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Review

# Effectiveness of chronic obstructive pulmonary disease self-management interventions in primary care settings: a systematic review

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**Abstract.** Chronic obstructive pulmonary disease (COPD) is one of the more disabling diseases and the third cause of mortality worldwide. Self-management is considered an effective strategy for controlling and managing COPD. This review aims to summarise the available evidence on the effectiveness of COPD self-management in primary care settings. Social Sciences, Citation Index, MEDLINE, CINAHL, Academic Search Complete and Scopus were searched for randomised controlled trials of COPD self-management in general practice between 2001 and 2018. Ten randomised controlled trials of COPD self-management trials conducted in primary care settings were included in this review. The identified trials have recruited stable patients; a majority having mild to moderate COPD. The trials implemented different types of interventions and measured improvements in knowledge, skills and behaviours of self-management, mental health, self-efficacy and endpoint outcomes such as hospitalisation and quality of life. The findings showed that COPD self-management trials had positive effects on COPD knowledge and improved self-management behaviours such as adherence to medication, physical activities and smoking cessation in some cases; however, the effect of trials on hospitalisation rate, quality of life and healthcare utilisation were not conclusive. There was also not enough evidence to suggest that the trials were efficient in improving self-efficacy, a major driver of self-management behaviours. Primary care COPD self-management trials are efficient in improving surrogate outcomes such as knowledge of and adherence to self-management behaviours; however, such improvements are less likely to be sustainable in the absence of self-efficacy. Future studies should also focus on improving endpoint self-management outcomes like hospitalisation rate and quality of life to benefit both patient and healthcare system.

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## Introduction

Chronic obstructive pulmonary disease (COPD) is one of the major disabling diseases and the third cause of mortality worldwide (World Health Organization 2018). It is one of the top 10 diseases frequently referred from primary care to hospitals (Britt *et al*. 2015). During last decades, several efforts have been made to control COPD progression through the development of efficient self-management programs or interventions. The most recent Cochrane systematic reviews have reported that well-supported self-management interventions are effective in decreasing COPD hospital admissions and improving health-related quality of life (Majothi *et al*. 2015). 'Self-management' refers to 'the ability of a patient to deal with all that a chronic disease entails, including symptoms, treatment, physical and social consequences and lifestyle changes' (Barlow *et al*. 2002). COPD self-management requires improved COPD knowledge, self-recognition of symptoms, smoking cessation, physical activity, medication adherence, the correct use of inhalers and correct breathing techniques, as well as self-efficacy (Effing *et al*. 2016). Self-efficacy refers to an individual's belief in the ability to execute the courses of action required to accomplish or manage a task. Self-efficacy is a major driver of self-management behaviour as it enables individuals to deal with challenges despite barriers that may undermine motivation (Guo *et al*. 2017).

The majority of COPD self-management interventions have focussed on COPD patients in secondary and tertiary care settings following hospitalisation. Few efforts have been made to improve COPD self-management outcomes in primary care settings (Fromer 2011). Primary care is the first contact point between patients and healthcare system and is the best place to intervene with COPD process at an early stage and prevent the burden of managing advanced stages of the disease. However, the effectiveness of self-management interventions on COPD patients in the primary care setting is still uncertain (Mitchell *et al*. 2014). This systematic review therefore intends to summarise the available evidence regarding the effectiveness of self-management interventions on patient's COPD knowledge and skills in primary care settings.

## Methods

### *Search strategy*

The literature was searched to identify COPD self-management trials in primary care settings undertaken since 2001 until July 2018 (Fig. 1). The year 2001 was selected to ensure studies

 

**What is known about the topic?**

- COPD self-management interventions lead to decreased hospitalisation and improved quality of life in secondary and tertiary care settings.

**What does this paper add?**

- COPD self-management trials in primary care settings lead to more positive effects on knowledge than behaviours. Trials with a larger sample size, multiple follow ups, validated outcome measurements and ongoing evaluation plans are more likely to yield promising outcomes.

complied with the updated COPD management guidelines. Search terms included COPD or chronic bronchitis or pulmonary emphysema, self-management and primary care or general practice (Box 1). Online databases searched included Social Sciences, Citation Index, MEDLINE, CINAHL, Academic Search Complete and Scopus. The literature search identified 1089 potential studies. After removing duplications (290), 400 studies were also removed as they were not randomised controlled trials (RCT) and did not study primary care patients.

**Box 1. Example search strategy for reviewing the effectiveness of COPD self-management in primary care**

Search for the same word with multiple endings such as skill and skills.

1. 'COPD' or 'chronic obstructive pulmonary disease' or 'chronic bronchitis' or 'pulmonary emphysema'
2. 'self-management'
3. 'Primary care' or 'general practice'
4. 'Knowledge' or 'awareness' or 'skill' or 'self-efficacy'
5. 1 and 2 and 3 and 4
6. Limit to English language, peer-reviewed and full-text available

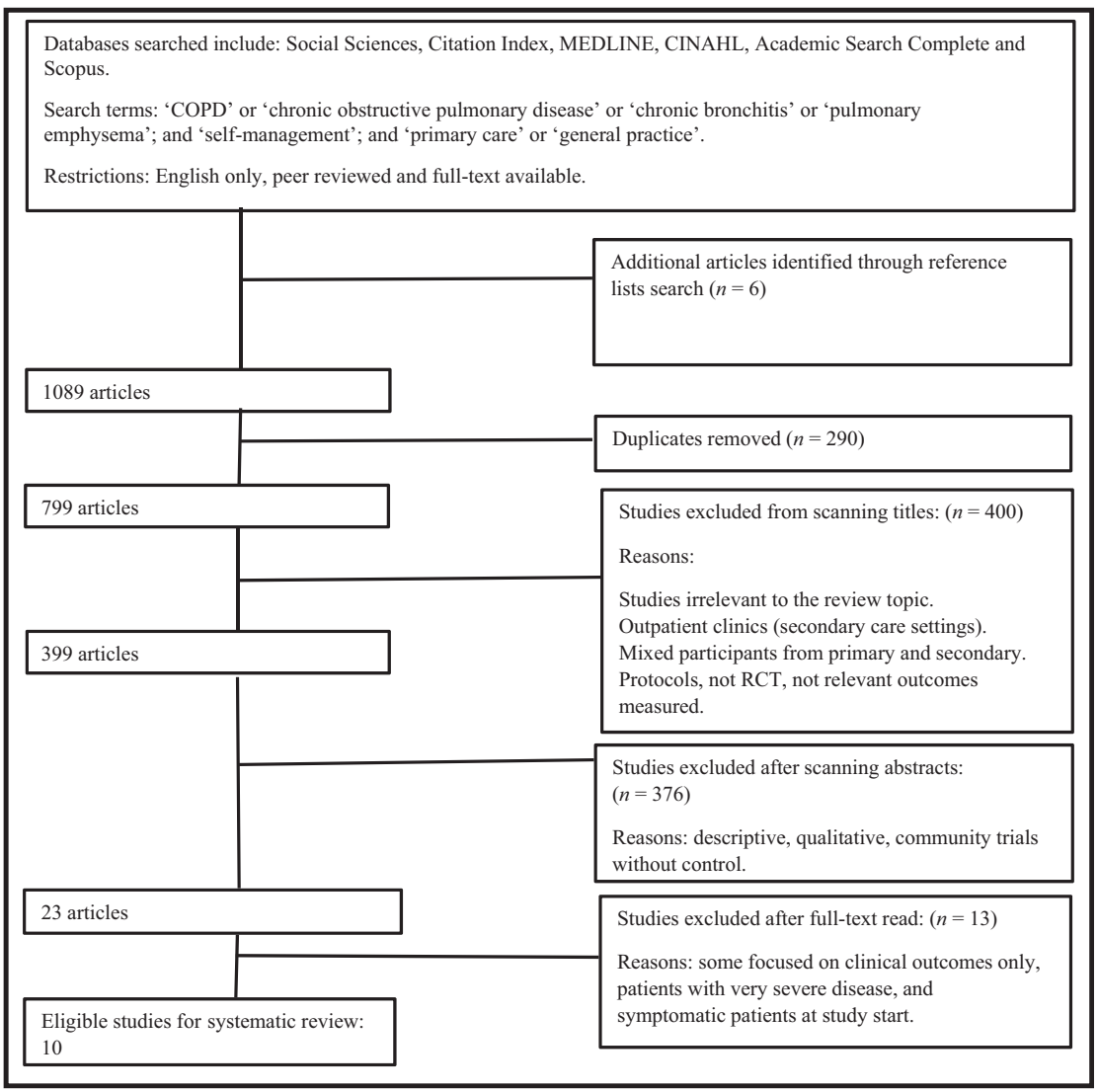


**Fig. 1.** Flow chart for study search and selection for inclusion.

**Table 1. Inclusion and exclusion criteria**

| Inclusion criteria | Exclusion criteria |
|---|---|
| Study type: randomised controlled trials (RCTs) only | Descriptive and qualitative studies |
| Trials measuring chronic obstructive pulmonary disease (COPD) self-management knowledge, skills, behaviours, capacity (i.e. self-efficacy), coping skills and self-management and endpoint outcomes like hospitalisation rate, healthcare utilisation and quality of life | Trials focussed on clinical measures solely such as hospitalisation rate, emergency department visits, symptoms burden and quality of life |
| Trials with stable patients at the beginning of the studies | Trials aimed to treat patient after exacerbation in community-based clinics and those targeted patients with very severe conditions |
| Trials delivered in primary care settings | Trials delivered in hospital settings |

The remaining 399 studies were assessed for eligibility. Titles and abstracts were reviewed against the inclusion criteria, and only 23 studies met the selection criteria. The full-text of the remaining 23 studies were further assessed against the inclusion criteria and 13 studies were excluded. Finally, 10 trials were included in the review (Fig. 1).

### *Study selection criteria and data extraction*

Only RCTs were included in this review. Inclusion and exclusion criteria are described in Table 1. Trials were included if they were conducted in a primary care setting, measured self-management outcomes and published in English. Trials were excluded if they were undertaken in secondary or tertiary care settings and solely focussed on clinical measures. Decisions on study selection based on the inclusion and exclusion criteria were made independently by the authors. Disagreements were resolved by discussion. After that, data were extracted and tabulated by one author and then was double checked by the second author. The quality of the trials was assessed using Cochrane Back Review Group assessment criteria (Furlan *et al*. 2009).

### *Intervention classification and outcomes measurements*

Primary care COPD self-management trials measuring improvement in COPD knowledge, self-management behaviours like physical activity and smoking cessation, mental health, self-efficacy and self-management endpoint outcomes like hospitalisation and quality of life, were reviewed using a Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) protocol (Moher *et al*. 2009). A narrative synthesis was used to organise the literature due to variability in reporting the outcomes of the studies. Quality of the included studies were assessed using Cochrane Back Review Group (CBRG) assessment criteria (Furlan *et al*. 2009). Only high-quality trials scoring six CBRG points or more were included.

## Results

### *Study selection*

The initial search process resulted in 799 articles found. After scanning titles and abstracts, 23 articles remained as potentially relevant trials for full-text reading, of which 10 RCTs were found eligible for the final review.

### *Patients' characteristics*

The demographics of the participants in the trials are described in Table 2. The proportion of males and females varied between the trials, but most of the participants were male. The age of participants ranged between 18 and 81 years. In terms of sample size, it ranged between 52 and 6221 patients.

### *Description of the interventions*

Components of the reviewed trials are depicted in Table 2. The trials included different levels of education delivered using different methods such as telephone mentoring (Walters *et al*. 2013; Jolly *et al*. 2018); face-to-face sessions (Efraimsson *et al*. 2008; Bischoff *et al*. 2012; Taylor *et al*. 2012; Lou *et al*. 2015); or mix methods (McGeoch *et al*. 2006; Zwar *et al*. 2012; Mitchell *et al*. 2014).

The educational component of the trials often covered smoking cessation counselling; breathing and coughing skills; mental health education; exacerbation symptoms recognition and management; improving physical activity levels; the correct use of inhalers; and medication compliance. The duration of the education sessions varied between 6 weeks and 4 years. All of the trials were tailored to the participants' needs.

Only Mitchell *et al*. (2014) and Jolly *et al*. (2018) had provided an exercise program; however, it was not supervised. Bischoff *et al*. (2012) did not provide any exercise program or physical activity education. Three trials used motivational interviewing methods and participants were encouraged to set goals, follow up and provide with further support to comply with the intervention (Taylor *et al*. 2012; Zwar *et al*. 2012; Jolly *et al*. 2018).

Three trials involved more complex and integrated self-management programs, whereby multidisciplinary health teams were involved (Bischoff *et al*. 2012; Mitchell *et al*. 2014; Lou *et al*. 2015). Bischoff *et al*. (2012) and McGeoch *et al*. (2006) mainly targeted improving self-recognition and self-treatment of exacerbation symptoms.

The interventions were often carried out by health professionals, mainly nurses and physiotherapists; the exception being the study by Taylor *et al*. (2012) whereby trained lay persons conducted the interventions. The trials conducted by Kruis *et al*. (2014) and Lou *et al*. (2015) involved multidisciplinary teams consisting of physicians, social workers, nurses and dietitians.

The duration of the interventions varied from 6 weeks (Mitchell *et al*. 2014) to 4 years (Lou *et al*. 2015).

**Table 2. Characteristics of the eligible studies for the review**

Data are presented as *n* unless otherwise stated. COPD, chronic obstructive pulmonary disease; QoL, quality of life; M, male; F, female

| Reference (country of study) | Sampling | Severity of disease | Intervention | Control | Outcomes measurements |
|---|---|---|---|---|---|
| Jolly *et al.* 2018 (UK) | 577 patients<br>Mean age (intervention/ control): 70.7/70.2 years<br>Gender intervention M(F)/ control M(F): 183(63)/183 (64) | Mild disease | Telephone-based intervention by nurse: education and action plan. It includes: smoking cessation, increase exercise and medication counselling, including the correct use of inhalers. Increase patient self-efficacy to self-recognise exacerbation symptoms and treat them accordingly. The intervention consisted of four calls. | Usual care: leaflet about COPD self-management | **At baseline, 6, 12 months**<br>Outcomes:<br>Primary outcome: QoL<br>Secondary outcomes: dyspnoea, self-reported physical activity, psychological morbidity, self-efficacy, health state utility, medication adherence, care plans.<br>**At 12 months:** smoking cessation rate and physical activity by accelerometers. |
| Efraimsson *et al.* 2008 (Sweden) | 52 patients (small sample size)<br>Mean age (intervention/ control): 66/67 years<br>Gender intervention M(F)/ control M(F): 13(13)/13 (13) | Mild, moderate and severe disease | Educational sessions about the disease, coughing and breathing techniques, managing exacerbation, smoking cessation, physical activity, mental health support and medication counselling, including correct inhalers use. Provided individualised action plan.<br>Respiratory nurse, physician and other required disciplines participated. | Usual care | **At baseline and at the end of intervention**:<br>Primary outcome: QoL<br>Secondary outcomes: COPD knowledge, smoking cessation. |
| Mitchell *et al.* 2014 (UK) | 184 patients<br>Mean age (intervention/ control): 69 ± 8/69 ± 10.1 years<br>Gender intervention M(F)/ control M(F): 54(35)/47 (48) | Mild disease | Usual care plus a comprehensive self-management program including: education, exercise programs including daily walking and three times per week of resistance training, management of exacerbation and coping skills.<br>Consultation face to face by physiotherapist who introduced the program for the participants then followed by two phone calls at 2 and 4 weeks to support compliance with the program. 6 weeks' duration of the program. | Usual care (treatment according to GPs and his team in primary care) | **At baseline, 6 weeks, 6 months:**<br>Primary outcome: symptom burden (dyspnoea)<br>Secondary outcomes: shuttle walking test, disease knowledge, anxiety, depression, self-efficacy, smoking status, health utilisation, other domains of the self-reported Chronic Respiratory Questionnaire (CRQ-SR). |

| | | | | | |
|---|---|---|---|---|---|
| Walters *et al*. 2013 (Australia) | 182 patients<br>Mean age (intervention/control): 68.2/67.3 years<br>Gender intervention M(F)/control M(F): 49(54)/47 (51) | Stable moderate or severe disease | Community health nurse provided regular 16 phone calls over 12 months including: mental health education, training of self-management skills, improve communication skills, improve self-efficacy, coping skills and action planning. | Usual care (as provided by the GP and monthly calls without information on self-management skills) | **At baseline, 6, 12 months:**<br>Primary outcome: QoL<br>Secondary outcomes: self-management capacity, self-efficacy, psychological wellbeing, satisfaction with life and hospital admission for COPD. |
| Bischoff *et al*. 2012 (Netherlands) | 165 patients<br>Mean age (intervention/control): 65.5/63.5 years<br>Gender intervention M(F)/control M(F): 37(67)/28 (51) | Mild or moderate disease | **Arm A:** Practice nurse provided a written action plan for recognition and treatment of exacerbation symptoms and a booklet about disease knowledge, treating exacerbation, inhalation techniques and adopting healthy lifestyles. Optional parts for exercises and mental health (coping with stress). The program was introduced in ~2–4 sessions depending on patients' conditions. A further six educational sessions and follow up were delivered to the patients to support patients' compliance with the program. No exercise program was provided.<br>**Arm B**: Practice nurse arranged routine monitoring plus usual care at least once in 1 year to a maximum four times. The frequency depends on patients' conditions and is determined by the GP. | Usual care (GP care according to symptoms as described by patient) | **At baseline, 24 months:**<br>Primary outcome: QoL<br>Secondary outcomes: change in chronic respiratory questionnaire domain scores, self-efficacy (those were additionally measured at 6 months), exacerbation frequency and management.<br>**During all visits (0, 6, 12, 18, 24 months):** Smoking habits, respiratory drugs, spirometry, QoL, self-efficacy. |
| Taylor *et al*. 2012 (UK) | 116 patients (pilot study)<br>Mean age (intervention/control): 69 ± 9.8/70.5 ± 10 years<br>Gender intervention M(F)/control M(F): 40(38)/13 (25) | Moderate or severe disease | Seven educational group sessions over 7 weeks by a trained lay tutor.<br>These include: breathing techniques, mental health support, communication skills, exercise, dietary counselling and action planning.<br>Medication management was discussed with respiratory professional. | Usual care | **At baseline, 2, 6 months:**<br>QoL<br>Anxiety and depression, self-efficacy, physical activity level, healthcare use. |

(*continued next page*)

**Table 2.** (*continued*)

| Reference (country of study) | Sampling | Severity of disease | Intervention | Control | Outcomes measurements |
|---|---|---|---|---|---|
| Zwar *et al*. 2012 (Australia) | 257 patients<br>Mean age (intervention/ control): 65.8/64.4 years<br>Gender intervention M(F)/ control M(F): 67(79)/54 (57) | Mild, moderate and severe disease | Education by nurse during two home visits, two GP consultations and five phone calls over 6 months. Educational visits include: education about COPD, smoking cessation, pulmonary rehabilitation program, vaccination, mental health, dietary counselling. Action planning for exacerbation was provided. | Usual care | **At baseline, 6, 12 months**<br>Primary outcome: QoL<br>Secondary outcomes: lung function, smoking status, immunisation status, attendance at pulmonary rehabilitation program, patients' knowledge of COPD and health service use. |
| Kruis *et al*. 2014 (Netherlands) | 1086 patients<br>Mean age (intervention/ control): 68.2/68.4 years<br>Gender intervention M(F)/ control M(F): 280(274)/305 (227) | Mild, moderate or severe disease | Integrated self-management program provided by a multidisciplinary team including a physician, nurse and physiotherapist.<br>The program included: self-recognition of symptoms, self-management skills and physical activity. | Usual care | **At baseline, 6, 12 months by nurses**<br>**By post at 9, 18, 24 months.**<br>Primary outcome: difference in health status at 12 months.<br>Secondary outcomes: QoL, dyspnoea, exacerbation-related outcomes, self-management, physical activity, level of integrated care, smoking behaviour, healthcare usage (hospital admissions and moderate/severe exacerbation). |
| McGeoch *et al*. 2006 (New Zealand) | 159 patients<br>Mean age (intervention/ control): 69.8/72.1 years<br>Gender intervention M(F)/ control M(F): 45(41)/49 (24) | Mild, moderate and severe disease | Usual care plus individual educational sessions on self-management activities, self-recognition and treatment of exacerbation, mental health education, dietary counselling, smoking cessation, promoting exercise and medication counselling including correct inhaler use. Provided written action plan for exacerbation. Face-to-face educational sessions at baseline and 12 months. Follow-up phone calls at 3, 6, 9 months. The intervention was delivered by a practice nurse or respiratory educator in coordination with their GP. | Usual care (from GP and the practice team, no written action plan was provided) | **At baseline and 12 months:**<br>Primary outcome: QoL<br>Secondary outcomes: frequency of hospital and primary care attendance, frequency of use of courses of antibiotics and oral corticosteroids, change in Hospital Anxiety and Depression Scale, and self-management knowledge. |

| | | | | | |
|---|---|---|---|---|---|
| Lou *et al*. 2015 (China) | 6221 patients<br>Mean age (intervention/control): 61.6 ± 13.5/61.4 ± 13.2 years<br>Gender intervention M(F)/control M(F): 2006(2191)/1924(2096) | Mild, moderate and severe disease | Complex COPD management program including 48 educational sessions every 2 weeks about disease, self-management skills, mental health, importance of the Influenza vaccine, physical activity, medication counselling including correct use of inhalers, and smoking cessation. Caregivers were invited to attend lectures.<br>Written material was provided to patients and their GP.<br>Face-to-face follow up every 2 weeks by a GP either at home or at a clinic.<br>The program was evaluated monthly through the GP assessment report.<br>Patients were assessed every 2 months by a professional multidisciplinary team. | Usual care (by GP according to their needs. Patients were assessed every 2 months by phone calls or face-to-face visits) | **At baseline, 4 years:**<br>Primary outcome: change in the BODE (Body mass index, airflow Obstruction, Dyspnoea, Exercise capacity) index<br>Secondary outcomes: respiratory medication use, hospital admissions and emergency departments visit, depression and anxiety rates, current smoking rates, awareness of COPD, mortality, risk factors. |

### *Quality of the trials*

Only high-quality trials scoring the highest score (six points or more) based on Cochrane Back Review Group assessment criteria (Furlan *et al*. 2009) were selected. The majority of trials were single blinded. This might be explained by the fact that it is not often practical to blind healthcare practitioners as they are involved in delivering interventions. One trial was unblinded (McGeoch *et al*. 2006).

### *Findings*

The effectiveness of the trials was assessed by measuring improvement in COPD self-management behaviours, COPD knowledge, self-efficacy and self-management endpoint outcomes such as hospitalisation rate and quality of life at baseline and at different intervals after the intervention. Tables 2 and 3 summarise the measured variables and achieved outcomes.

### *COPD knowledge*

Six studies found statistically significant improvements in COPD knowledge among the intervention groups compared with the control groups (McGeoch *et al*. 2006; Efraimsson *et al*. 2008; Zwar *et al*. 2012; Walters *et al*. 2013; Mitchell *et al*. 2014; Lou *et al*. 2015). Four studies did not measure COPD knowledge (Bischoff *et al*. 2012; Taylor *et al*. 2012; Kruis *et al*. 2014; Jolly *et al*. 2018).

### *Self-efficacy*

Six studies found no difference in self-efficacy either in the short term or long term (Bischoff *et al*. 2012; Taylor *et al*. 2012; Walters *et al*. 2013; Kruis *et al*. 2014; Mitchell *et al*. 2014; Jolly *et al*. 2018). Taylor *et al*. (2012) found some degree of improvement in self-efficacy in terms of communicating with doctors in the intervention group; however, patients in the control group had higher confidence in managing COPD.

### *Physical activity*

Four trials had shown improvement in physical activity (Efraimsson *et al*. 2008; Taylor *et al*. 2012; Mitchell *et al*. 2014; Lou *et al*. 2015). Jolly *et al*. (2018) found statistically significant improvements in exercise level at a 6-month follow up, but it was diminished at a 12-month follow up. Zwar *et al*. (2012) and Kruis *et al*. (2014) found no improvement in physical activity level.

### *Smoking cessation*

Three studies showed improvement in smoking cessation rate among the intervention groups (Efraimsson *et al*. 2008; Mitchell *et al*. 2014; Lou *et al*. 2015). Efraimsson *et al*. (2008) used spirometry as encouragement to quit smoking, which resulted in one-third of patients being able to quit. Whereas in other studies, there was no difference in the smoking cessation rate at the 6- and 12-month follow ups (Zwar *et al*. 2012; Kruis *et al*. 2014; Jolly *et al*. 2018).

### *Medication adherence and use*

Medication adherence and inhaler use techniques were improved in two studies (Lou *et al*. 2015; Jolly *et al*. 2018). In the trial by Jolly *et al*. (2018), medication compliance was statistically

**Table 3. Summary of outcomes results**
COPD, chronic obstructive pulmonary disease; BODE, Body mass index, airflow Obstruction, Dyspnoea, Exercise capacity

| Study and duration of intervention | Summary of outcomes results |
|---|---|
| Jolly *et al*. 2018 (6 months) | No improvement in self-efficacy.<br>No improvement in smoking cessation.<br>Improved physical activity and medication adherence at 6 months, but it was not sustained at 12 months.<br>No changes in hospital admissions at 6 and 12 months.<br>Lower physician and pharmacist consultations at 6 months, but there were no changes at 12 months.<br>Higher emergency department visits at 6 months, but there were no changes at 12 months.<br>No improvement in dyspnoea.<br>No improvement in quality of life at 6 and 12 months. |
| Efraimsson *et al*. 2008 (3–5 months) | Improve rate of smoking cessation, physical activity, emotional health, patient knowledge of disease and medications use.<br>Improvement in quality of life at the end of intervention (at 3–5 months). |
| Mitchell *et al*. 2014 (6 weeks) | Improved physical activity level (the improvement in exercise level was found to be positive by endurance shuttle walking testing, but not by incremental shuttle walking testing), smoking cessation, anxiety and disease knowledge.<br>No improvement in self-efficacy.<br>Improvement in dyspnoea at 6 weeks, but it was not sustained at 6 months.<br>No improvement in healthcare utilisation.<br>Improvement in fatigue levels, emotion domains at 6 weeks but no improvement in mastery domain. These improvements were diminished at 6 months. |
| Walters *et al*. 2013 (12 months) | Improved self-management activities and disease knowledge.<br>No improvement in self-efficacy.<br>No changes in hospitalisation rate.<br>No improvement in quality of life or satisfaction with life. |
| Bischoff *et al*. 2012 (24 months) | No improvement in self-efficacy.<br>Improved self-management of exacerbation.<br>No improvement in quality of life. |
| Taylor *et al*. 2012 (7 weeks) | Improvement in physical activity level.<br>Improved anxiety but not depression.<br>No improvement in self-efficacy.<br>Improvement in quality of life.<br>No improvement in healthcare utilisation. |
| Zwar *et al*. 2012 (6 months) | Improved COPD knowledge only. No improvement in smoking cessation, physical activity or mental health.<br>No improvement in quality of life, lung function, immunisation rate or health service use.<br>Improved attendance at pulmonary rehabilitation. |
| Kruis *et al*. 2014 (2 years) | No improvement in self-management skills or physical activity.<br>No improvement in quality of life or healthcare usage. |
| McGeoch *et al*. 2006 (12 months) | Improved self-management knowledge only.<br>No improvement in quality of life, health service utilisation or mental health. |
| Lou *et al*. 2015 (4 years) | Improved self-management knowledge and skills, physical activity level, smoking cessation rate and increase vaccination.<br>Decrease in mortality rate and healthcare use including hospital admissions and emergency department visits.<br>Improved health status measured by BODE index. |

significant at 6 months, but it was not sustained at a12-month follow up. In contrast, correct inhaler use maintained at statistically significant at both the 6- and 12-month follow ups.

### *Exacerbation self-management*

Action planning for exacerbation self-management showed improvement in recognition and management of exacerbation (McGeoch *et al*. 2006; Bischoff *et al*. 2012).

### *Mental health*

Four trials reported statistically significant improvement in mental health status through decreased depression and anxiety levels (Efraimsson *et al*. 2008; Taylor *et al*. 2012; Mitchell *et al*. 2014; Lou *et al*. 2015).

### *Self-management endpoint outcomes: quality of life and hospitalisation rate*

Only the trial by Lou *et al*. (2015) improved the hospitalisation rate and the trial by Taylor *et al*. (2012) led to a statistically significant improvement in the quality of life.

## Discussion

This systematic review analysed the effectiveness of 10 COPD self-management trials on COPD self-management outcomes in primary care settings. The interventions were heterogeneous in

terms of contents, duration, intensity, severity of the disease, frequency of follow ups, methods of delivery and healthcare disciplines involved. Some trials involved only education and action planning, whereas others involved more complex self-management programs (Bischoff *et al*. 2012; Mitchell *et al*. 2014; Lou *et al*. 2015). Only one trial involved an integrated disease management program (Kruis *et al*. 2014). Thus, the findings of this review should be interpreted with caution.

Patient education was an integral part of the all trials. This complies with the current guidelines that mandate education as a corner stone in COPD self-management programs (Wang *et al*. 2017). Our findings showed that the majority of interventions improved COPD knowledge and adherence to treatment and correct use of inhalers. There were also some improvements in patients' mental health, especially in terms of anxiety level. Few interventions had a positive effect on physical activity and smoking cessation. These findings are consistent with the findings of other systematic reviews assessing the effects of self-management education (Effing *et al*. 2007; Wang *et al*. 2017).

We found that improvement in COPD knowledge does not always lead to improvement in self-management skills or behaviour (Jolly *et al*. 2018). This is in line with the literature, which indicates that health literacy and disease knowledge are not readily translated into self-management behaviours (Niknami *et al*. 2018). Despite compelling evidence suggesting that physical activity improves COPD management by reducing exacerbation (Dheda *et al*. 2004; Jolly *et al*. 2016), only two of the trials had incorporated limited unsupervised exercise programs (Mitchell *et al*. 2014; Jolly *et al*. 2018). The trials appeared to have some positive effects on exercise level. Our findings suggest that supervised physical activity programs are more likely to be more efficient (Jolly *et al*. 2016).

In line with previous systematic reviews (Wang *et al*. 2017), our findings suggest that self-management interventions can have some positive effects on the rate of smoking cessation (Efraimsson *et al*. 2008; Mitchell *et al*. 2014). Available literature suggests that using motivational behaviour-changing strategies is more likely to result in smoking cessation (Bartlett *et al*. 2014).

More importantly, the majority of the trials, especially those recruited stable patients with mild-to-moderate COPD, failed to improve self-efficacy, which is essential for both changing and maintaining self-management behaviours (Guo *et al*. 2017). This finding suggests that assessing patient readiness, especially among stable patients with mild-to-moderate disease, who are more likely to be motivated to follow self-management plans due to their relatively stable condition, is critical in improving the effectiveness of self-management interventions (Robinson *et al*. 2008).

We also found that the self-management trials lead to positive improvements in exacerbation self-recognition and management, which is critical in COPD management in primary care settings. This is in line with another systematic review, which found that action planning and brief education about the action plan are enough to improve exacerbation self-management skills (Howcroft *et al*. 2016).

In line with the literature (Jonkman *et al*. 2016), our findings suggest that more intense and frequent education interventions with frequent and long-term follow ups, combined with active patient engagement, are more likely to yield promising outcomes.

Finally, the trials were mainly unsuccessful in generating significant improvements in terms of COPD self-management endpoint outcomes, namely quality of life and hospitalisation rate. Only one trial improved the COPD hospitalisation rate (Lou *et al*. 2015) and one trial generated improvements in quality of life (Taylor *et al*. 2012). Improvement in quality of life and hospitalisation rate is critical for the cost effectiveness of COPD self-management trials in primary care. Our finding warrants further studies to find better strategies to improve COPD-related quality of life and hospitalisation rate to benefit both patients and the community.

### *Limitations*

Despite invaluable data obtained in this study, this systematic review has some limitations. The description of interventions, as well as reporting and analysis of the outcomes measurements, were not clear in all the trials. The heterogeneity of the interventions makes comparison very difficult. The professional background of those who administered the interventions could affect the quality of the information provided.

## Conclusion and future research implications

COPD self-management trials in primary care settings lead to more positive effects on knowledge than self-management behaviours. This might be explained by the fact that the trials were unable to improve self-efficacy, which is essential for translating knowledge to behaviour. Therefore, future studies should focus on improving self-efficacy to make sure patients have self-belief and capacity to execute the courses of action required to accomplish self-management tasks despite barriers undermining motivation (Guo *et al*. 2017).

More importantly, the trials failed to yield any significant improvement in quality of life and hospitalisation rate, which is vital for cost-effectiveness from a healthcare system point of view. This finding requires well-designed trials equipped with strategies aiming to improve endpoint outcomes such as quality of life and hospitalisation rate in primary care settings. Our analysis recommends that trials with a larger sample size, longer follow ups, validated outcome measurements and ongoing evaluation allowing frequent revisions of the intervention content and delivery methods are more likely to improve quality of life and hospitalisation rate (Lou *et al*. 2015).

## Conflicts of interest

The authors have no conflicts of interest to declare.

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