the studies both invited patients to clinic for training and used phone calls (range between 2–25) (Billington et al., 2015; Bischoff et al., 2012; Boer et al., 2019; Chang & Dai, 2019; Jolly et al., 2018; Jonsdottir et al., 2015; Kuo et al., 2013; Song et al., 2014), while the remaining four studies used both home visits (range between 1–7) and phone calls (Aboumatar et al., 2018; Bucknall et al., 2012; LianHong et al., 2019; Walters et al., 2013). In addition, diaries (*N* = 2) (Bucknall et al., 2012; Jolly et al., 2018), pedometer (*N* = 1) (Jolly et al., 2018) and tele monitoring (*N* = 1) (Boer et al., 2019) were used for following the severity of symptoms and regular exercise. The follow-up periods varied between a minimum of 2 months (Song et al., 2014) and a maximum of 24 months (Bischoff et al., 2012).

3.3 | Evidence level and methodological quality assessment

3.3.1 | Evidence level

The evidence level of included studies was evaluated according to the CEBM assessment (Version, March 2009) tool and all the studies showed that Level 1b evidence (Individual RCT with narrow CI) (Table 1).

3.3.2 | Methodological quality

According to the Modified Jadad Scale scoring procedure, one study had 8 points, seven studies got 7 points and two studies had 6 points (Billington et al., 2015; Bischoff et al., 2012; Boer et al., 2019; Bucknall et al., 2012; Chang & Dai, 2019; Kuo et al., 2013; LianHong et al., 2019). (Jolly et al., 2018; Song et al., 2014). Moreover, two of the studies were scored with 5 points owing to not using blinding procedures and reporting adverse effects related to the interventions (Jonsdottir et al., 2015; Walters et al., 2013) (Table 1). Considering all the findings in terms of methodological quality, the studies included in this meta-analysis showed good quality as they got points higher than 4.

3.3.3 | Adverse effects

The main problem in most of the studies was to assess the adverse effects of nurse-driven SM programs. Three studies revealed the adverse effects related with the interventions via recording the frequency of death- and COPD-related hospitalization. Besides, only one of abovementioned studies reported hospitalization as an adverse effect (Boer et al., 2019).

3.4 | Risk of bias

The randomization methods in all of the studies were described detailed enough for allowing an assessment of the risk of selection bias. Considering the blinding procedures, nine of the studies were carried out as single blinded. Five studies blinded the researcher, who collected the data (Aboumatar et al., 2018; Billington et al., 2015; Bischoff et al., 2012; Bucknall et al., 2012; Song et al., 2014), three studies blinded the data analyser (Aboumatar et al., 2018; Boer et al., 2019; LianHong et al., 2019) and two studies blinded the patients (Chang & Dai, 2019; Kuo et al., 2013). The remaining studies

TABLE 1 Characteristics of reviewed studies

Study (County)	Sample	Inclusion criteria	The severity of COPD	Professional staff	Intervention strategies	Control strategies	Outcome measures	Time points of assessment	Study results	Quality score[a]/ Evidence level[b]
Bischoff et al. (2012) (Netherlands)	Self-management (n = 55) or usual care (n = 55) Age: Mean = 65.5 years *SD* = 11.5 years Male: 64.8% Female: 35.2%	- Aged at least 35 years - FEV1 < %70 predict	Stage I-IV	Practice nurse	- The number of sessions depended on the patient's needs, but sessions were made at least two times. - The nurse called each patient six times during the rest of the study period to reinforce SM skills	- The usual care group did not receive any care from the practice nurse.	- CSES - CRQ	- Baseline - 24 months	-The authors found no statistically significant changes in the CSES total and domain scores - The CRQ scores were not statistically significant, except for the dyspnoea domain.	7 (good)/ 1b
Bucknall et al. (2012) (United Kingdom)	Intervention group (n = 232) or control group (n = 232) Age: Mean = 69.1 years *SD* = 9.3 years Male: 37% Female: 63%	- Patients with COPD who had been admitted to hospital with an acute exacerbation of COPD	Stage II-IV	Practice nurse	- Participants received 40 min individual training sessions at home from a study nurse, fortnightly over a 2-month period, with further home visits at least every 6 weeks thereafter for a total of 12 months. - Follow-up visits were patient centred, based on individual needs as well as reviewing and reinforcing basic SM messages on the basis of diary card content.	- The control group continued to be managed by their general practitioner, hospital-based specialists	- SGRQ - HADS - CSES	- Baseline - 12 months	-HADS anxiety score was also significantly improved at 12 months. - They found no significant differences in HADS depression scores or CSES scores between the groups - They found a significant change on total SGRQ score at 12 months	7 (good)/ 1b
Kuo et al. (2013) (China)	Intervention group (n = 33) and comparison group (n = 31) Age: - Male: 93.75% Female: 6.25%	- Aged at least 20 years - Having at least an elementary-level education	Stage I-IV	Practice nurse	- The individualized health education was given after physician visits and lasted 15–20 min. - Patients were scheduled for two telephone interviews within the first week to check on the status of their self-monitoring. - Patients were scheduled for one or two telephone interviews a week in the second and third weeks. - In the fourth week, nurse took around 15 to 20 min telephone interview with each participant to discuss preventions of symptom exacerbation.	-Patients received 4 week usual care and only the self-regulation guidebook	- Borg Dyspnoea Scale - CSES - PEF	- Baseline - 5 weeks - 9 weeks - 13 weeks	- There were significantly better scores in the dyspnoea and CSES between the groups. - On the 9th and 13th weeks, there was a significantly greater PEF in the intervention group.	7 (good)/ 1b

(Continues)

TABLE 1 (Continued)

Study (County)	Sample	Inclusion criteria	The severity of COPD	Professional staff	Intervention strategies	Control strategies	Outcome measures	Time points of assessment	Study results	Quality score[a]/ Evidence level[b]
Song et al. (2014) (Korea)	Experimental group ($n = 20$) or control group ($n = 20$) Age: Mean = 66.6 years *SD* = 11.1 years Male: 65% Female: 35%	-A diagnosis of moderate COPD -Age between 65–75 years -Capable of independent mobility	Stage III	Practice nurse	- The intervention consisted of two inpatient sessions and one outpatient session, which were delivered face-to-face, and then two booster sessions were delivered by phone calls. - Participants learned 10 sets of upper and lower extremities stretching with pursed lip breathing and performed a 10-min-per-toleration walk on a course 30-m corridor in the unit. - Participants were reminded and advised to continue and expand the exercises according to their own goals at home over a period of 2 months.	- The control group received usual care consisting of an education on COPD management, proven benefits of exercise, and maintaining daily activities.	- 6MWD - SGRQ - PEF	- Baseline - 2 months	- The results of 6MWD showed no significant differences between the groups - The subscale for symptom, activity, impact, and total score of SGRQ were significantly lower after the intervention	6 (good)/ 1b
Walters et al. (2013) (Australia)	Health mentor (HM) ($n = 74$) or usual care ($n = 80$) Age: Mean = 68 years *SD* = 8 years Male: 52% Female: 48%	- Age > 45 years - A diagnostic code for COPD -Smoking history > 10 pack-years	Stage II-III	Community health nurse	- The recommended predetermined schedule for mentor phone calls to a participant was 16 sessions 30 min over 12 months by nurses.	- The usual care group received from general practitioner care plus non-interventional brief phone calls.	- SF−36 - SGRQ - HADS	- Baseline - 6 months - 12 months	- Health mentor group did not show significant benefit on SF−36 and SGRQ - There was a significant decrease in anxiety over time in both the mentored and usual care groups measured by HADS	5 (good)/ 1b
Billington et al. (2015) (United Kingdom)	Intervention group ($n = 34$) or control group ($n = 37$) Age: Mean = 72 years *SD* = 9.2 years Male: 47.9% Female: 52.1%	-Previous spirometry results of FEV1/ FVC < 70%	Stage I-IV	Practice nurse	- The phone call was lasted maximum 25 min. - The intervention group received exactly the same treatment as the usual care group. - Patients in the intervention group were contacted twice by nurse, at weeks three and five post baseline by scheduled phone appointment.	- The control group received standard care including a SM plan	- CAT	- Baseline - 12 weeks	- CAT scores in the intervention group decreased significantly in 12 weeks with no significant change in the control group	7 (good)/ 1b

(Continues)

TABLE 1 (Continued)

Study (County)	Sample	Inclusion criteria	The severity of COPD	Professional staff	Intervention strategies	Control strategies	Outcome measures	Time points of assessment	Study results	Quality score[a]/ Evidence level[b]
Jonsdottir et al. (2015) (Iceland)	Intervention group (n = 48) or control group (n = 52) Age: Mean = 59.4 years *SD* = 4.6 years Male: 46% Female: 54%	- Aged 45–65	Stage II-III	Clinical nurse	- The patient received three to four times 30–45 min semi-structured conversations by a clinical nurse. - Patients received at least one face-to-face conversation with a clinical nurse in smoking cessation followed by ≥ 3 conversations face to face or by telephone. -Intervention group participated in a 6-month, partnership-based SM program consisting of: three to four conversations between nurse and patient-family member; 6 months of smoking cessation.	- Control group received traditional health care	- SGRQ - HADS	- Baseline - 6 month - 12 month	- There was no difference between groups on the total and subscales score of SGRQ - There was no difference between the groups on the total score of HADS	5 (good)/ 1b
Aboumatar et al. (2018) (United States)	Intervention group (n = 120) and usual care (n = 120) Age: Mean = 64.9 years *SD* = 9.8 years Male: 38.3% Female: 61.7%	- Acute COPD exacerbation - Older than 40 years - Having a smoking history of more than 10 pack-years - Not being homeless, and expecting discharge to home	Stage I-IV	COPD nurses	- The nurses met with the patient during the hospital stay and followed them for 3 months after discharge. - They provided SM support and addressed barriers to care. The program followed a patient-centred partnership approach and was delivered during a series of sessions held at the hospital and after discharge via home visit or telephone.	- The usual group received the usual transitional care	- SGRQ	- Baseline - 1 months - 3 months - 6 months	- The mean change in SGRQ scores between groups was clinical important	8 (good)/ 1b
Jolly et al. (2018) (United Kingdom)	Telephone health coaching (n = 289) or usual care (n = 288) Age: Mean = 70.7 years *SD* = 8.8 years Male: 63.5% Female: 36.5%	- Having mild dyspnoea (MRC grades 1 or or 2) at the baseline assessment - FEV1/ FVC < 0.70 after post bronchodilator	Stage I-III	Research nurses	- The telephone session in the first week lasted 35–60 min. - The nurse called each patient at weeks 3, 7 and 11 with written materials for education. - Nurses provided standard written prompts or information at weeks 16 and 24.	- The usual care group received a standard information about COPD	- SGRQ - mMRC - HADS - EQ–5D	- Baseline - 6 months - 12 months	- There was no difference in SGRQ total score at 12 months - There were also no differences in the HADS, EQ–5D and MMRC at six and 12 months.	6 (good)/ 1b

(Continues)

TABLE 1 (Continued)

Study (County)	Sample	Inclusion criteria	The severity of COPD	Professional staff	Intervention strategies	Control strategies	Outcome measures	Time points of assessment	Study results	Quality score[a]/ Evidence level[b]
Boer et el. (2019) (Netherlands)	İntervention group ($n = 43$) and usual care ($n = 44$) Age: Mean = 67.2 years *SD* = 8.8 years Male: 62.0% Female: 38.0%	- Aged at least 40 years - Had experienced 2 or more symptom-based exacerbations in the previous 12 months	Stage I-IV	- Pulmonary nurse - Practice nurse	- Patients were instructed to visit the nurse within 2 weeks for instructions on the use of the mHealth tool. - The tool consisted of a mobile phone, a pulse oximeter, a spirometer, and a forehead thermometer. - Patients answered yes-or-no questions concerning changes in symptoms, physical limitations, and emotions on the phone. - The mHealth tool then provided one or more of the following advices: (a) increase your bronchodilator use, (b) use your breathing techniques, (c) use your coughing techniques, (d) be thoughtful of how you distribute your energy during the day, (d) contact your healthcare professional today, (e) measure again tomorrow. - This follow-up program lasted 12 months	- Patents visited the nurse within 2 weeks for instructions on the use of a paper exacerbation action plan. - The plan consisted of instructions about the self-management of an exacerbation	- CCQ - NCSI - EQ−5D	- Baseline −3 months - 6 months - 9 months - 12 months	- There were no differences between the groups in changes between baseline and follow-up scores of the subscales and total of the NCSI, CCQ and EQ−5D	7 (good)/ 1b

(Continues)

TABLE 1 (Continued)

Study (County)	Sample	Inclusion criteria	The severity of COPD	Professional staff	Intervention strategies	Control strategies	Outcome measures	Time points of assessment	Study results	Quality score[a]/ Evidence level[b]
Chang and Dai (2019) (China)	Experimental group (n = 30) and Control group (n = 30) Age: Mean = 72.0 years *SD* = 11.14 years Male: 91.7% Female: 8.3%	- Older than 20 years of age - Normal cognition as assessed by the Short Portable Mental State Questionnaire	Stage I-III	Research nurses	- Nurse motivated patients to self-learn about COPD management from booklet through motivation interviewing. - Nurse made a phone call to make sure patients have learned the booklet and to make an appointment. - Nurse asked patients to reflect why they suffered from COPD and discussed their self-management with them for 1–1.5 hr to help them create action plans. - Nurse conducted scheduled telephone interviews (10–15 min/time) with the participants during the 2nd, 3rd, 4th, 8th, and 12th weeks of the program to motivate them and track their progress on their chosen action plans.	- Patients received patient education provided by the medical centre	- COPD-Q - PAM - PRAISE - CAT	- Baseline - 1 months −3 months	- The COPD-Q, PRAISE PAM scores of experimental group were significantly increased compared with the control group. - The CAT scores of the experimental group were significantly decreased compared with the control group at 1 months	7 (good)/ 1b
LianHong et al. (2019) (China)	Intervention group and (n = 77) control group (n = 77) Age: Mean = 68.9 years *SD* = 11.14 years Male: 78.5% Female: 22.5%	- Aged 40 years or older - Patients hospitalized for acute exacerbation of COPD	Stage II-IV	Respiratory nurses	- Each participant's needs were assessed using open-ended questions approximately 6 to 7 days before discharge. - A 3-month follow-up intervention was administered by nurses that included phone calls every week and three home visits.	- Patients only received usual care	- 6MWD - SGRQ		- The results of the 6MWT showed significant differences Between groups. - Improvements were shown in all domains of the SGRQ in the intervention group, whereas deteriorations were noted in the control group	7 (good)/ 1b

Abbreviations: 6MWD, 6-min walking distance; CAT, Chronic Obstructive Pulmonary Disease Assessment Tool; CCQ, Clinical Chronic Obstructive Pulmonary Disease Questionnaire; COPD-Q, Chronic Obstructive Pulmonary Disease Knowledge Questionnaire; CRQ, Chronic Respiratory Questionnaire; CSES, Chronic Obstructive Pulmonary Disease Self-Efficacy Scale; EQ-5D, EuroQol-5 dimensions; HADS, Hospital Anxiety and Depression Scale; mMRC, Modified Medical Research Council scale; NCSI, Nijmegen Clinical Screening Instrument; PAM, Patient Activation Measure; PEF, Peak Expiratory Flow; PRAISE, Pulmonary Rehabilitation Adapted Index of Self-Efficacy; *SD*, Standard deviation; SF-36, 36-Item Short Form Survey; SGRQ, St George's Respiratory Questionnaire; SM, Self-management.

[a]The Modified Jadad Scale (0–3: low; 4–8: good).

[b]The Oxford Centre for Evidence-Based Medicine (CEBM) assessment tool (1b: Individual RCTs with narrow Confidence Interval).

were not blinded (Jolly et al., 2018; Walters et al., 2013). Eight of the studies did not explain the reason for the missing data that causes a high risk of bias (Aboumatar et al., 2018; Boer et al., 2019; Bucknall et al., 2012; Chang & Dai, 2019; Jolly et al., 2018; Jonsdottir et al., 2015; Kuo et al., 2013; LianHong et al., 2019). On the other hand, four of the studies did report the missing data and had a low risk of bias (Billington et al., 2015; Bischoff et al., 2012; Song et al., 2014; Walters et al., 2013). If risk of bias for the selective outcome reporting was high, then the study authors reviewed the relevant protocols. However, the sources of bias were not available. Four of the studies had a low risk of bias in terms of 'other risk factors for bias' (Billington et al., 2015; Boer et al., 2019; Bucknall et al., 2012; Jonsdottir et al., 2015), while the remaining studies reported an unclear information (Aboumatar et al., 2018; Bischoff et al., 2012; Chang & Dai, 2019; Jolly et al., 2018; Kuo et al., 2013; LianHong et al., 2019; Song et al., 2014; Walters et al., 2013) (Table 3). Moreover, the publication bias assessed by using both Begg's and Egger's tests, revealed no evidence of publication bias (Begg's test: $z = 0.45$, $p = .76$, Egger's test: $t = 0.12$, $p = .98$). Additionally, the funnel plot was significantly symmetrical and indicated no publication bias in all the studies (Figure 2).

3.5 | The effects of nurse-driven SM programs on clinical outcome variables

3.5.1 | Physical health

Two studies, using the CAT and involving 64 patients each in the intervention group and 67 in the control group were analysed and a fixed-effects model was used as they showed a low level of heterogeneity ($I^2 = 22.2\%$, $p = .257$) (Billington et al., 2015; Chang & Dai, 2019). This meta-analysis revealed a significant improvement in the health status in patients receiving nurse-driven SM programs compared with the patients in the control groups (SMD = −1,99, 95% CI: −2.41 to −1.57) (Figure 3). Billington et al. (2015) found that 3.12 points decrease in the CAT scores following nurse-driven SM program. Similarly, Chang and Dai (2019) stated that 2.12 points decrease in the CAT scores. On the contrary, Boer et al. (2019) evaluated the health status using the NCSI and CCQ and reported no significant effect of SM programs on health status.

Two studies, using the PEF and involving 53 patients in the intervention group and 51 individuals in the control group were analysed (Kuo et al., 2013; Song et al., 2014). The PEF variable was presented as litre per minute in this meta-analysis. A fixed-effects model was used as these studies showed a no level of heterogeneity ($I^2 = 0.0\%$, $p < .931$). There was no significant difference in the PEF between the intervention and the control groups (MD = 0.23, 95% CI: −0.15 to 0.62) (Figure 4). Song et al (2014) found a 5.2 L/min increase in the PEF following nurse-driven SM program, although the differences were not statistically significant. Kuo et al. (2013) reported a significant increase (33.6 L/hr) in the PEF after nurse-driven SM program.

Two studies, using the 6MWD and including 97 patients in the intervention group and 97 in the control group were analysed (LianHong et al., 2019; Song et al., 2014). These studies had a high level of heterogeneity and thus a random-effects model was used ($I^2 = 99.3\%$, $p < .001$). This meta-analysis revealed a significant increase in the 6MWD of the intervention groups (MD = 3.75, 95% CI: 3.17 to 4.34) (Figure 5). Song et al. 2014) found that a significant increase (33.5 m) in the 6MWD of the intervention group, while LianHong et al. (2019) reported 154.6 m increase in the 6MWD of patients in the intervention group. Furthermore, Chang and Dai (2019) evaluated the physical activity level of patients through the PAM and documented significant increase in the PAM scores of the intervention group compared with the control group.

Due to the differences between the scales (The Borg Dyspnoea, mMRC) that evaluating the dyspnoea severity of patients with COPD, a meta-analysis could not be performed. However, considering the study results in a systematic manner, Kuo et al. (2013) emphasized that nurse-driven SM program significantly reduced the scores of Borg Dyspnoea Scale. On the other hand, Jolly et al. (2018) evaluated dyspnoea scores using mMRC and reported no significant differences between the intervention and the control group.

3.5.2 | Psychosocial health

Quality of life

Seven studies, using the SGRQ tool, involving 860 patients in the intervention group and 869 in the control group were used for analysis (Aboumatar et al., 2018; Bucknall et al., 2012; Jolly et al., 2018; Jonsdottir et al., 2015; LianHong et al., 2019; Song et al., 2014; Walters et al., 2013). A random-effects model was used as these studies had a high level of heterogeneity ($I^2 = 98.0\%$, $p < .001$). When symptoms domain of SGRQ was analysed, the studies showed a significant reduction in symptom scores of the intervention group when compared with the control group (SMD = −0.87, 95% CI: −0.97 to −0.76). Furthermore, there was a significant reduction in activity (SMD = −0.77, 95% CI: −0.87 to −0.66), impacts domains of SGRQ (SMD = −0.55, 95% CI: −0.65 to −0.45) and total scores of the SGRQ in the intervention group (SMD = −0.71, 95% CI: −0.81 to −0.61) (Figure 6). Furthermore, Bischoff et al. (2012) measured QOL using the CRQ and emphasized that nurse-driven SM program did not provide a significant effect on QOL.

In addition, two studies measuring the QOL with the EQ-5D and including 261 patients in the intervention group and 187 in the control group were analysed (Boer et al., 2019; Jolly et al., 2018). A random-effects model was used as these studies had a high level of heterogeneity ($I^2 = 99.2\%$, $p < .001$). The EQ-5D scores significantly reduced in the intervention group when compared with the control group (SMD=−0.17, 95% CI: −0.33 to −0.01) (Figure 7). Jolly et al. (2018) found that 0.3 points decrease in the EQ-5D following nurse-driven SM program, while LianHong et al. (2019) reported that 0.2 points decrease in the EQ-5D. Moreover, only one study

TABLE 2 Content, used tools and follow-up procedures of nurse-driven self-management programs

	Content of self-management programs								
	İnformation on COPD	İnformation on medications	Exacerbation management	Daily exercises	Breathing retraining	Daily activities	Lifestyle changes	Energy conservation techniques	Smoking cessation
1. Bischoff et al.	+	+	+	+	+	+	+	-	-
2. Bucknall et al.	+	+	+	+	+	+	+	-	-
3. Kuo et al.	+	+	+	+	+	+	-	-	+
4. Song et al.	+	+	+	+	+	+	-	-	-
5. Walters et al.	+	+	+	-	-	-	+	-	+
6. Billington et al.	+	+	+	-	-	-	-	-	-
7. Jonsdottir et al.	+	+	+	-	+	-	+	-	+
8. Aboumatar et al.	+	+	+	+	+	+	+	+	+
9. Jolly et al.	+	+	+	+	-	-	-	-	+
10. Boer et al.	+	+	+	+	+	+	+	-	-
11. Chang et al.	+	+	+	+	+	-	+	-	+
12. LianHong et al.	+	+	+	+	+	+	-	-	+

Note: +: included, -: did not include

evaluated QOL by SF-36 and reported no significant difference in QOL scores of the intervention group compared with the control group (Walters et al., 2013).

Anxiety and depression

With regard to anxiety and depression of patients with COPD, four studies, using the HADS and composed of 643 participants in the intervention group and 652 in the control group were analysed and demonstrated a high level of heterogeneity (I^2 = 91.1%, p < .001) (Bucknall et al., 2012; Jolly et al., 2018; Jonsdottir et al., 2015; Walters et al., 2013). When the anxiety sub-domain of HADS was analysed, the results reported a significant effect in reducing anxiety in the intervention group compared with the control group (SMD = −0.40, 95% CI: −0.51 to −0.29). Probably, the depression sub-domain scores of HADS was significantly reduced in the intervention group when compared with the control group (SMD = −0.34, 95% CI: −0.45 to −0.23) (Figure 8).

Self-efficacy

Furthermore, three studies, measuring the self-efficacy though the CSES and involving 320 patients in the intervention group and 318 in the control group were analysed (Bischoff et al., 2012; Bucknall et al., 2012; Kuo et al., 2013). These studies had a high level of heterogeneity (I^2 = 98.4%, p < .001). The results showed no statistically significant difference between the interventions and the control groups (SMD = −0.05, 95% CI: −0.11 to 0.22) (Figure 9). Kuo et al. (2013) reported a significant increase (0.5 points) in the CSES. However, Bischoff et al. (2012) emphasized that nurse-driven SM programs had no significant effect on the CSES. Chang and Dai (2019) measured self-efficacy using the COPD-Q and PRAISE (mean difference 3.8) and stated a significant increase in the intervention group compared with the control group.

4 | DISCUSSION

The present systematic review and meta-analysis is the first to provide a comprehensive review of existing RCTs with evidence Level 1b (Individual RCTs with narrow CI) on nurse-driven SM programs. Apart from the current literature, the present meta-analysis gives detailed information about the content of nurse-driven SM programs, the methodological quality of these selected studies and the effects of nurse-driven SM programs on physical and psychosocial health variables in patients with COPD covering the past 10 years. According to this meta-analysis, nurse-driven SM programs were found to vary in terms of characteristics of participants (age, gender and COPD stages), sample size, content of SM programs and duration of follow-up (Billington et al., 2015; Bischoff et al., 2012; Jolly et al., 2018). These wide differences in the studies may be attributed to study settings (United Kingdom, China, Netherlands, United States, Australia, Iceland and Korea), as well as the financial status, resources and services available for patients with COPD, multidisciplinary team members, methods used in delivering SM programs, follow-up opportunities, home-care services, qualifications, experiences and training certificates of nurses (Bischoff et al., 2012; Jonsdottir et al., 2015; Kuo et al., 2013; Song et al., 2014; Walters et al., 2013). Considering all the differences, the results cannot be generalized to the entire population of COPD patients and this makes drawing conclusions on the effects of nurse-driven SM programs on physical and psychosocial health variables in patients with COPD difficult.

As for the outcomes of studies related to physical health, nurse-driven SM programs showed significant positive effect on variables including health status (CAT), maximum speed of expiration (PEF) and walking distance (6WMD) of the intervention groups when compared with the control ones with an evidence at Level 1b (Billington

			Used tools		Follow-up procedures				
Nutrition	Cope with anxiety–stress	Teaching family caregivers	Booklet	Written material	Phone call + clinic	Home visit + phone call	Diary	Tele-monitor	Pedometer
-	+	-	+	-	+	-	-	-	-
-	+	-	+	-	-	+	+	-	-
-	-	-	+	-	+	-	-	-	-
-	+	-	-	+	+	-	-	-	-
-	+	-	-	-	-	+	-	-	-
-	+	-	-	+	+	-	-	-	-
+	+	+	-	+	+	-	-	-	-
-	-	-	-	-	-	+	-	-	-
-	-	-	-	+	+	-	+	-	+
-	+	-	-	-	+	-	-	+	-
-	-	-	+	-	+	-	-	-	-
-	-	-	+	-	-	+	-	-	-

et al., 2015; Chang & Dai, 2019; LianHong et al., 2019; Song et al., 2014). The results of this meta-analysis combining the results of included five studies showed significant effects of nurse-driven SM programs on physical health among patients with COPD. Among the three pooled studies, two studies (Billington et al., 2015; Chang & Dai, 2019) reported a significant improvement in health status of the intervention group compared with the control group ($d = 1.99$). Although one study, Boer et al. (2019) did not show significant effects on the health status ($p = .7$). Another important variable in the context of physical health in this meta-analysis is that maximum speed of expiration (PEF) of patients with COPD. Only two of the studies (Kuo et al., 2013; Song et al., 2014) examined the PEF among patients with COPD and showed no significant effect on this variable. This may be due to that the content of nurse-driven SM program, COPD stage and used scales in the studies. Regard to the last variable for the physical health, probably only two studies (LianHong et al., 2019; Song et al., 2014) measured the distance change in 6MWD following nurse-driven SM programs and reported a significant increase in the 6MWD of patients. Similar to these outcomes, a meta-analysis examining the effects of SM programs conducted by multidisciplinary

TABLE 3 The summary of bias risk

Study	Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	Other bias
	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other sources of bias
1. Bischoff et al.	+	+	-	+	+	?	?
2. Bucknall et al.	+	+	?	+	-	?	+
3. Kuo et al.	+	+	+	-	-	?	?
4. Song et al.	+	+	+	?	+	?	?
5. Walters et al.	+	+	?	-	+	?	?
6. Billington et al.	+	+	?	+	+	?	+
7. Jonsdottir et al.	+	+	?	?	-	?	+
8. Aboumatar et al.	+	+	-	+	-	?	?
9. Jolly et al.	+	+	-	-	-	?	?
10. Boer et el.	+	+	-	+	-	?	+
11. Chang et al.	+	+	+	-	-	?	?
12. LianHong et al.	+	+	+	+	-	?	?

Note: +low risk of bias, ?: unclear risk of bias, -: high risk of bias

team members on patients with COPD reported significant improvements in the physical health (Cannon et al., 2016). Considering all the study outcomes from a holistic perspective, nurse-driven SM programs may have helped to improve physical health through regular deep-breathing techniques, daily exercises, rest periods and energy conservation techniques. In particular, it is believed that the regular deep-breathing techniques applied in the nurse-driven SM programs may contribute to increase in lung capacity and improvements in pulmonary function (Billington et al., 2015; Nici, Bontly, ZuWallack, & Gross, 2014). However, it should be noted that the improvements in these clinical variables are not only associated with SM programs, as patients with COPD continued to take conventional medications and followed their physicians' recommendations.

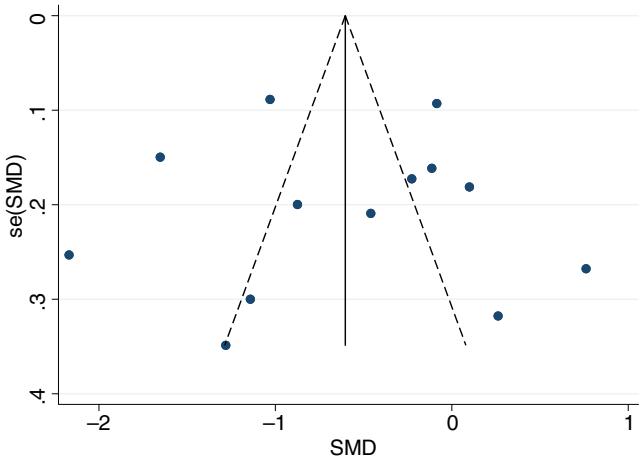

FIGURE 2 Funnel plot for publication bias. Note. SMD: standardized mean differences [Colour figure can be viewed at wileyonlinelibrary.com]

The results of this meta-analyses combining the results of included nine studies also showed significant effects (d = 0.72 for the SGRQ, d = 0.17 for the EQ-5D) of nurse-driven SM programs on psychosocial health (QOL) in the intervention groups when compared with the control ones with evidence Level of 1b (Aboumatar et al., 2018; Boer et al., 2019; LianHong et al., 2019). One of the important components of psychosocial health in this meta-analysis is that anxiety and depression status (HADS) of patients. Regarding the results of this meta-analyses, four studies (Bucknall et al., 2012; Jolly et al., 2018; Jonsdottir et al., 2015; Walters et al., 2013) reported a significant small effect (d = 0.37) in reducing anxiety and depression scores in the intervention group compared with the control group. The third variable of psychosocial health of patients is that self-efficacy levels in this meta-analysis. Among the three pooled studies, all these studies (Bischoff et al., 2012; Bucknall et al., 2012; Kuo

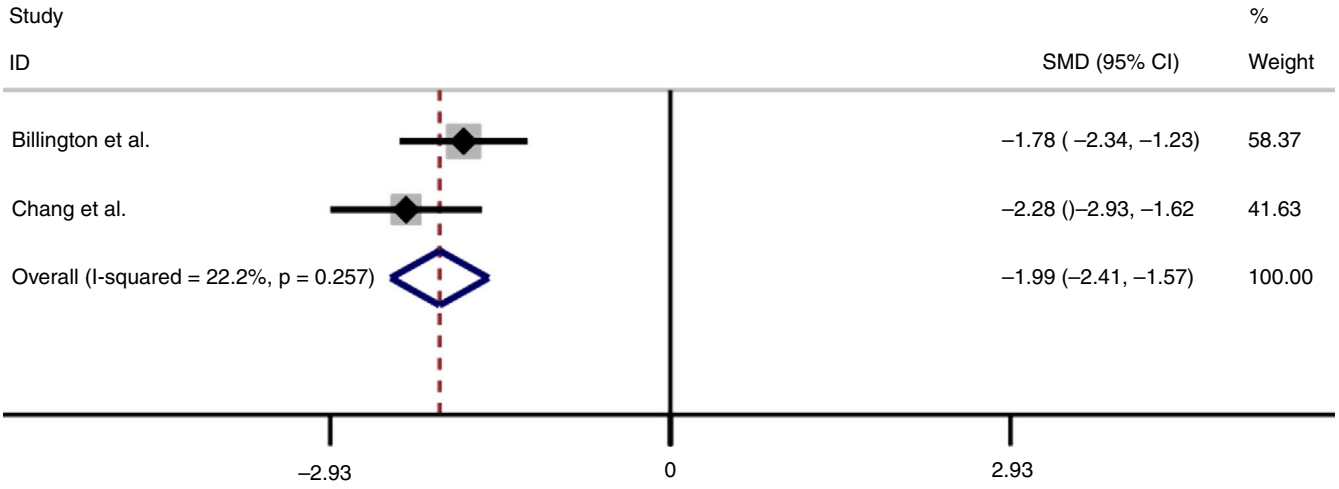

FIGURE 3 Forest plot for Chronic Obstructive Pulmonary Disease Assessment Tool [Colour figure can be viewed at wileyonlinelibrary.com]

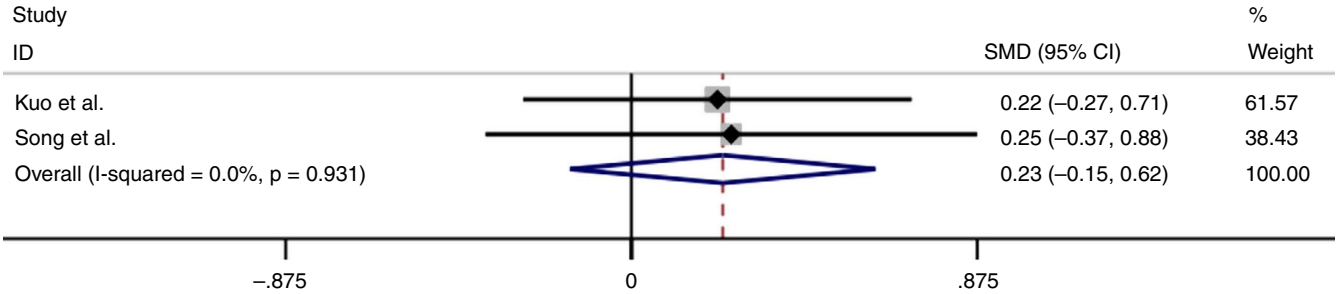

FIGURE 4 Forest plot for Peak Expiratory Flow [Colour figure can be viewed at wileyonlinelibrary.com]

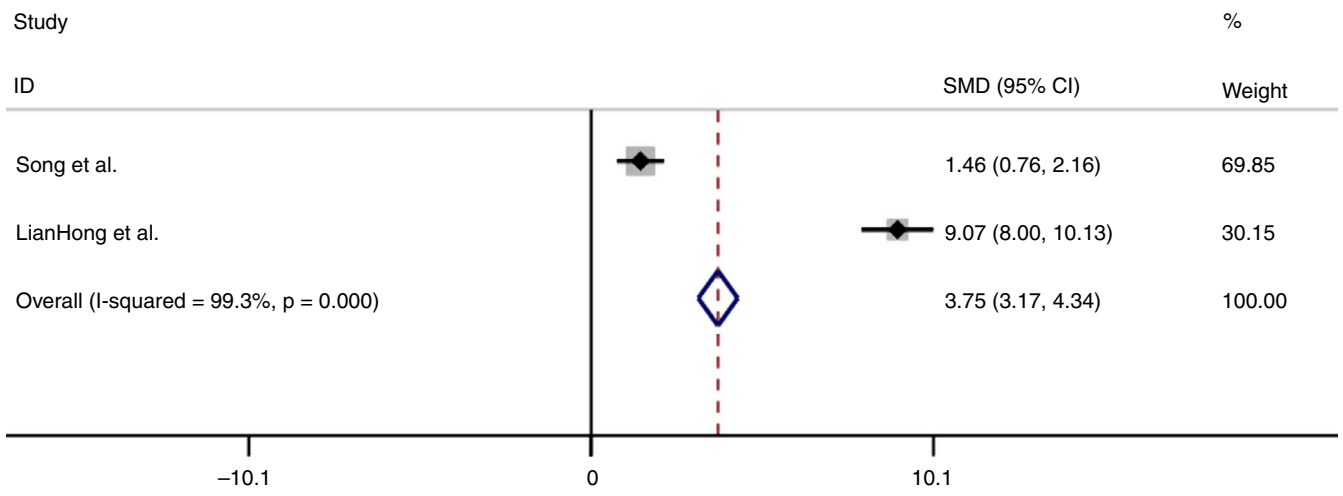

FIGURE 5 Forest plot for Six Minute Walking Distance [Colour figure can be viewed at wileyonlinelibrary.com]

et al., 2013) showed no significant effect regarding nurse-driven SM programs on self-efficacy between the intervention and the control groups. These study outcomes may result from the high level of heterogeneity between the methodologies in the studies (the types of SM intervention, duration of the interventions, follow-up assessment, data collection tools and qualifications of nurses delivering SM programs) and socio-demographic and clinical variables of participants (age, comorbid diseases, time since diagnosis and COPD stage) (Bischoff et al., 2012; Bucknall et al., 2012).

Considering the methodological quality in terms of randomization, blinding, withdrawal, inclusion and exclusion criteria, adverse effects and statistical analysis, the results showed that all of the studies had scores greater than 4, mean that good quality. However, scores of studies, which had good quality, ranged between 5–8. Taking the underlying causes of this variability in quality assessment into account, it is noteworthy that most studies were incomplete in using blinding methods and did not evaluate adverse effects related to interventions. However, it has been emphasized in the literature that the blinding procedures and evaluating the adverse effects in RCTs are the important components to minimize the risk of bias and maximize the validity of results (Karanicolas, Farrokhyar, & Bhandari, 2010). Besides, even though systematic reviews and meta-analyses deal with published results and not with the original data, it is important to consider that the quality of a study depends on the statistical methods used for obtaining the results of interest for the reviews and meta-analyses. Also, the studies included in this meta-analysis used different approaches to data analyses, with divergent results. Therefore, future studies should pay attention to these methodological issues to improve the quality of statistical methods and increase the level of evidence.

The main content of nurse-driven SM programs incorporates information on COPD, breathing exercises, regular medications, exacerbation management and healthy-life styles, which are the core elements of SM programs for people with COPD (Aboumatar et al., 2018; Billington et al., 2015; Bischoff et al., 2012). However, nurse-driven SM programs were lack of focusing on smoking cessation, adequate nutrition, vaccination and coping with stress. Future studies might focus on these special topics when preparing the content of SM programs. Moreover, it needs to be kept in mind that nurses may need to employ individualized support strategies for each patient, due to standardized approaches may not be effective for all the patients.

This meta-analysis also draws attention to the literature gaps for the future studies. From this perspective, the study authors recognized that nurse-driven SM programs included in this meta-analysis were lack of giving training on energy conservation techniques, dyspnoea and fatigue management and nutritional issues. However, symptoms, in particular dyspnoea and fatigue may directly deteriorate daily living activities of patients and lead to sleep disturbance, cognitive impairment and even care dependency. On the other hand, it needs to be kept in mind, only one of the studies provided counselling and support regarding the psychosocial issues of family caregivers in SM programs (Jonsdottir et al., 2015). As COPD progresses, increased COPD exacerbation, recurrent hospitalizations, lower health status, difficulties in daily living activities and the level of care dependency in COPD affect patients and their caregivers, as well (Jonsdottir et al., 2015). Family members providing care for patients with COPD experience major caregiver burden, depression, anxiety and stress and they also face with challenges regarding the changing familial roles (Strang, Osmanovic, Hallberg, & Strang, 2018). Therefore, it is needed to further alleviate common COPD symptoms, such as dyspnoea, fatigue, sleep deprivation and integrate the family caregivers into nurse-driven SM programs since the diagnosis of COPD.

4.1 | Relevance to clinical practice

Current evidence shows that nurse-driven SM programs could be safely integrated into the clinical practice for patients with COPD. We identified four key gaps in the studies to date of nurse-driven SM programs important for further studies. First, considering

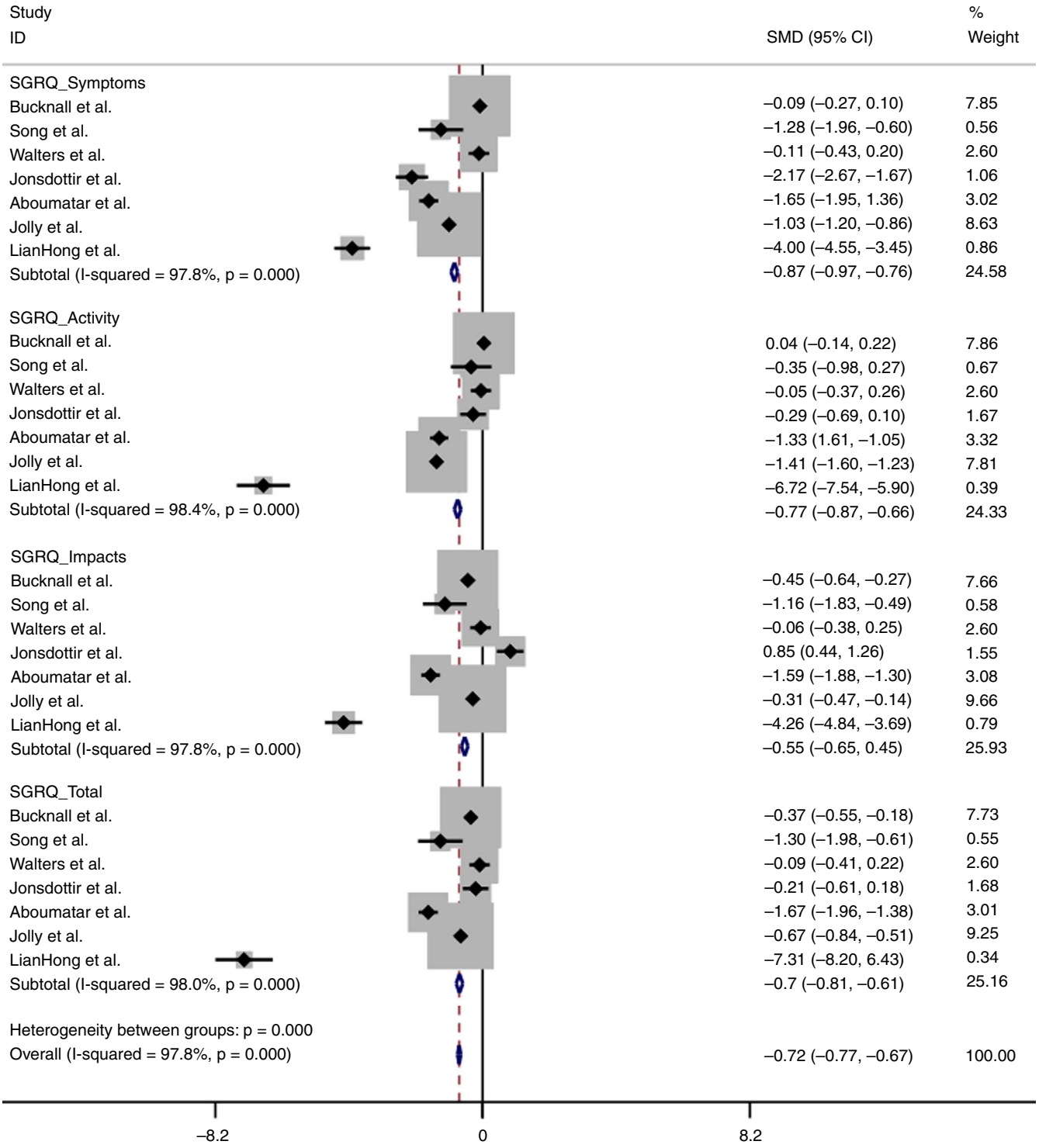

FIGURE 6 Forest plot for St George's Respiratory Questionnaire [Colour figure can be viewed at wileyonlinelibrary.com]

nurse-driven SM programs, necessary attention was not paid to smoking cessation, adequate nutrition, vaccination, coping with stress or providing support and counselling for patients with COPD and their family caregivers. In this respect, it is important to consider integrating these issues into further nurse-driven SM programs for patients with COPD. Second, it is also necessary to carry out further studies that composed of larger sample size, multi-centred and including patients with advanced-stage COPD. Third, educating and counselling family caregivers, besides the patients with COPD, may provide better disease management, skills to manage stress and anxiety and social support to cope with changing familial rules. Fourth, future studies are warranted that evaluating the effects of nurse-driven SM programs on other common COPD symptoms such as cough, fatigue and sleep disturbance and targeting to decrease the care dependency among COPD patients.

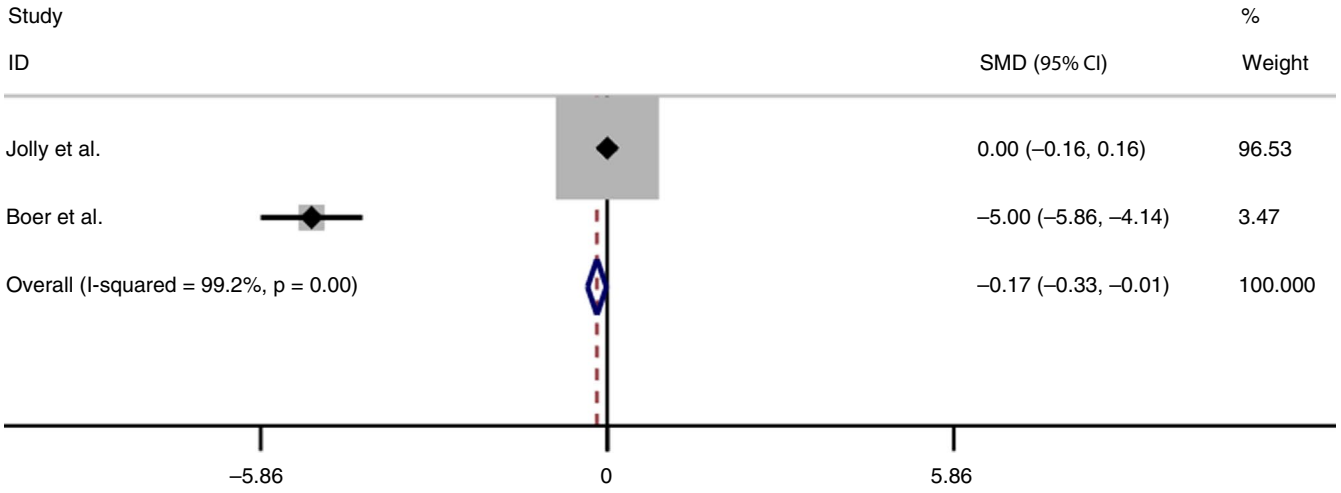

FIGURE 7 Forest plot for EuroQol-5 Dimensions [Colour figure can be viewed at wileyonlinelibrary.com]

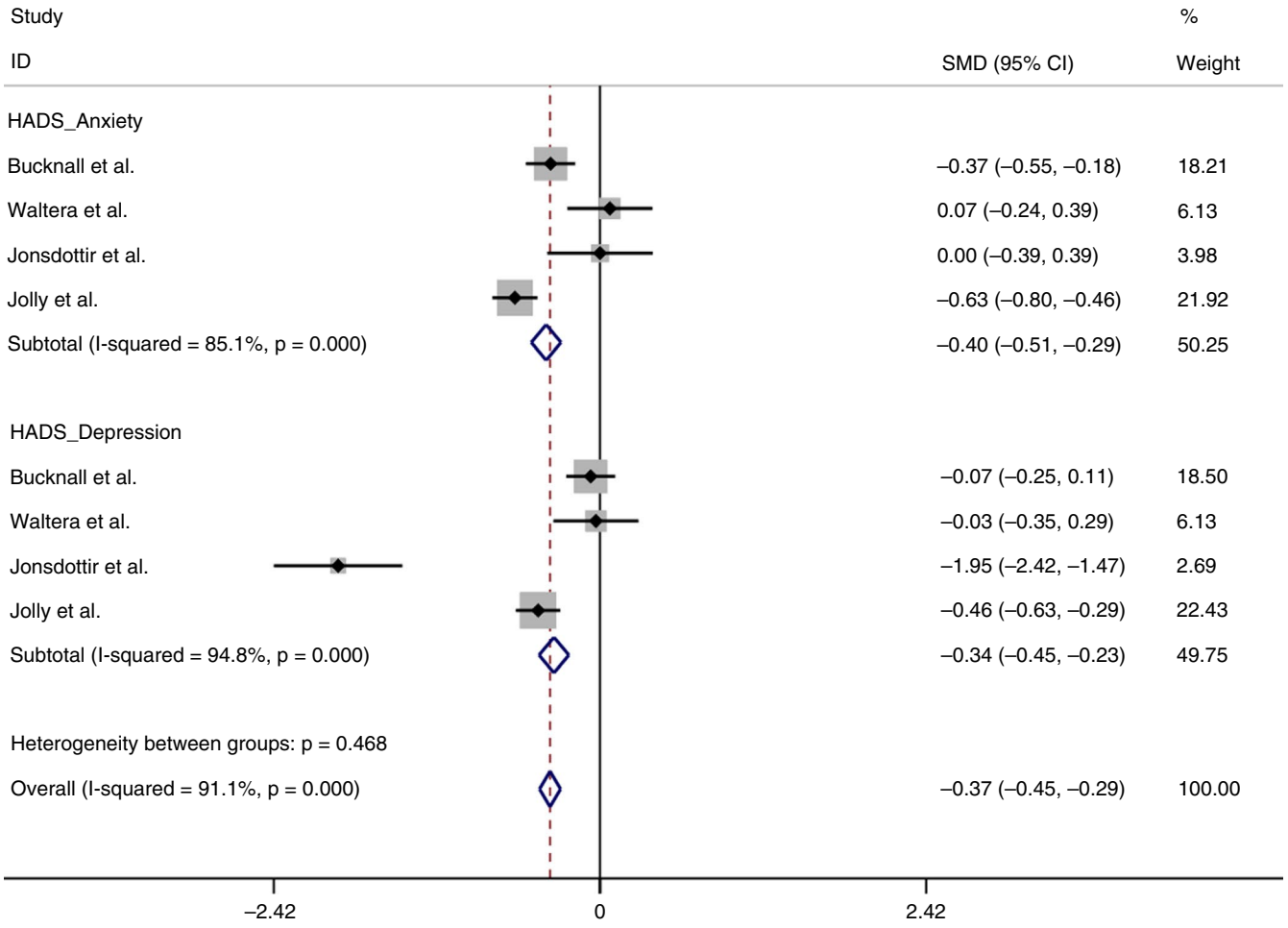

FIGURE 8 Forest plot for Hospital Anxiety and Depression Scale [Colour figure can be viewed at wileyonlinelibrary.com]

4.2 | Limitations

This systematic review and meta-analysis have several limitations such as articles in languages other than English and grey literature including academic papers like thesis, dissertations, research or committee reports and conference papers were not examined. Therefore, some relevant studies might have been missed and this may cause a potential bias. Second, we could not pool all included

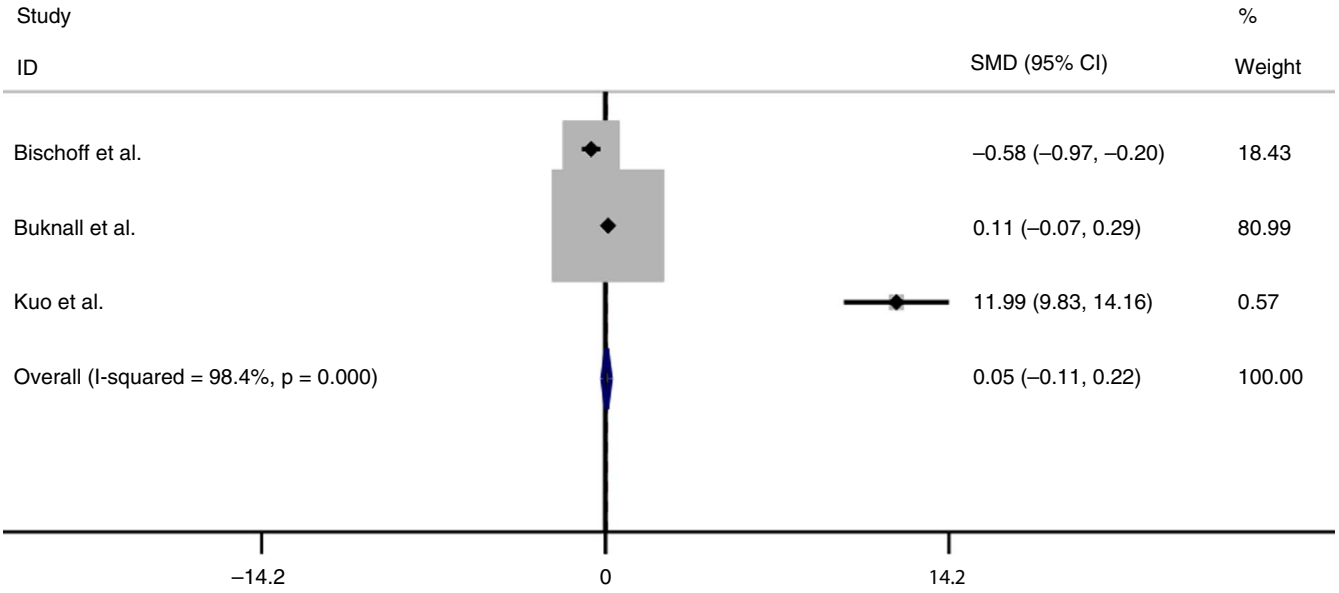

FIGURE 9 Forest plot for Chronic Obstructive Pulmonary Disease Self-Efficacy Scale [Colour figure can be viewed at wileyonlinelibrary.com]

studies for all outcomes in the meta-analyses owing to the high heterogeneity of the outcomes in the included studies and insufficient data in some included studies. Third, treating the sum scores from subjective assessments including continuous quantitative data such as length, walking distance, speed of patients with COPD may have limited this meta-analysis. Finally, interventions varied between the included studies in terms of duration of the intervention, the number of sessions, intervention providers and settings, which caused heterogeneity in the current results.

5 | CONCLUSION

This synthesis of the available evidence suggests the benefits in physical and psychosocial health variables among COPD participants enrolled in a nurse-driven SM programs when compared with the control groups. Overall, the present systematic review and meta-analysis provided evidence at Level 1b that nurse-driven SM programs improved the health status, walking distance and QOL and decreased anxiety and depression scores among patients with COPD. On the contrary, it is hard to make firm conclusions in terms of beneficial effects of nurse-driven SM programs on self-efficacy owing to important differences between the studies in terms of characteristics of participants (age, gender and COPD stage), sample size, content of SM programs, the application of nurse-driven SM programs through home visits, phone calls, or tele-health, developed education materials, scales used and their sensitivity and specificity, time points for measurements and duration of follow-up. Further RCTs are necessary to determine which nurse-driven SM programs are more beneficial for both physical and psychosocial health variables of patients with COPD.

FUNDING STATEMENT

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

ACKNOWLEDGEMENT

The authors also express their thank to Education, Practice and Research Center in Nursing of University for their collaboration and great support.

CONFLICT OF INTEREST

The author(s) declared no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR CONTRIBUTIONS

All authors contributed equally to this article.

PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1111/jan.14505.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

How to cite this article: Helvaci A, Gok Metin Z. The effects of nurse-driven self-management programs on chronic obstructive pulmonary disease: A systematic review and meta-analysis. *J Adv Nurs*. 2020;00:1–23. https://doi.org/10.1111/jan.14505