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Does health coaching improve health-related quality of life and reduce hospital admissions in people with chronic obstructive pulmonary disease? A systematic review and meta-analysis

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Purpose. To systematically review the evidence for health coaching as an intervention to improve health-related quality of life (HRQoL) and reduce hospital admissions in people with chronic obstructive pulmonary disease (COPD).

Methods. We systematically searched MEDLINE, EMBASE, PsycINFO, and CINAHL from database inception to August 2018 to identify all randomized controlled trials (RCTs) of health coaching for people with COPD. Eligible health coaching interventions had to include three components: goal setting, motivational interviewing, and COPD-related health education. Data were extracted on study characteristics and the effects of the intervention on HRQoL, hospital admissions, physical activity, self-care behaviour, and mood. Study quality was appraised by two authors using the Cochrane tool for assessing the risk of bias in RCTs. Effect sizes (standardized mean differences [SMD] or odds ratios [OR]) with 95% confidence intervals (CIs) were calculated and pooled using random effects meta-analyses.

Results. Of 1578 articles, 10 RCTs were included. Meta-analysis showed that health coaching has a significant positive effect on HRQoL (SMD = −0.69, 95% CI: −1.28, −0.09, p = .02, from k = 4) and leads to a significant reduction in COPD-related hospital admissions (OR = 0.46, 95% CI: 0.31, 0.69, p = .0001, from k = 5), but not in all-cause hospital admissions (OR = 0.70, 95% CI: 0.41–1.12, p = .20, from k = 3). Three of four studies reported significant improvements to self-care behaviours such as medication adherence and exercise compliance.

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Conclusions. This is the first systematic review to show that health coaching may be a candidate intervention to improve HRQoL and reduce costly hospital admissions in people with COPD.

Statement of contribution

What is already known on this subject?

- COPD is a leading cause of death worldwide and considerably reduces HRQoL. In turn, HRQoL is associated with a range of adverse health outcomes in COPD.
- Health coaching is a self-management intervention for people with long-term conditions such as COPD. Studies have examined whether health coaching improves HRQOL and other health outcomes in people with COPD, but no systematic review has been conducted.

What does this study add?

- The first systematic review and meta-analysis of RCTs of health coaching for people with COPD.
- Health coaching may be a candidate intervention for improving HRQoL and reducing COPD-related hospital admissions in people with COPD.
- The need to establish the most effective health coaching components, delivery modality, and economic impact.

Chronic obstructive pulmonary disease (COPD) is a long-term condition (LTC) that affects approximately 300 million people globally (Vos *et al.*, 2015). It is currently the fifth leading cause of death worldwide and is expected to become the third by 2030 (World Health Organization, 2016). In the United Kingdom (UK), COPD exacerbations are the second most common cause of emergency hospital admissions and COPD is one of the most costly inpatient conditions to be treated by the National Health Service (NHS; Department of Health, 2012). Similarly, in the United States of America (USA), almost 700,000 hospitalizations each year are due to COPD (Almagro *et al.*, 2006). These hospitalizations account for a substantial proportion of the annual direct medical costs of COPD, yet they are potentially preventable (Roberts *et al.*, 2002). As the global population increases and ages, the human and economic costs of COPD will continue to increase.

COPD is a progressively disabling condition and is associated with impaired health-related quality of life (HRQoL; Garrido *et al.*, 2006; Jones *et al.*, 2011). HRQoL is a measure of the impact of disease on daily life and subjective well-being (Jones, 1991). It is a multidimensional concept that includes domains related to the physical, social, and psychological impact of illness (Bakas *et al.*, 2012). As COPD is not reversible and lung function will not improve, HRQoL is a key, modifiable patient-centred factor that is associated with important health outcomes for people.

Poor HRQoL in COPD is negatively associated with symptom severity (Garrido *et al.*, 2006; Hu & Meek, 2005), reduced physical functioning (Hu & Meek, 2005), depression, and anxiety (Blakemore *et al.*, 2014), and an increased risk of exacerbations (Seemungal *et al.*, 1998) and mortality (Domingo-Salvany *et al.*, 2002). Furthermore, people with moderate to severe COPD and poor HRQoL are at a greater risk of readmission to hospital and are more likely to be issued a home nebulizer and to be referred to a respiratory specialist (Osman, Godden, Friend, Legge, & Douglas, 1997). In addition, clinical measures of pulmonary function (i.e., FEV1 and FVC) have been found to be unrelated to readmission in people with low HRQoL. In a systematic review of prospective longitudinal cohort studies, it was found that depression predicted poor HRQoL in people with COPD (Blakemore *et al.*, 2014). Depression in

COPD patients has also been found to be associated with an increased risk of hospital admission (Dickens *et al.*, 2012; Guthrie *et al.* 2016). Thus, it is plausible that differences in HRQoL can better explain the variance in use of health care resources than differences in pulmonary function. Improving HRQoL in people with COPD may be a promising route through which to reduce associated urgent health care costs.

Self-management interventions can improve HRQoL and reduce exacerbations in people with COPD (Cannon *et al.*, 2016; da Silva, 2011; Peytremann-Bridevaux, Staeger, Bridevaux, Ghali, & Burnand, 2008). Such interventions focus on increasing patients' knowledge of COPD and improving their confidence and skills in managing symptoms and treatment. Intervention content typically includes action planning, health education, and support from a health care professional (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002; Monninkhof *et al.*, 2003). The aim is to facilitate behaviour change through a combination of health education and promotion of healthy behaviours (e.g., smoking cessation). The King's Fund (2012) has highlighted the importance of patient-centred, tailored care plans and has called for greater efforts to enable patients to co-design a personalized self-management plan through interventions such as health coaching.

Health coaching is rapidly emerging as an approach to improve patient self-management and facilitate healthy behaviour change in LTCs. It is a patient-centred intervention that aims to improve disease self-management by motivating patients to achieve goals that improve their HRQoL and overall health. It is believed that the distinct 'coaching' element, aided by the use of motivational interviewing techniques, is key to empowering people to improve and maintain a good health status (Linder, Menzies, Kelly, Taylor, & Shearer, 2003). The potential of health coaching for improving a range of patient outcomes has been demonstrated across different populations with LTCs, such as type 2 diabetes mellitus, congestive heart failure, and rheumatoid arthritis (Kivelä, Elo, Kyngäs, & Kääriäinen, 2014). In their systematic review, Kivelä *et al.* (2014) found that health coaching improved various physiological (e.g., weight loss and HbA1c), behavioural (e.g., physical activity), psychological (e.g., self-efficacy and mental health status), and social (e.g., social support) outcomes across 11 of 13 studies.

To date, there have been several studies of health coaching for people with COPD, but results have been inconclusive as to any benefits on HRQoL, health care utilization, physical activity, and other health outcomes. However, qualitative process evaluations have indicated high acceptability of this intervention for people (Walters *et al.*, 2012). It is possible that the inconsistent findings across studies are partly due to the lack of consensus regarding the optimal components and content of an effective health coaching intervention (Wolever *et al.*, 2013). Researchers have adopted varying definitions of health coaching, resulting in different delivery modalities and a range of intervention strategies targeted for psychological and behavioural change. In an attempt to resolve this issue, Wolever *et al.* (2013) systematically reviewed the medical and health literature on health and wellness coaching to establish a consensus definition of health coaching. Based on their findings, the present review defines health coaching as a patient-centred approach wherein the individual and coach work together to set goals to improve health outcomes, achieving these through active health education processes and motivational interviewing techniques applied by the coach. Therefore, the present review aims to systematically review the evidence for health coaching as an intervention for people with COPD. The specific objectives of the review are to:

1. Examine whether health coaching is an effective intervention for improving HRQoL in people with COPD.
2. Examine whether health coaching is an effective intervention for improving other health outcomes in people with COPD, such as hospital admissions, physical activity, self-care adherence, and mood.

Method

This review is reported according to the PRISMA statement (Moher, Liberati, Tetzlaff, & Altman, 2009; Appendix S1). The PROSPERO protocol registration number for this systematic review is CRD42016050329 (Peters, Blakemore, & Long, 2016).

Search strategy and study inclusion process

We initially conducted a systematic search of four electronic databases (MEDLINE, EMBASE, PsycINFO, and CINAHL) from database inception to December 2016 to identify RCTs of health coaching interventions for people with COPD. The searches were then rerun in all databases in August 2018 and limited to the 2016–2018 publication period. Search strategies were developed within the team and used Medical Subject Headings (MeSH) terms, keywords, and suitable variants on COPD, health coaching, HRQoL, and hospital admissions (Appendix S2). Microsoft Excel and Endnote software were used to organize articles retrieved by the searches.

Following the database searches, duplicated articles were excluded and the first author screened the titles and/or abstracts of all identified articles and retrieved the full texts of any potentially eligible articles. The full texts were assessed against the inclusion and exclusion criteria to determine eligibility (Table 1). The PICOS ('Population', 'Intervention, 'Controls', 'Outcomes', and 'Study Design') tool was used to formulate the eligibility criteria (Centre for Reviews and Dissemination, 2009). An inter-rater reliability test on a subsample (20%; $k = 11$) of potentially eligible articles retrieved in the December 2016 searches was completed by a second author and demonstrated high agreement (91%). The single disagreement was related to the definition of motivational interviewing, and this was resolved through discussion with a third author. Sixteen per cent ($k = 9$) of the full texts were also screened by a second author before making a final decision. These were not randomly selected but were studies for which eligibility was more ambiguous. We requested further information from seven authors (reflecting eight articles), of whom five replied. Of these, four articles were included and the remaining four excluded (following three unanswered requests and one reply that contained details that led to the exclusion of the article).

Data extraction

A data extraction sheet was developed, piloted, and refined, following data extraction guidelines (Centre for Reviews and Dissemination, 2009; Higgins & Green, 2011). One author extracted data on study setting, design, intervention content and characteristics, health professionals delivering the intervention, sample characteristics, outcome measures, and results. A second author extracted the data needed to undertake the meta-analyses.

Table 1. Inclusion and exclusion criteria using the PICOS tool

Eligibility criteria	
Population	Adults (aged 18+) with COPD diagnosed and/or confirmed by spirometry as an forced expiratory volume in 1 s (FEV_1) < 80% of the predicted values according to GOLD (2017) criteria or FEV_1/forced vital capacity (FVC) ratio of < 0.70. Co- or multi-morbidities were included, except asthma, a current respiratory disorder other than COPD, or serious and unstable cardiovascular disease (unless separate data for COPD patients are reported)
Intervention	Intervention must include evidence of goal setting, motivational interviewing techniques, and COPD-related health education. Interventions that do not have clear evidence of all three components will be excluded The intervention must be delivered by a qualified HCP, over a minimum of two sessions, either face to face, by telephone, online, email, tablet, smartphone, or a combination of these methods. Interventions that include group, instead of individual, coaching sessions will be excluded
Control	Trials must consist of one group that received the health coaching intervention and one group that received either treatment as usual, wait-list control, or a no intervention control group
Outcomes	Primary outcome measure: a validated, self-report measure of general quality of life and/or disease-specific HRQoL Secondary outcome measure(s): COPD-related hospital admissions (validated by hospital records). We accepted any objective measure of physical activity. Self-care adherence and mood must be measured using a self-report measure. Secondary outcome measures will be included as and when reported
Study design	Randomized controlled trials (RCTs)

Data analysis and synthesis

We conducted a narrative synthesis of the results, including all primary and secondary outcome measures. Where possible, we conducted meta-analysis in Review Manager 5.3. Meta-analysis was deemed possible where the necessary data, as outlined below, were available in the published paper. We did not contact authors for additional data to include in the meta-analysis. We also did not make any decisions about inclusion in the meta-analysis based on the quality of the studies.

We calculated the effect size (standardized mean differences [SMD]) and 95% confidence intervals (CIs) for continuous outcomes where means, standard deviations (SD), and sample sizes were available for both the health coaching and control groups. SMD was chosen to allow comparison between studies that had measured the same outcome using different measures (e.g., measured HRQoL with the St George's Respiratory Questionnaire [SGRQ; Jones, Quirk, & Baveystock, 1991] and the SGRQ-C). SMD was calculated by dividing the difference in the mean outcome between the two groups with the pooled SD. Appropriate transformations were made to ensure that the direction of each scale was the same (mean scores multiplied by -1; Borenstein, Hedges, Higgins, & Rothstein, 2009; Higgins & Green, 2011). Studies that presented change scores, or baseline and change scores, were not eligible for inclusion in the meta-analysis, as per Cochrane guidelines which state that final value and change-from-baseline measures should not be combined together as SMD (Higgins & Green, 2011).

A SMD of zero would be interpreted as health coaching and treatment as usual having equivalent effects on the outcome. In the case of the SGRQ, improvement in HRQoL is associated with lower scores, and therefore, an SMD of lower than zero would indicate that health coaching is more efficacious than treatment as usual. The size of the effect can be interpreted using Cohen's (1988) guidelines: small effect (SMD = 0.2), medium effect (SMD = 0.5), and a large effect (SMD = 0.8).

Odds ratios (ORs) and 95% CIs were calculated for hospital admissions where the number of subjects admitted for COPD-related reasons and/or all-cause admissions and sample size was reported. The OR is the ratio of odds of hospital admissions in the intervention condition to the odds of hospital admissions in the usual care condition (Borenstein *et al.*, 2009). An OR equal to 1 would indicate that there is no difference in effect between the intervention condition and usual care condition, whereas an odds ratio less than 1 indicates that the intervention reduced hospital admissions.

Where there were multiple follow-up data points, SMDs and ORs were calculated for the follow-up data collected nearest to 6 months to maximize consistency across studies. Effects of the interventions were pooled across independent studies using random effects models, weighted using the inverse of the variance (DerSimonian & Laird, 1986).

Heterogeneity across studies was assessed using the chi-squared test (X^2), which gives an assessment of whether the differences found are due to chance. The I^2 statistic was also calculated, which shows the percentage of variability in the effect estimate that is due to heterogeneity rather than chance (Higgins & Green, 2011). An I^2 of 0–40% can be interpreted as low heterogeneity, 30–60% as moderate heterogeneity, 50–90% as substantial heterogeneity, and 75–100% as considerable heterogeneity (Higgins & Green, 2011). We did not formally test for publication bias in this review because of the small number of studies eligible for inclusion (Lau, Ioannidis, Terrin, Schmid, & Olkin, 2006).

Quality assessment

Study quality was appraised using the Cochrane tool for assessing the risk of bias in RCTs (Higgins *et al.*, 2011). This tool features six domains of bias: selection bias, performance bias, detection bias, attrition bias, reporting bias, and other bias. Within each domain, judgements were made for one or more items that relate to aspects or outcomes of the domain. Assessing the risk of bias for each item involved two steps. Firstly, a summary of the trial information pertinent to the decision of bias for that item was made. Secondly, each item was assigned a rating of high, low, or unclear risk of bias. This judgement was based on the extent to which the study characteristics are deemed sufficient to have had an effect on the study results or conclusions.

Two authors independently assessed the risk of bias in the included studies (79% agreement). Any disagreements were resolved through discussion, and if a decision could not be reached, a third author was consulted. The authors rated items across the studies differently on 17 of 80 occasions and discussed these items before agreeing on a final rating. Most disagreements were because of differing opinions regarding whether the primary study authors had provided sufficient detail in order to give a rating of high, low, or unclear bias. The authors revisited Higgins *et al.* (2011) published risk of bias tool to further discuss the rating system based on the information provided by the primary study authors.

Results

In December 2016, electronic and hand searches identified 1,578 articles, and of these, 56 full texts were reviewed and nine studies included. The updated searches in August 2018 retrieved 276 new articles, of which 31 full texts were read in full and one new eligible study was identified. In total, 10 studies met the inclusion criteria (Benzo *et al.*, 2016; Bischoff *et al.*, 2012; Cameron-Tucker *et al.*, 2016; Greening *et al.*, 2014; Johnson-Warrington, Rees, Gelder, Morgan, & Singh, 2016; Jolly *et al.*, 2018; Khdour, Kidney, Smyth, & McElnay, 2009; Mitchell *et al.*, 2014; Song, Yong, & Hur, 2014; Walters *et al.*, 2013). The flow of included studies can be seen in Figure 1.

Study characteristics

The characteristics and main findings of included studies are summarized in Table 2. Table 3 presents a 'quick look' summary of the main findings. The 10 included studies comprised data for 1959 people with COPD, with study sample sizes ranging from 40 to 577 (mean = 196). The mean age of participants was 68 (52% male) (mean age and gender breakdown calculated from $k = 9$ as these details were not reported for the COPD subsample in Greening *et al.*, 2014).

The studies were published between 2009 and 2018. Five studies were conducted in the United Kingdom (Greening *et al.*, 2014; Johnson-Warrington *et al.*, 2016; Jolly *et al.*, 2018; Khdour *et al.*, 2009; Mitchell *et al.*, 2014), two studies in Australia (Cameron-Tucker *et al.*, 2016; Walters *et al.*, 2013), one study in Korea (Song *et al.*, 2014), one study in the Netherlands (Bischoff *et al.*, 2012), and one study in the United States (Benzo *et al.*, 2016). Participants were recruited in either a hospital or primary care setting. Severity of COPD at baseline was measured in nine studies, and most participants had moderate COPD.

Five studies measured respiratory-specific HRQoL using the SGRQ (Greening *et al.*, 2014; Jolly *et al.*, 2018; Khdour *et al.*, 2009; Song *et al.*, 2014; Walters *et al.*, 2013), four studies used the Chronic Respiratory Questionnaire (CRQ; Williams, Singh, Sewell, Guyatt, & Morgan, 2001) (Benzo *et al.*, 2016; Bischoff *et al.*, 2012; Johnson-Warrington *et al.*, 2016; Mitchell *et al.*, 2014), and one study used the COPD Assessment Test (CAT; Jones *et al.*, 2009) (Cameron-Tucker *et al.*, 2016). One study measured general HRQoL using the EuroQoL 5 Dimensions 5 Levels (EQ-5D-5L; Herdman *et al.*, 2011) (Jolly *et al.*, 2018), and one study used the 36-Item Short Form Survey (SF-36; Ware & Sherbourne, 1992) (Walters *et al.*, 2013). Seven studies presented data on hospital admissions, either due to COPD or all-cause, or both. Eight studies measured physical activity using self-report and objective measures. Four studies measured self-care behaviour (e.g., exacerbation management, exercise 'compliance', medication adherence, and smoking cessation behaviours). Three studies measured mood, each using the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983). Total follow-up time varied between studies from 2 to 24 months (mean = 9.8 months).

At baseline, participant HRQoL was moderate for the majority of studies (Benzo *et al.*, 2016; Bischoff *et al.*, 2012; Cameron-Tucker *et al.*, 2016; Khdour *et al.*, 2009; Mitchell *et al.*, 2014; Song *et al.*, 2014; Walters *et al.*, 2013), relatively high in one study (Jolly *et al.*, 2018), and relatively low in one study (Johnson-Warrington *et al.*, 2016).

Details of the intervention

Interventions were delivered by a range of health care professionals: nurse ($k = 5$), pharmacist ($k = 1$), and health coach ($k = 1$) (Table 2). Three studies used the Self-Management Programme of Activity, Coping and Education (SPACE) COPD manual (Apps, Mitchell, & Harrison, 2013). Participants were introduced to the manual by a

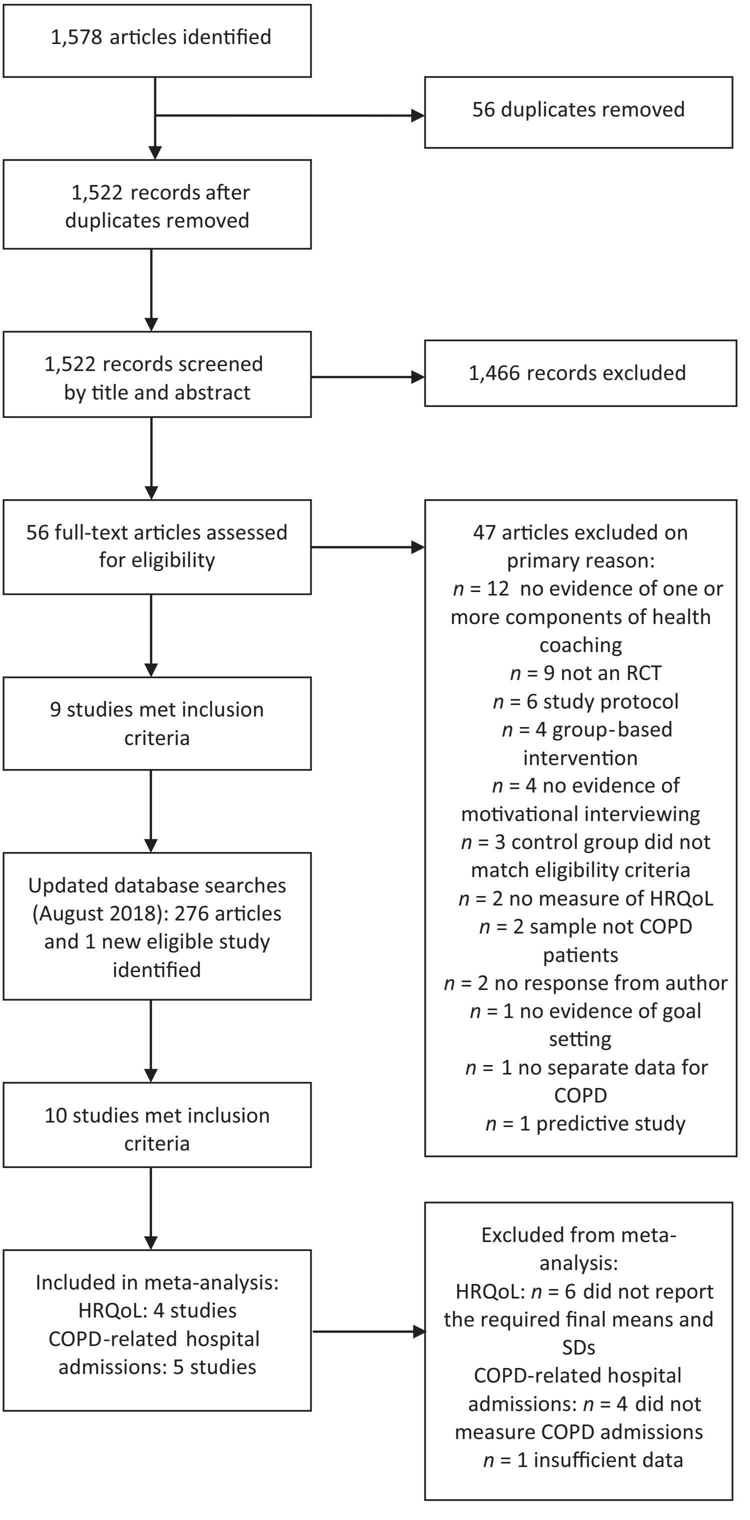

Figure 1. Flow diagram of study inclusion and exclusion process.

Table 2. Main characteristics and findings of the included studies

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
Benzo *et al.* (2016)	United States	*N* = 215, 68 years, 45% male, moderate HRQoL	IG: 1 × 2 hr session in person and seven telephone sessions (duration unknown) over 8 weeks CG: usual care	The two sites had a dedicated health coach. One site also had a registered nurse and the other had a respiratory therapist	The first session was conducted in person by the health coach. The pps was given a written exacerbation emergency plan and the self-management concepts, goal setting, action planning. The details of the forthcoming telephone sessions were discussed	HRQoL: CRQ COPD-related hospital admissions Physical activity: BMA 1, 3, 6, and 12 months	HRQoL: significant between-group differences at 6 and 12 months, favouring the IG COPD-related hospital admissions: significantly lower at 1, 3, and 6 months in the IG, but not at 12 months Physical activity: no significant differences
Bischoff *et al.* (2012)	The Netherlands	*N* = 165, 65 years, 65% male, moderate HRQoL	IG: 2–4 × 1 hr in person sessions scheduled in 4-6 consecutive weeks and 6 × 15 min telephone	Nurses were trained to deliver the intervention	Pps were introduced and guided through to the 'Living well with COPD' programme in person by the	HRQoL: CRQ Self-care adherence: exacerbation management 6 and 24 months	HRQoL: no significant differences Self-care adherence: no significant differences

Continued

Table 2. (*Continued*)

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
			sessions over 24 months CG: (1) routine monitoring and (2) usual care		nurse. A tailored, written exacerbation plan was provided. Telephone calls were made to reinforce self-management skills		
Cameron-Tucker *et al.* (2016)	Australia	*N* = 65, 69 years, 45% male, moderate HRQoL	IG: 1 × in person session (duration unknown) and a mean of 7 × 17 min telephone sessions every 7 days over 8-12 weeks CG: usual care	A research officer delivered the first session. Trained community nurses acted as health mentors in the telephone sessions	In the first session, goals and a personal home-walking action plan were established, and health behaviours were discussed. Telephone calls supported action plans and other health behaviour plans	HRQoL: CAT Physical activity: 6MWD 8-12 weeks	HRQoL: no significant differences Physical activity: significant between-group difference, favouring the CG
Greening *et al.* (2014)	United Kingdom	*N* = 320 with COPD (82%; from total	IG: 1 × in person session (duration unknown) and	The interventionist team (made up of physiotherapists	MI techniques were used to introduce pps to the manual.	HRQoL: SGRQ (at 1.5, 3, and 12 months)	HRQoL: no significant differences

Continued

Table 2. (*Continued*)

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
		$N = 389$), age, gender and baseline HRQoL scores not reported for COPD subgroup	3 × telephone sessions (duration unknown) at 48 hr, 2 weeks, and 4 weeks) CG: usual care	and nurses) introduced pps to the SPACE for COPD manual in person and delivered the telephone sessions	The manual was used to structure the telephone sessions.	COPD-related hospital admissions (at 12 months) Physical activity: ISWT and ESWT (at 1.5, 3, and 12 months)	COPD-related hospital admissions: no significant differences Physical activity: significant between-group difference in ESWT at 1.5 months, favouring the IG, but not at 3 or 12 months. No significant differences found in ISWT
Johnson-Warrington *et al.* (2016)	United Kingdom	$N = 78$, 68 years, 36% male, low HRQoL	IG: 1 × 30-45 min in person session and 6 × telephone sessions (duration unknown) over 10 weeks (within	A physiotherapist introduced pps to the SPACE for COPD manual. The research team delivered the	MI techniques were used to introduce pps to the manual and to facilitate behaviour change, goal setting, and problem-solving.	HRQoL: CRQ COPD-related hospital admissions Physical activity: ISWT and ESWT	HRQoL: no significant differences. Both conditions significantly improved their CRQ score

Continued

Table 2. (*Continued*)

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
			72 hr, at 2, 4, 6, 8, and 10 weeks) CG: usual care	telephone sessions	Pps worked through the manual at home. Telephone sessions were tailored to the pps needs and reinforced skills (e.g., how to identify and manage exacerbations, promote an active lifestyle, and provide encouragement)	Mood: HADS 3 months	(within-group differences) COPD-related hospital admissions: no significant differences Physical activity: no significant differences. Both conditions significantly improved their exercise tolerance (ESWT) Mood: no significant differences
Jolly *et al.* (2018)	United Kingdom	$N = 577$, 70 years, 63% male, high HRQoL	IG: 4 × telephone sessions (21–40 min) at weeks 1, 3, 7, and 11, with supported written	Nurses were trained to deliver the intervention	Telephone health coaching including self-management skills related to health behaviours	HRQoL: SGRQ, EQ-5D-5L (at 6 and 12 months) Physical activity: IPAQ (at 6 and	HRQoL: no significant differences Physical activity: significant

Continued

Table 2. (*Continued*)

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
			information at weeks 16 and 24 CG: usual care		and correct inhaler use technique. A pedometer and self-monitoring diary were provided. Standard as well as supportive, tailored written information was given after each session (e.g., goals agreed, information leaflet showing correct inhaler use technique)	12 months), GENEActiv accelerometers (at 12 months) Mood: HADS (at 6 and 12 months) Self-management activities related to smoking cessation, medication adherence (at 6 and 12 months)	differences in favour of the IG at 6 months, but not 12 months Physical activity: no significant differences Mood: no significant differences
Khdour *et al.* (2009)	United Kingdom	$N = 173$, 66 years, 44% male, moderate HRQoL	IG: 4 × in person sessions (the first lasted approx. 1 hr) and 2 × telephone sessions at 3 and	A research pharmacist delivered the first session. A clinical pharmacist then designed a tailored	Pps' individual needs were determined in the first session. A tailored intervention was	HRQoL: SGRQ COPD-related hospital admissions Self-care adherence:	HRQoL: significant differences in the symptoms domain, impact domain, and

Continued

Table 2. (*Continued*)

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
			9 months (duration unknown) CG: usual care	intervention and delivered the remaining in person and telephone sessions	designed for the remaining sessions. Pps attended an outpatient clinic every 6 months, where self-management education was reinforced. Pps received telephone calls between outpatient clinic appointments to reinforce COPD-related health education, during which they were encouraged to be motivated to achieve their goals	medication adherence, Morisky adherence scale 6 and 12 months	total score at 6 months, favouring the IG. Symptoms and impact domains remained significantly different at 12 months COPD-related hospital admissions: significant difference at 6 and 12 months, indicating a reduction in hospital readmissions in the IG Self-care adherence: the IG exhibited high adherence scores than the

Continued

Table 2. (*Continued*)

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
							CG at 6 and 12 months
Mitchell *et al.* (2014)	United Kingdom	*N* = 184, 69 years, 55% male, moderate HRQoL	IG: 1 × 30–45 min in person session and 2 × telephone sessions at 2 and 4 weeks (duration unknown) CG: usual care	A physiotherapist delivered all sessions	Pps were introduced to the SPACE for COPD manual during the initial in person session. MI techniques were used to explore the pps' readiness to change and to enhance motivation. Pps' needs were discussed and goal setting strategies were introduced. Pps were advised how to use the manual at home and implement the exercise regime. Skills and	HRQoL: CRQ COPD-related hospital admissions Physical activity: ISWT and ESWT Mood: HADS 6 weeks and 6 months	HRQoL: significant differences in three of four CRQ domains (dyspnoea, fatigue, and emotion) at 6 weeks, favouring the IG, but not at 6 months. No significant differences for CRQ-mastery at 6 weeks or 6 months COPD-related hospital admissions: no significant differences

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Table 2. (*Continued*)

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
					encouragement were given during telephone calls		Physical activity: significant differences in both the ISWT and ESWT at 6 weeks; this effect was maintained for the ESWT at 6 months Mood: significant between-group difference in anxiety scores at 6 weeks and 6 months, favouring the IG. No significant differences in depression score

Continued

Table 2. (*Continued*)

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
Song *et al.* (2014)	Korea	$N = 40$, 67 years, 65% male, moderate HRQoL	IG: 3 × in person sessions (duration unknown) and 2 × telephone sessions (duration unknown) over 8 weeks CG: usual care	A nurse interventionist delivered all sessions	Each in person session consisted of self-management education, underpinned by MI techniques, PR-based exercises and encouragement to achieve goals	HRQoL: SGRQ Physical activity: 6MWD Self-care adherence: self-report measures of medication adherence and exercise compliance 2 months	HRQoL: significant between-group differences in all SGRQ components, favouring the IG Physical activity: no significant differences Self-care adherence: significant between-group differences in medication adherence and exercise, favouring the IG.
Walters *et al.* (2013)	Australia (Tasmania)	$N = 182$, 68 years, 52% male,	IG: 16 × 30 min telephone sessions over	A community health nurse was trained as a health mentor	Mentors supported pps in setting medium- to long-	HRQoL: SF-36 and SGRQ COPD-related	HRQoL: no significant differences

Continued

Table 2. (*Continued*)

Authors (year)	Country	Sample: *N*, mean age, % male, baseline HRQoL	Intervention duration	Interventionist and delivery	Intervention details	Outcome measures and follow-up points	Main findings
		moderate HRQoL	12 months, with increasing time between calls CG: usual care including monthly telephone calls	and delivered all sessions.	term goals targeting different health behaviours and individual action plans to reach these goals. Goals were reviewed and revised collaboratively during telephone sessions	hospital admissions 6 months and 12 months	COPD-related hospital admissions: no significant differences

Note. 6MWD = 6-min walking distance; BMA = Body Media Armband; C = control group; CAT = COPD Assessment Test; COPD = chronic obstructive pulmonary disease; CRQ = Chronic Respiratory Questionnaire; EQ-5D-5L = EuroQoL 5 Dimensions 5 Levels; ESWT = endurance shuttle walk test; HADS = Hospital Anxiety and Depression Scale; HRQoL = health-related quality of life; I = intervention group; IPAQ = International Physical Activity Questionnaire; ISWT = incremental shuttle walk test; MI = motivational interviewing; pps = participants; PR = pulmonary rehabilitation; RCT = randomized controlled trial; SF-36; Short Form 36 Health Survey; SGRQ = St. George's Respiratory Questionnaire; SPACE = Self-management programme of Activity = Coping and Education.

Table 3. Summary of findings for key outcome domains

Author (year)	HRQoL	COPD-related hospital admissions	Physical activity	Self-care behaviour	Mood
Benzo *et al.* (2016)	CRQ 6 months: ✓ CRQ 12 months: ✓	1 month: ✓ 3 months: ✓ 6 months: ✓ 12 months: X	BMA 1 month: X BMA 3 months: X BMA 6 months: X BMA 12 months: X	n/a	n/a
Bischoff *et al.* (2012)	CRQ 6 months: X CRQ 24 months: X	n/a	n/a	Exacerbation management: X	n/a
Cameron-Tucker *et al.* (2016)	CAT 2-3 months: X	n/a	6MWD 2-3 months: ✓[a]	n/a	n/a
Greening *et al.* (2014)	SGRQ 6 weeks: X SGRQ 3 months: X SGRQ 12 months: X	12 months: X	ISWT 6 weeks: X ESWT 6 weeks: ✓ ISWT 3 months: X ESWT 3 months: X ISWT 12 months: X ESWT 12 months: X	n/a	n/a
Johnson-Warrington *et al.* (2016)	CRQ 3 months: X	3 months: X	ISWT 3 months: X ESWT 3 months: X	n/a	HADS 3 months: X
Jolly *et al.* (2018)	EQ-5D-5L 6 months: X EQ-5D-5L 12 months: X SGRQ 6 months: X SGRQ 12 months: X	6 months: X 12 months: X	IPAQ 6 months: ✓ IPAQ 12 months: X GENEActiv 12 months: X	Smoking cessation 6 months: X Smoking cessation 12 months: X Medication adherence 6 months: ✓ Medication adherence 12 months: ✓	HADS 6 months: X HADS 12 months: X

Continued

Table 3. (*Continued*)

Author (year)	HRQoL	COPD-related hospital admissions	Physical activity	Self-care behaviour	Mood
Khdour *et al.* (2009)	SGRQ 6 months: ✔ SGRQ 12 months: ✔[b]	6 months: ✔ 12 months: ✔	ESWT 3 months: X	Medication adherence 6 months: ✔ 12 months: ✔	n/a
Mitchell *et al.* (2014)	CRQ 6 weeks: ✔[b] CRQ 6 months: X	6 weeks: X 6 months: X	ISWT 6 weeks: ✔ ESWT 6 weeks: ✔ ISWT 6 months: X ESWT 6 months: ✔	n/a	HADS 6 weeks: ✔ (anxiety only) HADS 6 months: ✔ (anxiety only)
Song *et al.* (2014)	SGRQ 2 months: ✔	n/a	6MWD 2 months: X	Medication adherence 2 months: ✔ Exercise compliance 2 months: ✔	n/a
Walters *et al.* (2013)	SF-36 6 months: X SGRQ 6 months: X SF-36 12 months: X SGRQ 12 months: X	6 months: X 12 months: X	n/a	n/a	n/a

Notes. 6MWD, 6-min walking distance; CAT, COPD Assessment Test; COPD, chronic obstructive pulmonary disease; CRQ, Chronic Respiratory Questionnaire; ESWT; endurance shuttle walk test; HADS, Hospital Anxiety and Depression Scale; HRQoL, health-related quality of life; ISWT, incremental shuttle walk test; SF-36, Short Form 36 Health Survey; SGRQ, St. George's Respiratory Questionnaire.
[a]In favour of the comparison group.
[b]In some of the questionnaire domains.

physiotherapist (k = 2) or a member of the intervention team (k = 1) and instructed to work through it independently. The average number of health coaching sessions was 7 (range = 3–16), but in two studies, the number of sessions varied between participants. In addition to health coaching, one study incorporated an inpatient pulmonary rehabilitation (PR) component with an exercise programme (Greening *et al.*, 2014), which means it is difficult to say with confidence that any positive effects of this intervention are due to health coaching alone.

Risk of bias within studies

The results of the quality assessment are presented in Table 4. Quality varied across the studies, but risk of bias judgements was generally of low risk (69%) or unclear risk (15%). Blinding of research personnel and participants (performance bias) and blinding of outcome measure assessments (detection bias) represent the highest risk of bias domains in the included studies. In addition, three of the included studies assessed intervention fidelity. Benzo *et al.* (2016) and Jolly *et al.* (2018) achieved good fidelity to the intervention. Walters *et al.* (2013) reported low fidelity to the delivery of some intervention elements.

Effect of health coaching on HRQoL

Four of 10 studies reported a significant improvement in HRQoL at follow-up (Benzo *et al.*, 2016; Khdour *et al.*, 2009; Mitchell *et al.*, 2014; Song *et al.*, 2014). Mitchell *et al.* (2014) reported a significant improvement in HRQoL at 6 weeks, but not 6 months. Song *et al.* (2014) reported a significant improvement at 2 months follow-up. Benzo *et al.* (2016) and Khdour *et al.* (2009) reported a significant improvement in HRQoL at 6 and 12 months after the intervention.

The remaining studies did not observe statistically significant findings. Two studies reported that the direction of effect for total HRQoL score favoured the intervention condition (Jolly *et al.*, 2018; Johnson-Warrington *et al.*, 2016). Johnson-Warrington *et al.* (2016) reported statistically significant within-group differences for both conditions for all CRQ-SR domains except CRQ emotion for the usual care condition. Between-group differences were approaching statistical significance for CRQ dyspnoea (p = .062) and CRQ emotion (p = .077) in favour of the intervention.

Conversely, Bischoff *et al.* (2012) reported a reduction (−0.10) in HRQoL in the intervention condition over time, but it was not clinically significant (defined as a change in score of equal to or >0.50). Walters *et al.* (2013) reported that the direction of effect for total HRQoL score at 12 months favoured the usual care condition. Another study reported no within- or between-group changes (Cameron-Tucker *et al.*, 2016), and the final study did not state the direction of effect in the COPD subsample analyses (Greening *et al.*, 2014). Of note, Greening *et al.* (2014) included a PR and exercise component and it is therefore not possible to say with confidence that any positive effects of this intervention are due to health coaching alone.

Four studies were eligible to be included in the meta-analysis for HRQoL (Jolly *et al.* 2018; Khdour *et al.*, 2009; Song *et al.*, 2014; Walters *et al.*, 2013). Each study had used a respiratory-specific measure of HRQoL (i.e., the SGRQ). However, Jolly *et al.* (2018) used the SGRQ-C, which is a COPD-specific version of this measure. Random effects meta-analysis using SMD to pool effects across studies (n = 947) found a significant positive effect for health coaching on the total HRQoL, as measured by the SGRQ, when compared

Table 4. The risk of bias of the included studies

Author (year)	Selection bias		Performance bias		Detection bias	Attrition bias	Reporting bias	Other bias
	Random sequence generation	Allocation concealment	Blinding of personnel	Blinding of participants	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	
Benzo *et al.* (2016)	+	?	+	–	+	+	+	+
Bischoff *et al.* (2012)	+	?	+	–	?	+	+	+
Cameron-Tucker *et al.* (2016)	+	+	+	–	+	+	+	+
Greening *et al.* (2014)	+	+	+	–	+	+	+	+
Johnson-Warrington *et al.* (2016)	+	+	?	–	+	+	+	+
Jolly *et al.* (2018)	+	+	+	–	?	+	+	+
Khdour *et al.* (2009)	+	?	–	–	–	+	+	+
Mitchell *et al.* (2014)	+	+	?	–	+	+	+	+
Song *et al.* (2014)	?	?	?	–	?	+	+	+
Walters *et al.* (2013)	+	+	–	–	?	+	+	+

Note. + low risk of bias, – high risk of bias, ? unclear risk of bias.

with treatment as usual (SMD = −0.69, 95% CI −1.28, −0.09, p = .02) (Figure 2). A considerable degree of heterogeneity was seen across the four studies (X^2 = 40.30, df = 3, p = .00001; I^2 = 93%).

Random effects meta-analysis for the SGRQ subscales did not show any significant effects in favour of the intervention condition: for symptoms (SMD −0.50, 95% CI: −1.02, 0.03, p = .06) and activity limitation (SMD −0.13, 95% CI: −0.26, −0.01, p = .07). However, there was a significant effect in favour of health coaching on the SGRQ impact subscale (SMD −0.61, 95% CI: −1.14, −0.07, p = .03). There was considerable heterogeneity found across all subscale meta-analyses, except for the activity subscale where heterogeneity was low (X^2 = 2.67, df = 3, p = .45; I^2 = 0%).

Effect of health coaching on COPD-related hospital admissions

Seven of 10 studies assessed the impact of health coaching on hospital admissions (Benzo *et al.*, 2016; Greening *et al.*, 2014; Johnson-Warrington *et al.*, 2016; Jolly *et al.* 2018; Khdour *et al.*, 2009; Mitchell *et al.*, 2014; Walters *et al.*, 2013), and two of these reported significantly fewer hospital admissions in the intervention condition. Benzo *et al.* (2016) reported a significant reduction in COPD-related hospital admissions in the intervention condition. This positive effect was sustained at 1, 3, and 6 months follow-up, but not at 12 months. Khdour *et al.* (2009) reported a significant reduction in hospital admissions at both 6 and 12 months follow-up.

Hospital admissions measurements were split into all-cause hospital admissions and COPD-related hospital admissions. Three studies (n = 470) were eligible for inclusion in random effects meta-analysis for the effect of health coaching on all-cause hospital admission (Khdour *et al.*, 2009; Song *et al.*, 2014; Walters *et al.*, 2013). There was no significant reduction in all-cause hospital admissions for people who received health coaching (OR = 0.70, 95% CI: 0.41–1.12, p = .20).

Five studies (n = 808) were eligible for inclusion in random effects meta-analysis for the effect of health coaching on COPD-related hospital admissions (Benzo *et al.*, 2016; Johnson-Warrington *et al.*, 2016; Khdour *et al.*, 2009; Mitchell *et al.*, 2014; Walters *et al.*, 2013). There was a significant positive effect of health coaching on COPD-related admissions (OR = 0.45, 95% CI: 0.30, 0.67, p = .0001) (Figure 3). Heterogeneity was found to be low across these studies (X^2 = 2.08, df = 4, p = .76; I^2 = 0%).

Effect of health coaching on physical activity

Eight studies measured the effect of health coaching on physical activity (Benzo *et al.*, 2016; Cameron-Tucker *et al.*, 2016; Greening *et al.*, 2014; Jolly *et al.*, 2018; Johnson-Warrington *et al.*, 2016; Khdour *et al.*, 2009; Mitchell *et al.*, 2014; Song *et al.*, 2014). Three studies reported a significant group difference in favour of the intervention

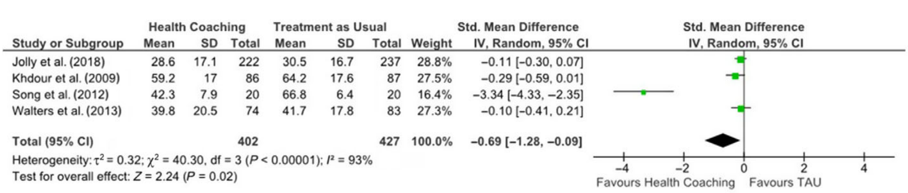

Figure 2. SMD and 95% CI for effect of health coaching on HRQoL in people with COPD. [Colour figure can be viewed at wileyonlinelibrary.com]

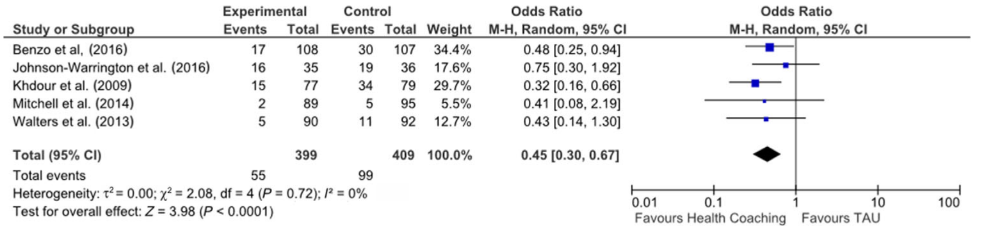

Figure 3. OR and 95% CI for effect of health coaching on COPD-related hospital admissions. [Colour figure can be viewed at wileyonlinelibrary.com]

condition: at 6 weeks follow-up (Greening *et al.*, 2014; Mitchell *et al.*, 2014) and at 6 months follow-up (Jolly *et al.*, 2018; Mitchell *et al.*, 2014). However, one study reported a significant group difference in favour of the comparison group at 2–3 months follow-up (Cameron-Tucker *et al.*, 2016). The remaining four studies reported no significant between-group differences in physical activity at any follow-up point.

Effect of health coaching on self-care behaviour

Four studies measured the effect of health coaching on self-care behaviour (Bischoff *et al.*, 2012; Jolly *et al.*, 2018; Khdour *et al.*, 2009; Song *et al.*, 2014). Three studies reported significant improvements in medication adherence in favour of the intervention condition: at 2 months follow-up (Song *et al.*, 2014) and at 6 and 12 months follow-up (Jolly *et al.*, 2018; Khdour *et al.*, 2009). Song *et al.* (2014) observed a significant improvement in exercise compliance at 2 months post-intervention. Bischoff *et al.* (2012) assessed exacerbation management as a self-care behaviour, but did not observe any differences between conditions. Jolly *et al.* (2018) measured smoking cessation behaviours, but did not observe any differences between conditions at 6 or 12 months follow-up.

Effect of health coaching on mood

Three studies investigated the effect of health coaching on mood in people with COPD (Jolly *et al.*, 2018; Johnson-Warrington *et al.*, 2016; Mitchell *et al.*, 2014). Mitchell *et al.* (2014) reported a significant improvement in the HADS anxiety subscale in favour of the intervention condition at 6 weeks follow-up. Jolly *et al.* (2018) and Johnson-Warrington *et al.* (2016) did not observe any significant between-group differences at follow-up.

Optimal mode of intervention delivery

Eight studies delivered health coaching through a combination of in person and telephone consultations. Of these eight, three studies also included the self-led SPACE for COPD manual. In five of the eight studies, only the initial consultation was in person and the remaining sessions were telephone consultations. Two studies delivered health coaching via telephone consultations only. There was no clear pattern of results regarding whether one particular mode of delivery was more effective than another. Two of five predominantly telephone-led health coaching interventions reported significant improvements to HRQoL, and two of four predominantly in person health coaching interventions also reported significant improvements to HRQoL. These studies all used a combination of in person and telephone sessions to deliver the intervention. The health coaching interventions delivered exclusively through telephone consultations did not report any positive effects. Therefore, the evidence for the optimal mode of delivery is inconclusive.

Discussion

This is the first review to systematically examine the effect of health coaching on HRQoL and other health outcomes in people with COPD. Our findings are not uniform; some studies found that health coaching had a positive effect on HRQoL and other studies did not. Across the studies eligible for inclusion in meta-analysis, health coaching had a significant positive effect on HRQoL and led to a significant reduction in COPD-related hospital admissions over 6 months. Therefore, health coaching may be a candidate intervention to improve these important outcomes in people with COPD.

We will now discuss these findings in the light of the limitations of the available evidence. Our findings are over a relatively short-term follow-up period. Only one included study measured outcomes after 12 months and reported no effect of health coaching on patient outcomes. Thus, the available evidence for longer-term improvements in COPD health outcomes is limited. The evidence for improvements to outcomes such as physical activity and mood is inconsistent.

Our meta-analysis included two of the four studies that reported a positive effect of health coaching on HRQoL and showed a pooled positive effect of health coaching on total HRQoL as well as the SGRQ impact subscale (Khdour *et al.*, 2009; Song *et al.*, 2014). It is important to note that, while a significant overall positive effect was found using the SGRQ scale, not all of the subscales demonstrated significant differences. It may be the case that, following health coaching, positive changes are more likely in some subscales than others (e.g., the impact subscale, measuring psychosocial disruption, rather than the symptoms subscale, measuring the severity of respiratory symptoms) and that these differences are sufficient to demonstrate an overall effect.

Our findings echo those of published systematic reviews of health coaching for people with other LTCs (Kivelä *et al.*, 2014) and for supporting various health behaviours that affect patient health outcomes (Olsen & Nesbitt, 2010). There are a number of possible reasons why the remaining six studies did not observe positive effects of health coaching. For example, the number and frequency of coaching sessions may affect the extent to which people with COPD engage with the intervention content and feel supported. Further, the goals set to overcome barriers may be so difficult for people with COPD to achieve that a relatively short-term health coaching intervention may not be sufficient to establish any real and lasting change. One of the six studies reported relatively low HRQoL in participants at baseline. It may be the case that improving HRQoL in participants with already low-scoring HRQoL presents greater or additional challenges compared with participants who begin the intervention with a higher baseline HRQoL score.

Across the studies reporting a positive effect of health coaching on HRQoL and included in our meta-analysis, the between-group difference on the SGRQ exceeded the minimum clinically important difference (MCID) for that particular scale (Jones, 2005; Jones *et al.*, 2014). However, this was not the case for the two studies that did not find a statistically significant effect, as the difference between the health coaching and treatment as usual group did not meet the level of the MCID. This was also the case across studies using alternative HRQoL measures. For example, Bischoff *et al.* (2012) reported a reduction on the CRQ, but this did not reach the level MCID for that scale (Schünemann, Puhan, Goldstein, Jaeschke, & Guyatt, 2005). Therefore, it is unclear whether participants who received health coaching would have noticed a clinically significant improvement in their day-to-day lives, compared with those participants in the treatment as usual group. We did not look at within-group changes from baseline to follow-up, which would have allowed further interpretation of the MCID.

Few studies included in this review specifically measured mood. Depression and anxiety are highly prevalent in people with COPD, and depression has been shown to predict poor HRQoL (Blakemore *et al.*, 2014) and to negatively impact on self-care and treatment adherence (DiMatteo, Lepper, & Croghan, 2000). Depression also predicts the use of urgent care in people with LTCs (Dickens *et al.*, 2012; Guthrie *et al.*, 2016). Support for depression and anxiety may therefore need to be a more significant part of health coaching interventions for people with COPD in future. The success of such support for low mood will need to be tested in models of health coaching to account for the considerable impact of depression on COPD outcomes. A previous systematic review of health coaching in LTCs found the intervention positively impacted psychological outcomes such as self-efficacy and mental health status (Kivelä *et al.*, 2014), suggesting there may be a promising role for health coaching in improving mental health outcomes for people with COPD. Investigating the impact of health coaching on mood (e.g., depression and anxiety) may therefore be a worthwhile avenue for future research.

Based on our meta-analysis results, we found that health coaching significantly reduces COPD-related hospital admissions. It may be the case that the increased awareness of and attention to self-management strategies that health coaching instils are important for motivating people to take up behaviours that translate into improvement of outcomes such as hospital admissions. Currently, it is estimated that COPD costs over £800 million per year in the United Kingdom and much of this cost is accounted for by attendance at accident and emergency and emergency admissions (British Lung Foundation, 2016; Department of Health, 2012). Therefore, any intervention that has the potential to improve self-management, impact HRQoL, and reduce urgent health care use is of interest to health care providers and health economists alike.

There are several strengths of this review. Firstly, it is the first systematic review of published RCTs assessing the impact of health coaching for people with COPD and thus furthers current understanding of the utility of health coaching. Health coaching has been generally poorly defined (Wolever *et al.*, 2013), and this review has applied a cogent definition rigorously. This somewhat conservative approach ensures findings reviewed are from core health coaching studies. We followed established, explicit, and reproducible procedures for conducting a systematic review. The inter-rater reliability of the study inclusion process was of high agreement, thus minimizing the chance of selection bias, and the quality assessment was second-coded, which increases methodological rigour (Centre for Reviews & Dissemination, 2009). We followed the PRISMA guidelines for reporting systematic reviews. The included studies were peer-reviewed RCTs and of reasonable quality.

This review has some limitations. We have reviewed a small number of studies, and we have not assessed publication bias. We were only able to include a minority of the eligible studies in the meta-analysis for HRQoL and hospital admissions and, therefore, these results must be interpreted with appropriate caution. As per Cochrane guidelines, five studies were excluded from the meta-analysis of the effects of health coaching on HRQoL on the basis that they presented change scores as opposed to final means and standard deviations (Higgins & Green, 2011). One further study was excluded as there were insufficient data presented.

Across most domains, the studies included in the meta-analysis were generally of a low risk of bias. However, the studies were at some risk of bias due to lack of blinding of participants. This is somewhat difficult to avoid due to the nature of the intervention. Furthermore, the study conducted by Song *et al.* (2014) and included in the meta-analysis is shown in the forest plot as a clear outlier, demonstrating a very positive effect of health coaching on HRQoL. One possible explanation for this is that the follow-up period used by Song *et al.* was shorter than that used in the other studies (2 months rather than 6 months). It is therefore possible that more positive effects are seen closer to the end of treatment when the intervention is fresh to the participants and that these effects deteriorate over time, as symptoms also increase in severity of this progressively worsening condition. In order to explore this, we reran the meta-analysis excluding the study by Song *et al.* (2014). We found that the effect on HRQoL was smaller (SMD −0.15), but still significant. This demonstrates that the significant effect of health coaching on HRQoL in COPD is not solely due to this outlier study. As per our protocol, we kept Song *et al.* in our meta-analysis.

The present review is limited by the relatively short follow-up points employed in the primary studies; no conclusions for longer-term effects can be drawn. Further, data to be included in the meta-analysis were only available across studies at 6 months. A core ethos of health coaching is to be patient-centred and tailored. This increases heterogeneity in intervention components and outcome assessments, as well as the challenge of synthesizing evidence in meta-analysis. Other systematic reviews report a similar heterogeneity (Dejonghe, Becker, Froboese, & Schaller, 2017; Hill, Richardson, & Skouteris, 2015; Wolever *et al.*, 2013). While it was possible to establish whether studies included the key components of health coaching, intervention content was generally poorly reported.

This review adds to the current literature by presenting an overview of the most up-to-date research of health coaching for people with COPD on a range of health outcomes. Our findings are of relevance to researchers interested in self-management interventions for people with COPD, HRQoL, hospital admissions, cost-effective health care, physical activity, self-care behaviours, and mood. Future health coaching interventions aimed at supporting these health outcomes in this population (or others) will benefit from better exploring the mechanisms through which health coaching has an effect. It is not possible to tell from this review what unique contribution each component of health coaching made to the intervention's success, or whether one 'active ingredient' of health coaching is more effective than other components at bringing about positive change in health outcomes. Given the diversity in health coaching interventions (Wolever *et al.*, 2013), an evidence-based assessment of the most effective health coaching interventions for people with COPD may be a worthwhile route for research. Specifically, examining the moderating impact of the presence or absence of intervention components and intervention features upon effect sizes may usefully indicate the critical components of an effective health coaching intervention. This will only be possible if intervention content is reported in sufficient detail to allow researchers to appreciate subtle yet key differences in content. Further, as only a minority of studies assessed intervention fidelity, it will be important to ensure that health coaching interventions are delivered as intended and that this is assessed in both the intervention and control group arms (e.g., to ensure no 'leakage' of intervention content to control participants), in order to establish that any observed effects are truly due to health coaching.

The interventions included in the present review were delivered by a range of health care professionals (the majority were nurses) and via a combination of in person and telephone consultations, which makes it difficult to draw any robust conclusions regarding the best delivery modality. Previous studies of health coaching for people with

LTCs have shown that the greatest effects were observed for interventions in which the coaches were trained psychologists (Sacco, Malone, Morrison, Friedman, & Wells, 2009; Wolever *et al.*, 2010), health lifestyle coaches (Hersey *et al.*, 2012) or educated coaches (Linden, Butterworth, & Prochasca, 2010). Further, Thom *et al.* (2016) developed a conceptual model of how health coaching can support people in making health-related decisions and behaviour change. The key focus of this model is for health coaches to establish a trusting relationship with the individual, which is underpinned by education, personal support, practical support, and the ability of the health coach to act as a bridge between patients and clinicians. In order to implement health coaching within any health care system, it remains important to identify who is best placed to deliver the intervention and how it should be delivered.

Conclusion

Health coaching may have the potential to improve HRQoL and reduce COPD-related hospital admissions for people with COPD. While this review suggests health coaching is a candidate intervention, the high heterogeneity of studies makes determining the exact effect of health coaching difficult. Future research should aim to identify how and by whom health coaching is most effective when delivered and establish the extent to which improved HRQoL may lead to other important health improvements in COPD, such as depression.

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Conflict of interest

All authors declare no conflict of interest.

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Supporting Information

The following supporting information may be found in the online edition of the article:

Appendix S1. PRISMA 2009 checklist.

Appendix S2. Search strategy.