Educational interventions for health professionals managing chronic obstructive pulmonary disease in primary care

by Elida Zairina

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Educational interventions for health professionals managing chronic obstructive pulmonary disease in primary care

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ABSTRACT

Background

Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable health condition. COPD is associated with substantial burden on morbidity, mortality and healthcare resources.

Objectives

To review existing evidence for educational interventions delivered to health professionals managing COPD in the primary care setting.

Search methods

We searched the Cochrane Airways Trials Register from inception to May 2021. The Register includes records from the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Allied and Complementary Medicine Database (AMED) and PsycINFO. We also searched online trial registries and reference lists of included studies.

Selection criteria

We included randomised controlled trials (RCTs) and cluster-RCTs. Eligible studies tested educational interventions aimed at any health professionals involved in the management of COPD in primary care. Educational interventions were defined as interventions aimed at upskilling, improving or refreshing existing knowledge of health professionals in the diagnosis and management of COPD.

Data collection and analysis

Two review authors independently reviewed abstracts and full texts of eligible studies, extracted data and assessed the risk of bias of included studies. We conducted meta-analyses where possible and used random-effects models to yield summary estimates of effect (mean differences (MDs) with 95% confidence intervals (CIs)). We performed narrative synthesis when meta-analysis was not possible. We assessed the overall certainty of evidence for each outcome using Grades of Recommendation, Assessment, Development and Evaluation (GRADE). Primary outcomes were: 1) proportion of COPD diagnoses confirmed with spirometry; 2) proportion of patients with COPD referred to, participating in or completing pulmonary rehabilitation; and 3) proportion of patients with COPD prescribed respiratory medication consistent with guideline recommendations.

Main results

We identified 38 studies(22 cluster-RCTs and 16 RCTs) involving 4936 health professionals (reported in 19/38 studies) and 71,085 patient participants (reported in 25/38 studies). Thirty-six included studies evaluated interventions versus usual care; seven studies also reported a comparison between two or more interventions as part of a three- to five-arm RCT design.

A range of simple to complex interventions were used across the studies, with common intervention features including education provided to health professionals via training sessions, workshops or online modules (31 studies), provision of practice support tools, tool kits and/or algorithms (10 studies), provision of guidelines (nine studies) and training on spirometry (five studies). Health professionals targeted by the interventions were most commonly general practitioners alone (20 studies) or in combination with nurses or allied health professionals (eight studies), and the majority of studies were conducted in general practice clinics.

We identified performance bias as high risk for 33 studies. We also noted risk of selection, detection, attrition and reporting biases, although to a varying extent across studies.

The evidence of efficacy was equivocal for all the three primary endpoints evaluated: 1) proportion of COPD diagnoses confirmed with spirometry (of the four studies that reported this outcome, two supported the intervention); 2) proportion of patients with COPD who are referred to, participate in or complete pulmonary rehabilitation (of the four studies that reported this outcome, two supported the intervention); and 3) proportion of patients with COPD prescribed respiratory medications consistent with guideline recommendations (12 studies reported this outcome, the majority evaluated multiple drug classes and reported a mixed effect). Additionally, the low quality of evidence and potential risk of bias make the interpretation more difficult.

Moderate-quality evidence (downgraded due to risk of bias concerns) suggests that educational interventions for health professionals probably improve the proportion of patients with COPD vaccinated against influenza (three studies) and probably have little impact on the proportion of patients vaccinated against pneumococcal infection (two studies).

Low-quality evidence suggests that educational interventions for health professionals may have little or no impact on the frequency of COPD exacerbations (10 studies).

There was a high degree of heterogeneity in the reporting of health-related quality of life (HRQoL). Low-quality evidence suggests that educational interventions for health professionals may have little or no impact on HRQoL overall, and when using the COPD-specific HRQoL instrument, the St George's Respiratory Questionnaire (at six months MD 0.87, 95% CI -2.51 to 4.26; 2 studies, 406 participants, and at 12 months MD -0.43, 95% CI -1.52 to 0.67, 4 studies, 1646 participants; reduction in score indicates better health).

Moderate-quality evidence suggests that educational interventions for health professionals may improve patient satisfaction with care (one study).

We identified no studies that reported adverse outcomes.

Authors' conclusions

The evidence of efficacy was equivocal for educational interventions for health professionals in primary care on the proportion of COPD diagnoses confirmed with spirometry, the proportion of patients with COPD who participate in pulmonary rehabilitation, and the proportion of patients prescribed guideline-recommended COPD respiratory medications. Educational interventions for health professionals may improve influenza vaccination rates among patients with COPD and patient satisfaction with care. The quality of evidence for most outcomes was low or very low due to heterogeneity and methodological limitations of the studies included in the review, which means that there is uncertainty about the benefits of any currently published educational interventions for healthcare professionals to improve COPD management in primary care. Further well-designed RCTs are needed to investigate the effects of educational interventions delivered to health professionals managing COPD in the primary care setting.

PLAIN LANGUAGE SUMMARY

Educational interventions for health professionals managing people with COPD in primary care

Background:

Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable lung disease. COPD makes it harder for a person to get air in and out of the lungs. Symptoms include shortness of breath, cough, excess phlegm and wheezing. COPD can cause a huge impact on a person's life and lead to poor health.

Question:

What evidence exists for educational interventions delivered to health professionals managing COPD in primary care?

Search strategy:

To find relevant studies, we searched six online databases, trial registries and the reference list of included studies, retrieving studies published up until May 2021.

Selection criteria:

We included randomised controlled trials (RCTs) or studies of similar design comparing a group of health professionals or patients (or both) receiving an intervention with a group receiving usual care (no intervention) or receiving a different intervention. We included trials that studied educational interventions aimed at any health professionals involved in the management of COPD in primary care.

Main results:

We identified 38 studies, 36 of which tested interventions versus usual care, and seven of which compared two or more different types of interventions. A range of simple to complex interventions were used across the studies, including education provided to health professionals via sessions, workshops or online modules (31 studies), provision of practice support tools or tool kits (10 studies), provision of COPD clinical practice guidelines (nine studies) and training on lung function tests (five studies).

The studies we identified were very different in terms of who received the interventions, what interventions people received, where the interventions were delivered, and how and when the outcomes were measured. Due to these differences and problems with how the trials were conducted, we mostly considered the overall quality of the evidence to be low or very low.

Based on the current evidence, we were unable to determine the effects of educational interventions for health professionals on the proportion of COPD diagnoses confirmed with lung function tests, the proportion of patients with COPD who participated in pulmonary rehabilitation (specialised education and exercises to improve breathing) and the proportion of patients with COPD who were prescribed medications for their lungs/breathing that were consistent with recommended guidelines. However, the available evidence does suggest that educational interventions for health professionals probably improve influenza (flu) vaccination rates among patients with COPD and patient satisfaction with care.

Author's conclusions:

It was unclear whether educational interventions improved COPD management in primary care, including COPD diagnosis confirmed with lung function tests, participation in pulmonary rehabilitation and prescribing of guideline-recommended respiratory medication. However, educational interventions for health professionals may improve influenza vaccination rates and patient satisfaction with care. Interventions and outcomes varied greatly among studies, and there were problems regarding how the trials were conducted, which may have affected their results. Further high-quality studies are necessary to determine the effectiveness of educational interventions for health professionals managing COPD in primary care.

SUMMARY OF FINDINGS

Summary of findings 1. Educational interventions for health professionals managing chronic obstructive pulmonary disease in primary care

Educational interventions for health professionals managing chronic obstructive pulmonary disease in primary care

Patient or population: health professionals managing COPD
Setting: primary care
Intervention: key elements of the intervention categorised into 5 groups: 1) HCP education; 2) provision of practice support tools, tool kits and/or algorithms to assist with patient management (10 studies); 3) resources related to guidelines and/or guideline dissemination (9 studies); 4) training on spirometry (5 studies); and 5) feedback, mentorship and ongoing support (7 studies)
Comparison: no intervention or against printed management guideline dissemination only

Outcomes	Impacts	Number of studies (participants)	Quality of the evidence (GRADE)	Comment
Proportion of people with COPD diagnoses confirmed with spirometry	Two studies reported that the intervention may increase the number of new COPD diagnoses, whereas another showed no significant effect. One study reported that the intervention increased the number of patients who had spirometry performed. One study reported no significant effect on change in rate of spirometry in patients affiliated with the practice.[a]	4 (1896[b])	⊕⊝⊝⊝ **Very low** [c]	We are uncertain of the effects of educational interventions for health professionals on the proportion of COPD diagnoses confirmed with spirometry.
Proportion of patients with COPD referred to, participating in or having completed pulmonary rehabilitation	Two studies involving blended face-to-face and online education to physicians increased referral to pulmonary rehabilitation. Two studies targeting physicians and nurses or physicians and practice assistants with education related to team-based COPD care showed no significant impact on referral.[a]	4 (625)[d]	⊕⊕⊝⊝ **Low** [e]	We are uncertain of the effects of educational interventions for health professionals on the proportion of patients with COPD who are referred to, participate in or complete pulmonary rehabilitation.
Proportion of patients with COPD prescribed respiratory medication consistent with recommended guidelines	Six studies involving education for prescribers, guideline provision, central case management resources and/or increased prescribing provisions for nurse practitioners reported significant changes in prescribing. However, six studies showed no significant impact on prescribing.[a]	12 (52,899)[f]	⊕⊕⊝⊝ **Low** [g]	We are uncertain of the effects of educational interventions for health professionals on the proportion of patients with COPD prescribed respiratory medication consistent with guideline recommendations.
Proportion of patients with COPD vaccinated against influenza/pneumococcal infections Follow-up: 12 months	Two studies involving education on COPD management/guidelines to both general practitioners and nurses/practice assistants significantly improved influenza vaccination rates in the intervention group, but showed no significant impact on pneumococcal vaccination rates. One study involving education for physicians, use of COPD CareManager online module and access to central case management was uncertain.	4 (6846)	⊕⊕⊕⊝ **Moderate** [h]	Educational interventions for health professionals probably improve the proportion of patients with COPD vaccinated against influenza, but probably have little impact on the proportion of patients vaccinated against pneumococcal infection.

	Two studies reported no clear impact on pneumococcal vaccination rates compared to usual care.			
HRQoL Follow-up: 6, 12 months	Five studies using the SGRQ as a measure of HRQoL were included in meta-analyses (at 6 months MD 0.87, 95% CI -2.51 to 4.26; 406 participants, and at 12 months MD -0.43, 95% CI -1.52 to 0.67; 1646 participants). Seven studies were excluded from the meta-analysis due to alternative reporting of outcome data, six showed no significant impact on HRQoL.	12 (6526)	⊕⊕⊝⊝ **Low** [i]	Educational interventions for health professionals may lead to little or no impact on the HRQoL of patients with COPD. The MCID of the SGRQ is 4 units.
Frequency of COPD exacerbations Follow-up: 12, 24 months	Ten studies were identified, using various definitions of COPD exacerbations. One study reported reduced hospitalisations in people with COPD at 12 months, but no clear benefit at 24 months. Nine studies did not demonstrated a significant impact on the frequency of exacerbations.[a]	10 (3128[j])	⊕⊕⊝⊝ **Low** [k]	Educational interventions for health professionals may have little or no impact on the frequency of COPD exacerbations.
Patient satisfaction with health care	One intervention involving training for clinicians and a model of care in which patients received three dimensions of review of their health (by nurse, pharmacist and physician) resulted in a higher proportion of patients being "very satisfied with care" compared to usual care.	1 (1222)	⊕⊕⊕⊝ **Moderate** [l]	Educational interventions may improve patient satisfaction with care.

[a]Meta-analysis was not possible due to differences in the definition of outcome and reporting of results.
[b]Total number of patient participants reported in three out of four studies only.
[c]One mark deducted due to high or unclear risk of bias across studies including blinding of outcome assessment. One mark deducted due to heterogeneity in the definition and reporting of outcome. One mark deducted due to imprecision with low event numbers in two of four studies.
[d]Total number of patient participants reported in three out of four studies only.
[e]One mark deducted due to high or unclear risk of bias across studies including allocation concealment and blinding of outcome assessment. One mark deducted due to imprecision with low event numbers in two of four studies.
[f]Total number of patient participants reported in eight out of 12 studies only.
[g]One mark deducted due to high or unclear risk of bias across studies with four of 11 studies having more than half of the domains as high or unclear risk of bias. One mark deducted due to heterogeneity in the definition of the outcome (including which respiratory medications were reported, whether it was the first, any or intensification of prescribing, and whether higher or lower prescribing was desirable).
[h]One mark deducted due to high or unclear risk of bias across studies, including randomisation, allocation concealment and baseline characteristics of participants.
[i]One mark deducted due to high or unclear risk of bias across studies, including blinding of outcome assessment and differences in baseline characteristics and outcome measurements. One mark deducted due to heterogeneity in outcome measures, timing of outcome measure and reporting of the outcome.
[j]Total number of patient participants reported in nine out of 10 studies only.
[k]One mark deducted due to most studies having high or unclear risk of bias across multiple domains. One mark deducted due to heterogeneity in outcome measures, timing of outcome measure and reporting of the outcome.
[l]One mark deducted due to imprecision as only one study was identified.
CI: confidence interval; COPD: chronic obstructive pulmonary disease; HCP: healthcare professional; HRQoL: health-related quality of life; MCID: minimal clinically important difference; MD: mean difference; SGRQ: St George's Respiratory Questionnaire

BACKGROUND

Description of the condition

Chronic obstructive pulmonary disease (COPD) is a "common, preventable and treatable condition that is characterised by persistent respiratory symptoms and irreversible airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious gases and particles" (GOLD 2022). Diagnosis and assessment of COPD severity are based on the ratio of post-bronchodilator forced expiratory volume in one second (FEV_1) to forced vital capacity (FVC). A FEV_1/FVC ratio < 0.7 suggests airflow limitation consistent with COPD (GOLD 2022). Another approach involves the use of lower limit of normal (LLN) values as cut-offs for COPD diagnosis, in contrast to the fixed cut-off value of 0.7 (Culver 2012).

Prevalence of COPD varies widely from 0.2% to 37% according to country, population, age group analysed and method of diagnosis used (such as spirometry and other classification methods according to symptoms) (Rycroft 2012). The actual prevalence of COPD is likely to be higher than reported in some studies owing to widespread underdiagnosis of the condition in some parts of the world (Koblizek 2016). Approximately 80% of COPD cases confirmed by spirometry were previously undiagnosed (Koblizek 2016). The best available and most recent prevalence data are provided by the Burden of Obstructive Lung Disease (BOLD) study in many countries (Buist 2007; Toelle 2013; Mejza 2017).

COPD is widely acknowledged as a major health problem associated with substantial burden on morbidity, mortality and healthcare resources (Decramer 2012; Toelle 2013). It is the fourth leading cause of death in the world and is projected to be the third leading cause by 2030, accounting for 8.6% of deaths globally (WHO 2008).

Description of the intervention

New developments in therapeutics and changes in the evidence base for treatments occur over time. Treatment guidelines and strategies change accordingly. Educational programmes provide health professionals with an excellent opportunity to update their clinical and professional knowledge and skills to provide the best patient care (WHO 2017). The term "continuing professional development" (CPD) is used to describe the "process by which health professionals keep updated to meet the needs of patients, the health service, and their own professional development" (Peck 2000). This includes "continuous acquisition of new knowledge, skills, and attitudes to enable competent practice" (Peck 2000). Health professional registration boards and regulatory bodies in many countries mandate CPD for legislated revalidation and recertification of practitioners (Peck 2000). Continuing education (CE) is an integral part of CPD. Types of CE for different health professions are named accordingly, for example, continuing medical education (CME), continuing nursing education (CNE) and continuing pharmacy education (CPE). Recently, continuing interprofessional education (CIPE) has been recognised as a distinct branch of CE (Owen 2013).

Educational activities provided in CE/CPD programmes vary in terms of educational media (i.e. format used to deliver educational content, e.g. printed materials, videotapes, audiotapes, podcasts, online materials), method of delivery (e.g. live face-to-face sessions versus internet or other technology-based sessions), educational technique (specific educational tools used to deliver media, such as small group learning, lectures and simulation) and exposure (duration and frequency of the activity) (Moores 2009). Activities can be categorised as 1) 'live' or external activities, such as courses, seminars, meetings, conferences and audio and video presentations, 2) internal activities, including practice-based activities, case conferences, grand rounds, journal clubs, teaching and consultation with peers and colleagues, and 3) 'enduring' materials (print, CD-ROM or web-based materials, with testing or assessment) (Peck 2000). Educational interventions can consist of individual activities or may involve multiple activities, and can be didactic, interactive or a mixture of both (Davis 1999).

How the intervention might work

It is assumed that CE for health professionals improves healthcare practice and, thereby, health outcomes for patients receiving care (Forsetlund 2009). The effectiveness of CE can be analysed in three areas: competence, performance and patient health status (Lloyd 1979). Reviews have shown that CE can improve the knowledge, performance skills, attitudes and behaviour of health professionals, as well as patient healthcare outcomes (Bloom 2005; Toelle 2013; Cervero 2015). Additionally, more specific reviews of the effectiveness of different CE formats have been conducted. Reviews of online CME have shown positive effects on professional practice and satisfaction (Thepwongsa 2014), and reviews of CE meetings, including conferences, workshops and rounds, have shown beneficial effects on both professional practice and patient healthcare outcomes (Forsetlund 2009). In contrast, didactic presentations and distribution of printed information have been shown to provide little or no benefit in changing physician practice (Bloom 2005).

Despite dissemination of evidence-based guidelines and the availability of resources, evidence still suggests suboptimal management of COPD in primary care. Underutilisation of spirometry in COPD diagnosis is a key problem identified in the primary care setting (Walters 2011; Zwar 2011; Abramson 2012), leading to misdiagnosis and underdiagnosis. Lack of spirometry referral for high-risk patients is a major barrier to improved patient outcomes, as it delays treatment of patients with potential COPD and associated symptoms (Drexel 2011). In addition, adherence to recommended management guidelines by health professionals is poor. Approximately one in four adults 40 years of age or older, with known risk factors for COPD, have airway obstruction consistent with COPD diagnosis (Zhou 2010; Drexel 2011). Even though the prevalence of COPD is high in primary care, the condition remains undertreated compared with less morbid and asymptomatic conditions such as hypertension (Barr 2009). Various studies have identified deviations from recommended pharmacological treatment guidelines by primary care professionals (Jones 2008; Glaab 2012; Price 2014). It is also very common for evidence-based non-pharmacological components of guidelines to be omitted from COPD management (Bourbeau 2008; Jones 2008; Johnston 2012; Price 2014).

Although reviews have found good evidence showing benefits for patients with COPD of non-pharmacological management components such as pulmonary rehabilitation, smoking cessation support and vaccinations, these components are commonly absent from COPD management. It is important that health professionals are adequately educated on the benefits of these and their

routine use in practice. Smoking cessation is integral, regardless of disease severity (GOLD 2022), with quitting smoking shown to slow the rate of lung function decline, preserve remaining lung function and delay the onset of disability (Anthonisen 1994; Tashkin 1996; Anthonisen 2002; GOLD 2022). Knowing patients' smoking habits and recording smoking status and smoking information are essential for identifying high-risk patients and providing appropriate smoking cessation support to delay progression of COPD and worsening of symptoms (Vasankari 2011; Jimenez-Ruiz 2015). Influenza vaccination has been shown to reduce risks of exacerbation, hospitalisation and death among patients with COPD (Nichol 1994; Poole 2006; GOLD 2022). The incidence of community-acquired pneumonia in younger COPD patients with FEV_1 < 40% predicted or comorbidities was reduced after pneumococcal vaccination (Alfageme 2006; GOLD 2022).

Studies have shown beneficial effects of training and education on health professional knowledge and practices surrounding COPD diagnosis and treatment. A four-day spirometry and COPD interactive training programme with web assistance provided to community pharmacists was shown to improve the identification of high-risk individuals and the performance of spirometry to identify airflow obstruction (Castillo 2015). Participation in an educational programme on COPD in Danish primary care was shown to improve FEV_1 recording in patient files, smoking cessation counselling provision, referral to pulmonary rehabilitation and appropriate prescribing of inhaled corticosteroids (Ulrik 2010). Another study looking at a one-day interactive COPD CME/CE programme for 351 primary care clinicians in the United States showed improvement in clinician self-confidence, knowledge of COPD and implementation of clinical change after completion of the programme (Adams 2012).

Why it is important to do this review

The worsening burden of COPD calls for critical review and assessment of the efficacy of different interventions aimed at case finding and diagnosing COPD, controlling COPD symptoms, preventing exacerbations and maintaining quality of life. Education of health professionals involved in the management of COPD may fill existing practice gaps in COPD recognition and management.

Although numerous original studies and reviews have surrounded the effectiveness of educational interventions targeted at patients, less work has been done in reviewing the evidence behind educational interventions targeted at health professionals involved in the management of COPD. Patients are usually extensively treated in the primary care setting with general practitioners/family physicians serving as the main health professionals providing care for most patients with COPD (Koblizek 2016), before moving into secondary and tertiary care as the condition progresses. However, evidence of suboptimal management in the primary care setting has aroused concern, and awareness and use of evidence-based guidelines are known to be low (Adams 2012). Therefore, it is important that primary care health professionals involved in COPD management are clinically up-to-date and well-educated, so they can provide high-quality primary care services to affected patients (Fletcher 2007).

We conducted this review to assess the effectiveness of education provided to doctors, and of educational interventions provided to the wide range of health professionals who play important roles in COPD diagnosis and ongoing management. Different healthcare workers provide different components of care to patients with COPD. The roles of nurses, pharmacists and allied health professionals, such as physiotherapists, are becoming increasingly important with availability of new therapeutic agents and increasing awareness of the benefits of pulmonary rehabilitation. Growing interest in COPD management involving interprofessional collaboration among health professions and multidisciplinary team-based care has led to studies investigating both patient-related outcomes and health professional practices (Kruis 2010; Zwar 2012; Kruis 2014; Poot 2021). Improving knowledge and skills related to optimal COPD management amongst all health professionals working in primary care could further improve guideline adherence, health professional practice and patient-related outcomes.

OBJECTIVES

To review existing evidence for educational interventions delivered to health professionals managing COPD in the primary care setting.

METHODS

Criteria for considering studies for this review

Types of studies

We included cluster-randomised controlled trials (cRCTs) with at least two intervention sites and two comparator sites, and randomised controlled trials (RCTs). We included studies reported as full text, those published as abstract only and unpublished data (where available).

Types of participants

We included any health professionals involved in the management of COPD in primary care. Studies with health professionals involved in the management of COPD and other medical conditions that provided outcomes in patients with COPD were reported and analysed separately.

Types of interventions

We included trials analysing the efficacy of educational interventions for COPD management targeted at health professionals in primary care. Educational interventions were defined as interventions aimed at upskilling, improving or refreshing existing knowledge of health professionals in the management of COPD. We also included trials providing a health professional-targeted educational intervention within a more complex intervention module, providing a discrete analysis of this component is provided. We compared interventions against no intervention or against printed management guideline dissemination only.

Types of outcome measures

Primary outcomes

- Proportion of COPD diagnoses confirmed with spirometry
- Proportion of patients with COPD referred to, participating in or having completed pulmonary rehabilitation
- Proportion of patients with COPD prescribed respiratory medication consistent with recommended guidelines

Secondary outcomes

- Proportion of patients with COPD vaccinated against influenza/pneumococcal infection
- Proportion of patients with COPD receiving smoking cessation support
- Health professional knowledge of COPD management
- Health-related quality of life (HRQoL) of patients with COPD, measured on a validated scale
- Frequency of COPD exacerbations (exacerbation defined as requiring emergency department presentation, hospital admission, additional treatment with oral corticosteroids or antibiotics, or an unscheduled visit to a healthcare provider)
- Lung function (FEV_1) of patients with COPD
- Patient adherence to medications, including optimal device technique
- Patient satisfaction with care provided by health professional
- Any adverse outcomes (events/effects)

Reporting by trial authors of one or more of the outcomes listed here was not an inclusion criterion for this review.

Search methods for identification of studies

Electronic searches

We identified trials from the Cochrane Airways Trials Register, which is maintained by the Information Specialist for the Group. The Cochrane Airways Trials Register contains studies identified from the following sources:

- monthly searches of the Cochrane Central Register of Controlled Trials (CENTRAL), through the Cochrane Register of Studies (CRS 2021), from inception to May 2021;
- weekly searches of MEDLINE (Ovid) ALL from 1946 to May 2021;
- weekly searches of Embase (Ovid) from 1974 to May 2021;
- monthly searches of APA PsycINFO (Ovid) from 1967 to May 2021;
- monthly searches of CINAHL EBSCO (Cumulative Index to Nursing and Allied Health Literature) from inception to May 2021;
- monthly searches of AMED EBSCO (Allied and Complementary Medicine) from inception to May 2021;
- handsearches of the proceedings of major respiratory conferences.

Studies contained in the Trials Register were identified through search strategies based on the scope of Cochrane Airways. Details of these strategies, as well as a list of handsearched conference proceedings are in Appendix 1. See Appendix 2 for search terms used to identify studies for this review.

We also conducted a search of the Australian New Zealand Clinical Trials Registry (www.anzctr.org.au), ClinicalTrials.gov (www.clinicaltrials.gov) and the World Health Organization (WHO) trials portal (www.who.int/ictrp/en/).

All databases and trial registries were searched from their inception to 10 May 2021 without any restrictions on language or publication type.

Searching other resources

We checked the reference lists of included studies and review articles for additional references.

We searched for errata or retractions from included studies published in full text on PubMed (www.ncbi.nlm.nih.gov/pubmed) on 4 October 2021.

Data collection and analysis

Selection of studies

Two review authors (JL, JG) independently screened titles and abstracts for inclusion of all potential studies identified through the search and coded them as 'retrieve' (eligible or potentially eligible/unclear) or 'do not retrieve'. Full-text study reports/publications were retrieved then pairs of review authors (AC, JL, EZ, JG) independently screened the full texts, identified studies for inclusion and recorded reasons for exclusion of ineligible studies. Any disagreements were resolved through discussion or, when required, a third review author (MJA) was consulted. We identified and excluded duplicate articles. We collated multiple reports from the same study so that each study rather than each report was the unit of interest in the review. We recorded all selection processes in sufficient detail to complete a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram and a 'Characteristics of excluded studies' table.

Data extraction and management

We used a pre-piloted data extraction form to extract study characteristics and outcome data following pilot testing on at least one study in the review. Pairs of review authors (AC, JL, DT, EZ, JG) independently extracted the following study characteristics from studies included.

- Trial information: lead and corresponding authors' information, country and date of publication.
- Methods: study design, total duration of the study, details of any 'run-in' period, number of study centres and locations, study setting, withdrawals and date of the study.
- Participants: numbers enrolled, characteristics of health professional participants (e.g. age, gender, profession, previous experience, number of patients with COPD treated).
- Interventions: description and details of intervention (e.g. type, mode, duration, content, format and delivery of intervention and information about providers).
- Outcomes: primary and secondary outcomes specified and collected and time points reported.
- Notes: funding for the trial, reported conflicts of interest of trial authors and additional comments and information.

Pairs of review authors (AC, JL, DT, EZ, JG) independently extracted outcome data from the included studies. We put a note in the 'Characteristics of included studies' table if outcome data were not reported in a useable way. Any disagreements were resolved by reaching a consensus or by involving a third review author (MJA). One review author (AC or JL) transferred data into Review Manager (RevMan). A second review author (AC or JL) spot-checked study characteristics for accuracy against the trial report.

Assessment of risk of bias in included studies

Pairs of review authors (AC, JL, DT, EZ, JG) independently assessed the risk of bias for each study using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). We resolved disagreements by discussion or by consultation with another review author (MJA). We assessed the risk of bias according to criteria developed by the Cochrane Effective Practice and Organisation of Care (EPOC) Group (EPOC 2015), including the following.

- Sequence generation
- Allocation concealment
- Blinding
- Baseline characteristics
- Baseline outcome measurement
- Incomplete outcome data
- Selective outcome reporting
- Protection against contamination
- Other bias

We considered and reported when necessary additional biases related to cluster-randomised trials.

We graded each potential source of bias as 'high', 'low' or 'unclear' and constructed in a risk of bias table. We summarised the risk of bias judgements across different studies for each of the domains listed. We also noted any information on the risk of bias related to unpublished data or correspondence with a study author in the risk of bias table.

When considering treatment effects, we took into account the risk of bias for studies that contributed to that outcome.

Assessment of bias in conducting the systematic review

We conducted the review according to a published protocol (Liang 2017) and reported deviations from it in the Differences between protocol and review section of the systematic review.

Measures of treatment effect

We planned to analyse dichotomous data as numbers and percentages or odds ratios and continuous data as mean differences or standardised mean differences (when continuous outcomes were measured on different scales). Given the available data, we only used mean differences.

We undertook meta-analyses only when it was meaningful, i.e. if treatments, participants and underlying clinical questions were similar enough for pooling to make sense. Two or more studies needed to report a similar outcome measure with appropriate extractable data for a meta-analysis to be undertaken.

When multiple trial arms were reported in a single trial, we inflated the standard error to prevent double counting the usual care arms in the meta-analyses.

Unit of analysis issues

When cluster-randomised trials were included, we considered whether any unit of analysis errors were made. We extracted a direct estimate of the required effect measure from an analysis that properly accounted for the cluster design (Higgins 2011). In the case of trials with multiple arms, we included in the review only arms that met the eligibility criteria. If a study included more than one eligible intervention arm, we combined all relevant experimental groups to create a single pair-wise comparison, to avoid the problem of including the same group of participants twice in the same meta-analysis. If multiple intervention arms were eligible and not comparable, we included each pair-wise comparison separately, but with shared intervention arms divided out approximately evenly among comparisons.

Dealing with missing data

We contacted the investigators to verify key study characteristics and to obtain missing numerical outcome data when possible (e.g. when a study was identified from an abstract only).

Assessment of heterogeneity

We visually inspected forest plots and used corresponding Chi^2 and I^2 statistics to measure heterogeneity among the trials in each analysis. We did not perform meta-analysis when substantial heterogeneity was identified.

Assessment of reporting biases

We were not able to pool more than 10 trials, thus we did not create a funnel plot to explore possible small study and publication biases.

Data synthesis

We used a random-effects model for meta-analyses. We summarised outcomes where meta-analysis was not possible using a narrative synthesis.

Subgroup analysis and investigation of heterogeneity

We categorised trials according to the nature of the interventions. We had planned to consider the following subgroup analyses based on the nature of identified studies.

- Types of healthcare providers, e.g. doctors, nurses, physiotherapists, pharmacists and other health professionals identified through the search.
- Types of education delivered.
- Mode/application of forms of education.
- The complexity of intervention, e.g. minimal (fewer than three components) or intensive (three or more components).

We were not able to conduct these planned subgroup analyses due to insufficient studies and/or variations in reporting of outcomes. For future updates, should more studies be included, we would plan to conduct analyses based on these subgroups and use the formal test for subgroup interactions provided in Review Manager (Review Manager (RevMan)).

Sensitivity analysis

We planned a sensitivity analysis to investigate the robustness of effect sizes found in this review under different assumptions, particularly whether results were sensitive to the exclusion of trials judged to have a high risk of bias. Due to insufficient studies assessed as having low risk of bias, we were unable to conduct the planned sensitivity analyses. In future updates of this review we will conduct these sensitivity analyses, if sufficient studies with low risk of bias are identified.

Summary of findings and assessment of the certainty of the evidence

We created a summary of findings table using the following outcomes: change in proportion of COPD diagnoses confirmed by spirometry, change in proportion of patients with COPD referred to/participating in/having completed pulmonary rehabilitation, change in proportion of patients with COPD prescribed respiratory medication consistent with guideline recommendations, change in proportion of patients with COPD vaccinated against influenza/pneumococcal infection, change in HRQoL, change in frequency of COPD exacerbations, and change in patient satisfaction with health professional care.

We used the five GRADE considerations (study limitations, consistency of effect, imprecision, indirectness and publication bias) to assess the quality of a body of evidence as it related to studies that contributed data to each of the prespecified outcomes. We used the methods and recommendations described in Section 8.5 and Chapter 12 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2011). GRADEpro software was not used, as only one outcome involved meta-analysis. We justified all decisions to downgrade the quality of studies by using footnotes.

RESULTS

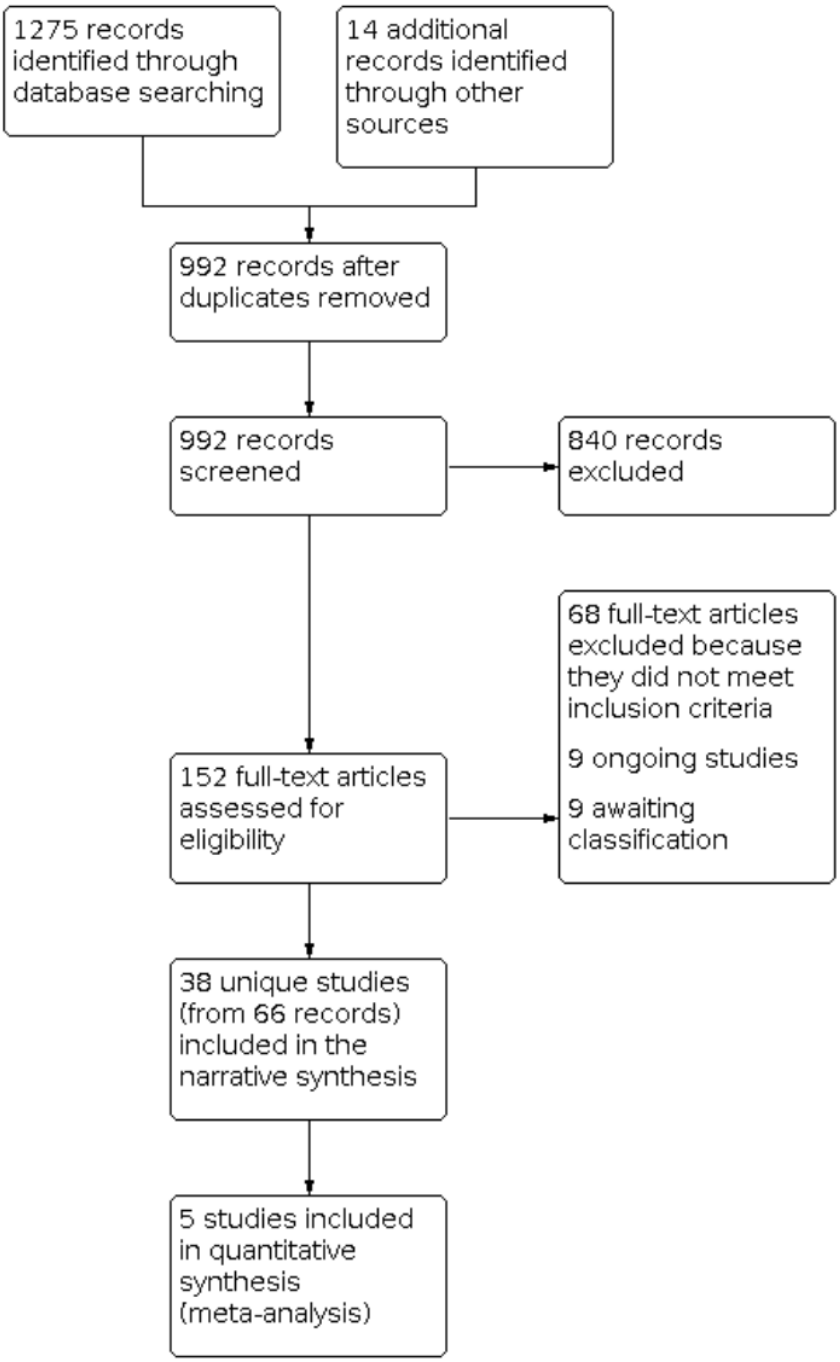
Description of studies

See: Included studies; Excluded studies; Studies awaiting classification; Ongoing studies.

Results of the search

The database search yielded 1275 titles. We found 14 additional studies through other sources (handsearching and trial registry searching). After removing duplicates, we screened 992 titles and abstracts and reviewed 152 full-text articles. We included 38 studies (described in 66 articles): 22 cluster-randomised controlled trials (cRCTs) and 16 randomised controlled trials (RCTs). Nine studies were ongoing (see Characteristics of ongoing studies) and nine are awaiting classification (see Characteristics of studies awaiting classification). Refer to Figure 1 for a PRISMA diagram.

Figure 1. Study flow diagram.



Included studies

Participants

Health professional and patient participant numbers were inconsistently reported in the included studies. A total of 4936 health professionals were reported in 19 studies, with the remaining 19 studies reporting the number of clinics/practices/facilities/pharmacies that participated rather than the exact number of health professionals. A total of 71,085 patient participants were reported in 25 studies, with the remaining 13 studies not reporting patient numbers due to the studies not having patient-level outcomes.

Health professionals targeted by the interventions (Table 1) were most commonly primary care prescribers (i.e. general practitioners) alone (20 studies) or in combination with nurses (three studies: Bunker 2009; Zwar 2016; Bachmann 2019), practice assistants/receptionists (two studies: Markun 2018; Salisbury 2018), nurses and specialised physiotherapists (one study: Kruis 2014), nurses and medical assistants (one study: Latzke-Davis 2011), or allied staff in general with no details provided (one study: Khan 2019). Five studies were targeted at nurses/nurse practitioners alone (Coultas 2005; Fairall 2005; Walters 2013; Naidoo 2014; Fairall 2016), one study targeted intern prescribers (Shelesky 2012), one study targeted medical assistants (Freund 2016), and two studies targeted community pharmacists (Weinberger 2002; Torres-Robles 2021). One study targeted health workers involved in tuberculosis management (Shrestha 2006).

Setting

The studies included were carried out across six continents (Table 1):

- Europe (17): Netherlands (five), Denmark (two), Italy (two), Switzerland (two), Germany (one), Spain (two), Sweden (one), UK (one) and one study was conducted across five European countries (Gruffydd-Jones 2013)
- North America (seven): USA (six), Canada (one)
- Oceania (six): Australia (six)
- Asia (four): Bangladesh (one), China (one), Nepal (one), Pakistan (one)
- Africa (three): South Africa (three)
- South America (one): Brazil (one)

A majority of studies (32) were conducted in primary care general practice clinics. One study was conducted in a simulated primary care setting (Gruffydd-Jones 2013). Five studies were conducted in other locations including: two in pharmacies (Weinberger 2002; Torres-Robles 2021), one in comprehensive cancer centres (Thoonsen 2015), one in general practitioner clinics and three hospitals (Smidth 2013), and one in specialised pulmonary centres (Lusuardi 2006).

Interventions

A range of simple to complex interventions were used across the studies, with the core features of the health professional targeted components summarised in Table 2. We have categorised the key elements of the intervention in five groups: 1) education provided to health professionals via education sessions, workshops and online modules (31 studies); 2) provision of practice support tools, tool kits and/or algorithms to assist with the management of patients with COPD (10 studies); 3) resources related to guidelines and/or guideline dissemination (nine studies); 4) training on spirometry and/or interpretation of spirometry results (five studies); and 5) feedback, mentorship and ongoing support (seven studies) delivered via various methods including: providing feedback on quality of prescribing and/or case management (four studies: Hilberink 2011; Poels 2008; Shelesky 2012; Hurlimann 2015), centralised case-management support (two studies: Morganroth 2016; Salisbury 2018), ongoing support by investigators (two studies: Weinberger 2002; Walters 2013) and mentorship by experts (one study: Boulet 2013). Two studies involved expanding prescribing permissions for nurses to assist physicians in the management of respiratory illnesses in primary care (Fairall 2005; Fairall 2016). Twenty interventions were multi-component and used more than one element of the intervention components (15 used two, four used three and one used four intervention components).

Primary outcomes

The proportion of COPD diagnoses confirmed with spirometry was reported in four studies. Two studies reported numbers of new COPD diagnoses using spirometry (Walters 2008; Bunker 2009). One study reported the number of patients who had spirometry performed at the GP practice at least once per year (Smidth 2013) and one study reported change in number of spirometry tests per 100 patients affiliated with the GP practice (Due 2014). Four further studies reported outcomes related to spirometry, but were not considered part of our primary outcome: one simulated COPD cases and reported the agreement on case diagnoses between GPs and expert panel judgement (Poels 2008); one used the COPD Physician Practice Assessment Questionnaire for GPs to self-report the percentage of COPD patients in whom they confirmed diagnosis by pulmonary function tests (Uzzaman 2020); one reported the number of patients with a request for spirometry (Bachmann 2019); and one reported the percentage of spirometry testing sessions that were assigned a 'pass' grade (Latzke-Davis 2011).

The proportion of patients with COPD referred to, participating in or having completed pulmonary rehabilitation was reported in four studies. One study reported referral to pulmonary rehabilitation (Markun 2018), one reported numbers enrolled in pulmonary rehabilitation at 12 months (Morganroth 2016) and one reported the number of participants who attended pulmonary rehabilitation at 12 months (Zwar 2016). One study used the COPD Physician Practice Assessment Questionnaire for GPs to self-report the percentage of COPD patients who they referred to a pulmonary rehabilitation programme with a Medical Research Council (MRC) dyspnoea scale score > 3 (Uzzaman 2020).

The proportion of patients with COPD prescribed respiratory medication consistent with recommended guidelines was reported by 12 studies, using varying definitions (see Table 3). Respiratory medications reported included short-acting beta agonists (SABA), long-acting beta agonists (LABA), inhaled corticosteroids (ICS), oral corticosteroids, tiotropium, theophylline, antibiotics and combinations of two or more of these medications. Seven studies reported on individual medications (Fairall 2005; Martens 2006; Soler 2010; Hurlimann 2015; Lou 2015; Morganroth 2016; Bachmann 2019). Six reported composite measures of multiple specified medications (Soler 2010; Fairall 2016; Bachmann 2019) or reported as prescriptions for any COPD medication (Tinelli 2003; Shrestha 2006; Markun 2018). One study reported “probability of

medication and non-medication changes" for COPD as an indicator of GP decision-making based on simulated COPD cases (Poels 2008). Timing of the outcome measurement ranged from three months to four years, with a median time frame at 12 months (five studies).

Secondary outcomes

Proportion of patients with COPD vaccinated against influenza/pneumococcal infection was reported by four studies. Three studies reported influenza vaccination rates at 12 months (Morganroth 2016; Zwar 2016; Markun 2018), two reported pneumococcal vaccination rates at 12 months (Morganroth 2016; Zwar 2016) and one reported a composite measure of use of immunomodulatory agents at four-year follow-up, which included being vaccinated against influenza/pneumococci (Lou 2015).

Proportion of patients with COPD receiving smoking cessation support was reported in three studies: three reported proportion of patients who received smoking cessation counselling/advice (Fairall 2005; Morganroth 2016; Markun 2018) and one reported the proportion who received a smoking cessation intervention (Markun 2018). Additional outcomes related to smoking that were reported in the included studies, but not analysed in this review, included proportion of patients who had quit/were still smoking at follow-up (Hilberink 2011; Kruis 2014; Fairall 2016; Zwar 2016; Sandelowsky 2018; Khan 2019) and a self-assessment of GP reported adherence to COPD guidelines including providing smoking cessation counselling and pharmacological intervention in smokers (Uzzaman 2020).

Health professional knowledge of COPD management was reported in six studies, all using different measures. One study assessed nurse knowledge of chronic conditions (15/150 questions related to COPD) (Naidoo 2014). One study evaluated intern skills in managing COPD by videotaping interns and scoring competency using the validated Internal Medicine Resident Evaluation Form (seven questions scored on a nine-point scale) (Shelesky 2012). Three studies evaluated physician knowledge of COPD: one used independent assessors to score physicians using videotaped consultations on whether they reviewed 10 standard COPD issues (score out of 20) (Gruffydd-Jones 2013); one involved a physician self-assessment of knowledge and judgement related to diagnosis and treatment of chronic bronchitis and emphysema (44 multiple choice questions) (Terry 1981); and another involved a questionnaire to assess GPs' level of knowledge about management of COPD (five short patient case vignettes, two to three questions per vignette) (Sandelowsky 2018). An additional study evaluated the prescriber's ability to demonstrate the correct inhaler technique and determined the level of training required to master and maintain it (Cvetkovski 2020).

Health-related quality of life (HRQoL) of patients with COPD was reported in 12 studies, using various different tools (see Table 4). The most common measure used was the St George's Respiratory Questionnaire (SGRQ), a 50-item (total score out of 100) COPD-specific instrument designed to measure the impact of COPD on overall health, daily life and perceived well-being, which was reported in six studies (Coultas 2005; Walters 2013; Kruis 2014; Fairall 2016; Zwar 2016; Liang 2019). Timing of the outcome measure ranged from 6 months to 24 months, with most studies measuring at 12 months.

Frequency of COPD exacerbations was reported in 10 studies (see Table 5). Two studies reported rates of health care utilisation for lung conditions (Coultas 2005; Zwar 2016), six studies reported COPD/breathing-related hospitalisations (Weinberger 2002; Tinelli 2003; Walters 2013; Kruis 2014; Thoonsen 2015; Freund 2016) and four studies reported exacerbation rates (Tinelli 2003; Kruis 2014; Sandelowsky 2018; Markun 2018). Timing of the outcome measure ranged from 3 months to 12 months.

Lung function of patients with COPD was evaluated in four studies, three reporting forced expiratory volume in the first second (FEV_1) (Lou 2015; Zwar 2016; Liang 2019) and one peak flow expiratory rate (PEFR) (Weinberger 2002). Timing of the outcome measure ranged from six months (Liang 2019) to four years (Lou 2015), with the remaining two studies measuring at 12 months.

Patient adherence to medications was reported in four studies, using a dichotomous (compliant or not compliant) measure (Weinberger 2002), adherence to treatment on a 0 to 8 scale (8 = better) as part of a self-management capacity questionnaire (Walters 2013), Morisky Medication Adherence Scale (Markun 2018) and Morisky Green Levine Medication Adherence Questionnaire (Torres-Robles 2021). One further study also reported proportion of patients with *correctinhaler technique* (Zwar 2016).

Patient satisfaction with care provided by health professional was reported in one study in a dichotomous format (number of patients reporting being very satisfied with care/total number of patients) (Salisbury 2018).

No studies were identified that reported any *adverse outcomes*.

Four studies were identified that met our eligibility criteria, but did not contribute to any outcome data as they did not report the outcomes of interest for this review (Lusuardi 2006; Hilberink 2011; Latzke-Davis 2011; Khan 2019).

Excluded studies

We excluded 68 studies in total after full-text screening (see Characteristics of excluded studies). We excluded 31 studies that did not have a COPD-specific, health professional targeted, educational component to the intervention. We excluded 16 studies because the study design did not involve an RCT or cluster-RCT, 17 studies that were not set in primary care and four studies that did not have data specific to COPD patients, i.e. no subgroup data that could be extracted.

Risk of bias in included studies

See Characteristics of included studies, Figure 2 and Figure 3 for a summary assessment of the risk of bias of included studies.

Figure 2.

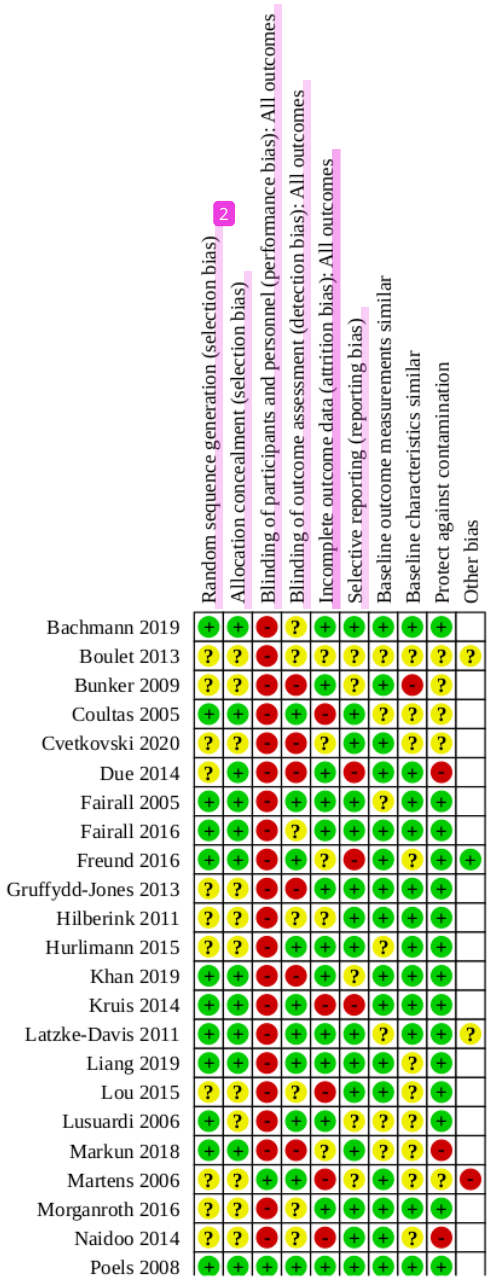


Figure 2. (Continued)

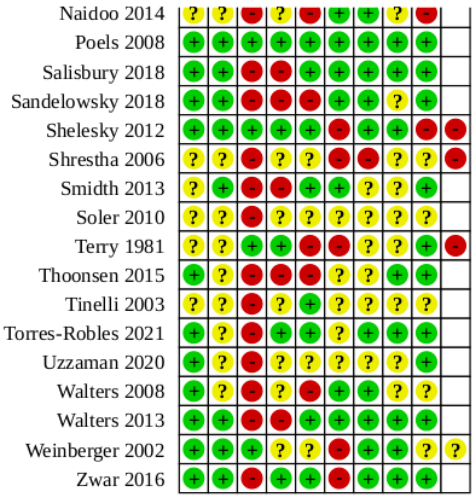
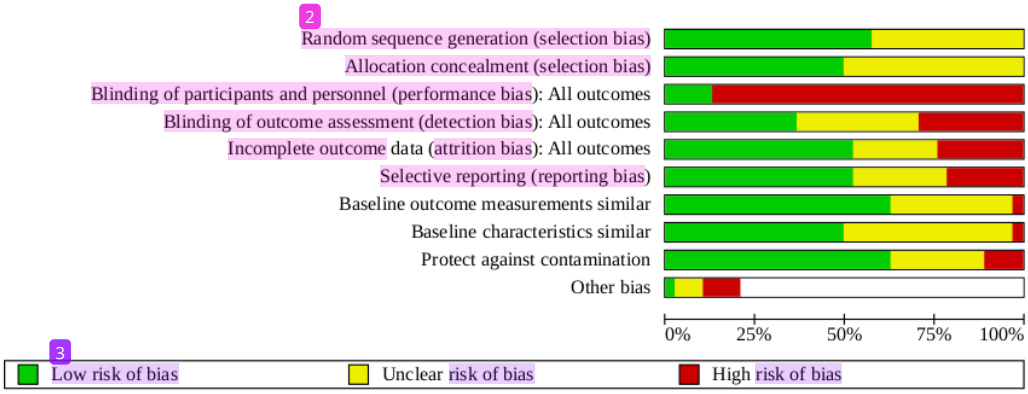


Figure 3.



Allocation

Risk of bias for random sequence generation was low in 22 studies (58%) and unclear in 16 (42%). For concealment of allocation, risk of bias was low in 19 studies (50%) and unclear in 19 (50%). We gave an unclear rating due to a lack of detail regarding the method of generating the random sequence and/or if and how allocation was concealed.

Blinding

Blinding of both participants and personnel could not be achieved through the study design in 33 of the 38 studies (87%), leading to high risk of performance bias. Three studies involved delivering a 'sham' intervention to the control group to achieve blinding of participants (Terry 1981; Weinberger 2002; Poels 2008). One study maintained blinding of interns throughout the study by filming both intervention and control group, but only delivering the direct observation and formal feedback to the intervention group (Shelesky 2012). One study maintained blinding, as GPs were not aware they were in an evaluation study, because only anonymous insurance data were collected from existing databases (Martens 2006).

Eleven studies (29%) had no blinding of outcome assessment; we considered these studies to have high risk of detection bias. We assessed 13 studies (34%) as having 'unclear' risk of detection bias. Studies with unclear detection bias included 10 studies where there were insufficient details to determine if blinding occurred (Weinberger 2002; Tinelli 2003; Shrestha 2006; Walters 2008; Soler 2010; Naidoo 2014; Lou 2015; Morganroth 2016; Markun 2018; Bachmann 2019), two studies where outcomes were self-reported

by unblinded participants (Hilberink 2011; Uzzaman 2020) and one study that was aborted (Boulet 2013).

Incomplete outcome data

We considered nine studies (24%) to have incomplete outcome data and therefore high risk of attrition bias: six were due to high loss to follow-up (Terry 1981; Martens 2006; Walters 2008; Naidoo 2014; Thoonsen 2015; Sandelowsky 2018) and three were due to unbalanced demographics amongst those who dropped out compared to those who stayed in the study (Coultas 2005; Kruis 2014; Lou 2015). We assessed nine studies (24%) as having unclear risk of bias: two due to higher follow-up in one arm than the other (Freund 2016; Markun 2018); four due to unclear details regarding dropout or characteristics of those that dropped out (Shrestha 2006; Soler 2010; Cvetkovski 2020; Uzzaman 2020); three due to dropout of clusters (Weinberger 2002; Hilberink 2011); and one because the study was aborted (Boulet 2013). Twenty studies (53%) reported minimal incomplete outcome data and/or adequately addressed this (low risk of bias).

Selective reporting

We considered eight studies (21%) to have high risk of reporting bias: four due to missing outcome data (Terry 1981; Kruis 2014; Freund 2016; Zwar 2016), two due to inconsistency in how data were presented (Shrestha 2006; Due 2014) and two because raw data were not provided (Weinberger 2002; Shelesky 2012). We considered 10 studies (24%) to have unclear risk of bias: three due to poorly described methods (Bunker 2009; Martens 2006; Soler 2010), three due to no pre-published protocol or trial registration (Lusuardi 2006; Tinelli 2003; Uzzaman 2020), one because secondary outcomes were added post-protocol (Khan 2019), one due to missing outcomes for the COPD subgroup (Thoonsen 2015), one due to no published results available for a number of outcomes (Torres-Robles 2021), and one because the study was aborted (Boulet 2013). We assessed 20 studies (55%) as having low risk of selective reporting.

Other potential sources of bias

Baseline outcome measurements similar: We considered one study to have high risk of bias for this domain, due to differences in numbers of prescriptions pre-intervention between groups and discrepancies in reporting of the number within the paper (Shrestha 2006). We considered 13 studies (34%) have unclear risk of bias, either due to baseline outcome measurements not being reported, or minor differences that would have unclear impacts on the findings. We assessed 24 studies (63%) as having low risk of bias.

Baseline characteristics similar: We considered one study to have high risk of bias for this domain, due to lack of comparison of baseline characteristics of the intervention versus usual care group (Bunker 2009). We considered 18 studies (48%) to have unclear risk of bias, mostly due to small differences in baseline characteristics between groups, which may have an unclear impact on findings. We assessed 19 studies (50%) as having low risk of bias.

Protect against contamination: We considered four studies (11%) to have high risk of bias for this domain, due to reported evidence of contamination between groups (Shelesky 2012; Due 2014; Naidoo 2014; Markun 2018). We considered 10 studies (26%) to have unclear risk of bias due to lack of details provided or suspected contamination of health professionals between intervention and usual care sites. We assessed 24 studies (63%) as having low risk of bias.

Effects of interventions

See: **Summary of findings 1** Educational interventions for health professionals managing chronic obstructive pulmonary disease in primary care

Primary outcomes

Proportion of COPD diagnoses confirmed with spirometry

We identified four interventions that showed mixed impacts on the proportion of COPD diagnoses confirmed with spirometry. Meta-analysis was not possible due to differences in reporting of the outcome measure.

Two studies reported that the intervention may increase number of new COPD diagnoses. One involved educational workshops for GPs and practice nurses, with nurses then performing spirometry and referring to GPs for further assessment (COPD diagnoses/number of patients: 16/79, versus 1/408) (Bunker 2009). One involved active, structured implementation of a disease management programme for COPD targeted at GPs and increased the number of patients who had spirometry performed at least once a year (risk ratio (RR) 1.36, 95% confidence interval (CI) 1.09 to 1.70, n = 458 versus 1.07, 95% CI 0.85 to 1.34, n = 376) (Smidth 2013). Two studies did not demonstrate a clear impact on the proportion of COPD diagnoses confirmed with spirometry. One involved trained spirometry nurses visiting practices to perform opportunistic patient testing, versus spirometry training and provision of a spirometer to practices (COPD diagnoses/number of patients: 11/499 versus 3/76) (Walters 2008). The other, which involved education for GPs, development of a toolbox and facilitator visits, did not change the number of spirometry tests per 100 patients affiliated with the practice (median 0.6; interquartile range (IQR) 0.2 to 1.2, n = 94 versus 0.5, IQR 0.1 to 0.8, n = 89) (Due 2014).

Overall, we are uncertain of the effects of educational interventions for health professionals on the proportion of COPD diagnoses confirmed with spirometry (very low-quality evidence). We downgraded the evidence due to high or unclear risk of bias across multiple domains (-1), inconsistency in definition and reporting of outcome measure (-1) and imprecision due to low event numbers (-1).

Proportion of patients with COPD referred to, participating in or having completed pulmonary rehabilitation

We identified four interventions that showed mixed impacts on the proportion of patients with COPD referred to, participating in or having completed pulmonary rehabilitation. Meta-analysis was not possible due to differences in reporting of the outcome measure.

Two studies reported that the intervention might increase referral and/or enrolment in pulmonary rehabilitation; both involved blended face-to-face and online education to physicians/GPs. One study, which involved both face-to-face and online education plus access to central case management resources, increased enrolment in pulmonary rehabilitation compared to the control group that only received access to CareManager COPD module online (14/117, 12% versus 4/125, 3%) (Morganroth 2016). Another study found GPs who received blended education rather than traditional face-

to-face classroom learning self-reported higher percentages of dyspnoeic COPD patients who they referred to a pulmonary rehabilitation programme if their MRC dyspnoea score was > 3 (66.4%, n = 19 physicians versus 40.9%, n = 21 physicians) (Uzzaman 2020). However, two studies showed no clear impact on the proportion of patients referred to pulmonary rehabilitation: one study involved practical education in team-based management of COPD delivered to physicians and nurses (patients attending pulmonary rehabilitation at 12 months 1/126 versus 1/96) (Zwar 2016). The other study involved educational workshops with GPs and their practice assistants on COPD guidelines and implementing a COPD care bundle (no significant difference between groups, actual numbers not reported) (Markun 2018).

Overall, we were uncertain of the effects of educational interventions for health on the proportion of patients with COPD referred to pulmonary rehabilitation (low-quality evidence). We downgraded the evidence due to high or unclear risk of bias across multiple domains (-1) and imprecision due to low event numbers (-1).

Proportion of patients with COPD prescribed respiratory medication consistent with recommended guidelines

We identified 12 interventions that showed mixed impacts on the proportion of patients with COPD prescribed respiratory medication consistent with recommended guidelines (Table 3). Meta-analysis was not possible due to differences in reporting of the outcome measure.

Six studies reported a clear impact on prescribed respiratory medication following the intervention. Two studies reported on 'prescriptions for COPD' in general with lower prescribing indicating more rational/guideline appropriate prescribing: one involved guideline provision and training for health workers (15/101 prescriptions versus 29/67 prescriptions) (Shrestha 2006). The other involved guideline provision and an algorithm for GPs (COPD prescriptions prescribed by GP for COPD: mean 3.63 (standard deviation (SD) 2.96), n = 72 versus 4.12 (SD 3.10, n = 51)) (Tinelli 2003). Four studies reported on individual medications, with higher prescribing rates considered better:

- Educational outreach sessions and expanded prescribing provisions for nurse practitioners resulted in an increase in prescriptions filled out for inhaled corticosteroids over three months (137/1000 versus 77/999 patients, P = 0.006) (Fairall 2005).
- Provision of guidelines and individual feedback on antibiotic prescribing patterns for physicians resulted in greater prescription of penicillins, but lower prescription of quinolones for respiratory tract infections compared to usual care (Hurlimann 2015).
- Two-day training in health management for COPD delivered to GPs in combination with a comprehensive health management programme for patients resulted in increased frequency of prescribing of long-acting beta agonists (LABA), inhaled corticosteroids (ICS), oral corticosteroids (OCS) and theophylline over four years compared to usual care (Lou 2015).
- Education for physicians, use of COPD CareManager online module and access to central case management resources increased prescriptions for bronchodilators, ICS/tiotropium, LABA + ICS and tiotropium at 12 months compared to access to the COPD CareManager online module alone (Morganroth 2016).

Six studies reported non-significant results (Martens 2006; Poels 2008; Soler 2010; Fairall 2016; Markun 2018; Bachmann 2019). Two studies reported a mixed effect (Fairall 2005; Hurlimann 2015).

Overall, we were uncertain of the effects of educational interventions for health professionals on the proportion of patients with COPD prescribed respiratory medication consistent with clinical practice guidelines (low-quality evidence). We downgraded the evidence due to high or unclear risk of bias across multiple domains (-1) and heterogeneity in definition of the outcome (including which respiratory medications were reported, whether it was the first, any or intensification of prescribing, and whether higher or lower prescribing was desirable) (-1).

Secondary outcomes

Proportion of patients with COPD vaccinated against influenza/ pneumococcal infection

We identified four interventions that showed mixed impacts on the proportion of patients with COPD vaccinated against influenza/ pneumococcal infection. Meta-analysis was not possible due to differences in reporting of the outcome measure.

Three studies reported influenza vaccination rates at 12 months, two reported significantly higher influenza vaccination rates in the intervention group compared to usual care (Zwar 2016; Markun 2018), and one study reported that the effect of the intervention was uncertain (Morganroth 2016). The two interventions with clear impact involved practical education in team-based management of COPD delivered to physicians and nurses (Zwar 2016: number of people vaccinated 91/126 intervention versus 54/96 usual care, P = 0.035); and educational workshops with GPs and their practice assistants on COPD guidelines and implementing a COPD care bundle (Markun 2018: significant difference reported in a figure, actual numbers not reported). The third study involved education for physicians, use of COPD CareManager online module and access to central case management resources compared to access to the COPD CareManager online module alone (Morganroth 2016: percentage of people vaccinated n = 90, 77% versus n = 83, 66%, P = 0.06).

Two studies reported pneumococcal vaccination rates at 12 months; neither intervention demonstrated clear impact on vaccination rates compared to usual care (Zwar 2016: number of people vaccinated 56/126 versus 36/96, P = 0.15 and Morganroth 2016: n = 98, 84% versus n = 96, 77%, P = 0.18).

One further study reported a composite measure of use of immunomodulatory agents including influenza vaccine, pneumonia vaccine, bronchitis vaccine, immunoglobulin etc. (Lou 2015). This intervention involved a two-day training in health management for COPD delivered to GPs in combination with a comprehensive health management programme for patients and resulted in an increased proportion of participants in the intervention group using immunomodulators at the four-year follow-up compared to the control group (77.1% n = 3418 versus 18.6% n = 2803, P < 0.001).

Overall, educational interventions for health professionals probably improved the proportion of patients with COPD

vaccinated against influenza, but probably have little impact on the proportion of patients vaccinated against pneumococcal infection (moderate-quality evidence). We downgraded the evidence due to high or unclear risk of bias across multiple domains (-1).

Proportion of patients with COPD receiving smoking cessation support

We identified three interventions that showed little or no impact on the proportion of patients with COPD receiving smoking cessation advice/counselling compared to usual care (Fairall 2005: 112/164 versus 127/193; Morganroth 2016: 37/117 versus 35/125; Markun 2018: non-significant, visually presented in a figure). One intervention, involving educational workshops with GPs and their practice assistants on COPD guidelines and implementing a COPD care bundle, did report increased implementation of the 'smoking cessation intervention' in the intervention group compared to the control (visually presented in a figure, actual numbers not reported) (Markun 2018). Meta-analysis was not possible due to differences in reporting of the outcome measure.

Overall, educational interventions for health professionals may have little or no impact on the proportion of patients with COPD receiving smoking cessation advice, but may improve slightly the proportion of patients who receive smoking cessation support (low-quality evidence). We downgraded the evidence due to high or unclear risk of bias across multiple domains (-1), and heterogeneity in reporting of the outcome (-1).

Health professional knowledge of COPD management

We identified six interventions that showed mixed impact on health professional knowledge of COPD management. Meta-analysis was not possible due to differences in health professionals and differences in outcome measures and reporting.

Three interventions reported improvement in health professional knowledge following the intervention compared to usual care. The first involved independent assessment of primary care physicians using video-taped consultations with standardised COPD patients with or without access to a completed COPD assessment test (mean 9.6 (standard error (SE) 0.3), n = 444 consultations versus 8.8 (SE 0.2), n = 428 consultations, P = 0.045) (Gruffydd-Jones 2013). The second involved independent assessment of intern skills in 14 interns following direct observation and feedback compared to those who did not receive feedback (data visually presented, P < 0.05 at 6 and 12 weeks) (Shelesky 2012). The third involved physician self-assessment of knowledge 9 months and 18 months after a continuing medical education course compared to those who did not attend the course (data visually presented, n = 144 physicians, P < 0.05) (Terry 1981).

Two studies reported no clear difference in health professional knowledge in the intervention group compared to the control group. The first assessed physician knowledge at 12 months of those who attended case method learning compared to traditional lectures (mean score 11.44 versus 10.91, n = 133 GPs) (Sandelowsky 2018). The second assessed nurse knowledge six months after attending training on chronic disease management compared to those who did not attend training (mean total knowledge percentage 42.3% versus 41.5%, n = 109 nurses) (Naidoo 2014).

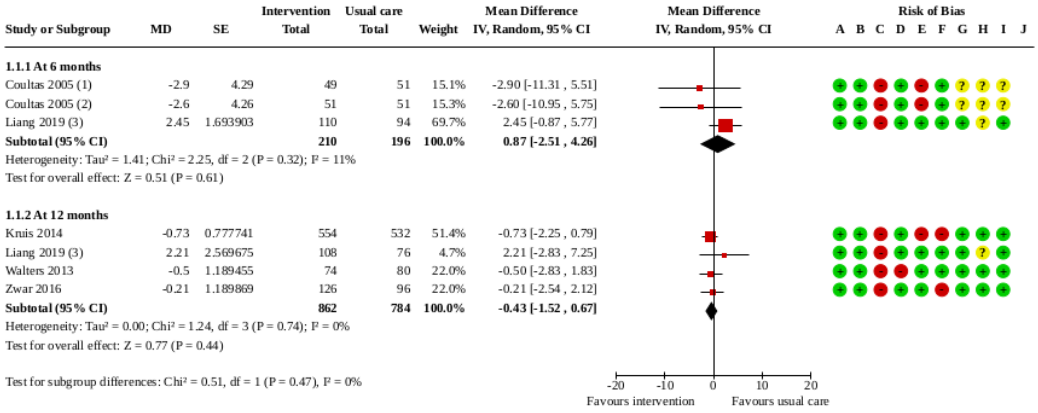
An additional study evaluated the prescriber's ability to demonstrate the correct inhaler technique and determine the level of training (level 1: no training; level 2: written instructions; level 3: instructional video; level 4: expert tuition; level 5: repeat reinforcement) required to master it (Cvetkovski 2020). More than half of the prescribers were able to use inhalers correctly without training (52% for Turbuhaler, 57% for Spiromax), and after three levels of training, almost all of them mastered it (99% for Turbuhaler, 99% for Spiromax).

Overall, educational interventions for health professionals may have little or no impact on health professional knowledge of COPD management (low-quality evidence). We downgraded the evidence due to high or unclear risk of bias across multiple domains (-1), and heterogeneity in type of health professionals involved, type of outcome measure and reporting of the outcome (-1).

Health-related quality of life (HRQoL) of patients with COPD

We identified 12 studies that reported a measure of HRQoL, but only one of the studies reported a clear impact on HRQoL compared to usual care (Freund 2016) (see Table 4). We conducted meta-analyses using five studies (Coultas 2005; Walters 2013; Kruis 2014; Zwar 2016; Liang 2019); we found that the interventions did not demonstrate a clear difference on HRQoL measured using the St George's Respiratory Questionnaire (SGRQ) at six months (mean difference (MD) 0.87, 95% CI -2.51 to 4.26, n = 406) or 12 months (MD -0.43, 95% CI -1.52 to 0.67, n = 1648) compared to usual care (see Analysis 1.1 and Figure 4). The pooled mean difference in SGRQ also did not reach the minimum clinically important difference (MCID) of four units (Jones 1992).

Figure 4.



Footnotes
(1) MM vs UC. SE adjusted to prevent double-counting usual care group.
(2) CM vs UC. SE adjusted to prevent double-counting usual care group.
(3) Intervention and Usual Care participant numbers provided by authors.

Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Incomplete outcome data (attrition bias)
(F) Selective reporting (reporting bias)
(G) Baseline outcome measurements similar
(H) Baseline characteristics similar
(I) Protect against contamination
(J) Other bias

Meta-analysis was not possible for the other studies due to differences in the measures of HRQoL, follow-up times and reporting of outcome. Overall, educational interventions for health professionals may have little or no impact on HRQoL of patients with COPD (low-quality evidence). We downgraded the evidence due to high or unclear risk of bias across multiple domains (-1), and heterogeneity in type of outcome measure and reporting of the outcome (-1).

Frequency of COPD exacerbations

We identified 10 studies that reported frequency of COPD exacerbations using various measures (see Table 5). Only one study demonstrated a reduction in hospitalisations for COPD at 12 months (mean 0.03 (SD 0.22), n = 321 versus 0.11 (SD 0.56), n = 222, P = 0.011), but there was no clear benefit reported at 24 months (mean 0.14 (SD 0.61), n = 321 versus mean 0.26 (SD 1.09), n = 222, P = 0.086) (Freund 2016). Meta-analysis was not possible due to differences in how the outcome was measured, timing of outcome and reporting of the outcome. Overall, educational interventions for health professionals may have little or no impact on the frequency of COPD exacerbations (low-quality evidence). We downgraded the evidence due to high or unclear risk of bias across multiple studies for multiple domains (-1), and heterogeneity in type of outcome measure, timing of outcome measure and reporting of the outcome (-1).

Lung function of patients with COPD

We identified four studies that showed mixed impact on lung function of patients (using PEFR or FEV_1). Meta-analysis was not possible due to differences in reporting of the outcome measure.

Two interventions had positive impacts on lung function. One intervention, involving training of pharmacists in addition to access to patient-specific clinical data, educational material and peak flow meter, demonstrated a significant improvement in peak flow rate of patients in the intervention group compared to usual care (mean 63.72 (SE 0.58) versus 61.82 (SE 0.71) L/min, total number of events = 996, P = 0.006) (Weinberger 2002). One intervention involving two-day training in health management for COPD delivered to GPs in combination with a comprehensive health management programme for patients resulted in less decrease in the percentage of predicted FEV_1 at four years (mean -5.9 L (SD 3.2), n = 3428 versus -6.5 L (SD 2.9), n = 2803, P = 0.01) (Lou 2015).

Two interventions did not demonstrate a clear impact on lung function. One intervention involved training for health professionals and a comprehensive model of care for patients (smoking cessation support, home medicine review and home-based pulmonary rehabilitation) (FEV_1 mean 0.79% predicted (95% CI -0.86 to 2.44) versus -0.09% predicted (95% CI -1.84 to 1.67), n = 208, P=0.41) (Liang 2019). The second intervention involved practical education in team-based management of COPD delivered

to physicians and nurses (FEV_1 mean 2.15 L (SD 0.72), n = 126 versus 2.38 L (SD 0.74), n = 96, P = 0.78) (Zwar 2016).

Overall, educational interventions for health professionals may have little or no impact on the lung function of patients (low-quality evidence). We downgraded the evidence due to unclear risk of bias across multiple domains (-1) and heterogeneity in timing and reporting of outcome measure (-1).

Patient adherence to medications, including optimal device technique

We identified five interventions that reported patient adherence to medications (see Table 6). One intervention involving training pharmacists on management of COPD, frameworks for changing patient behaviour and educational skills to provide the intervention to patients did improve adherence to COPD medication at six months (Morisky Green Levine Medication Adherence Questionnaire: intervention: 92.9% (95% CI 87.0 to 96.2) versus control: 72.5% (95% CI 62.3 to 80.7), P = 0.0001) (Torres-Robles 2021). Three interventions showed no clear impact on patient adherence to medication (Weinberger 2002; Walters 2013; Markun 2018). One intervention showed no benefit on the proportion of patients with correct inhaler technique compared to usual care (Zwar 2016). Overall, educational interventions for health professionals probably have little impact on patient adherence to medications (moderate-quality evidence). We downgraded the evidence due to heterogeneity in how the outcome was measured (-1).

Patient satisfaction with care provided by health professional

We identified one study that reported patient satisfaction with care provided by a health professional. The intervention involved training clinicians on eliciting patient concerns, exploring strategies to promote patient-centred care and ways to improve continuity care (Salisbury 2018). Patients then received three dimensions of review (nurse review, pharmacist review and physician review). A higher proportion of patients in the intervention group reported being "very satisfied with care" compared to the usual care group (345/614, 56% versus 236/608, 39%; P = 0.0014).

Overall, educational interventions for health professionals may improve patient satisfaction with care (moderate-quality evidence). We downgraded the evidence due to imprecision as only one study was found (-1).

Any adverse outcomes (events/effects)

We identified no studies that reported adverse outcomes.

DISCUSSION

Summary of main results

This review evaluated 38 randomised controlled trials (RCTs) (16 RCTs and 22 cluster-RCTs) of educational interventions for health professionals managing chronic obstructive pulmonary disease (COPD) in primary care and found limited evidence for effectiveness. There were a range of simple to complex interventions identified, and almost all studies (36/38) evaluated interventions versus usual care. The evidence was equivocal for our primary outcomes, the proportion of COPD diagnoses confirmed with spirometry, and the proportion of patients with COPD who participated in pulmonary rehabilitation or who were prescribed guideline-recommended respiratory medications. No meta-analysis was possible for the primary outcomes due to heterogeneity, including differences in the definition of outcomes and reporting of results.

Secondary outcomes evaluated other elements of COPD management in primary care, but meta-analysis was only possible for one outcome (health-related quality of life (HRQoL)). Overall, educational interventions probably improve the proportion of patients with COPD vaccinated against influenza, but there was little difference in the proportion vaccinated against pneumococcal infections. Interventions had little or no impact on the proportion of patients with COPD receiving smoking cessation advice, but they may slightly improve the proportion of patients who received smoking cessation support. Interventions for health professionals may have little or no impact on the HRQoL of patients with COPD, health professional knowledge of COPD management, frequency of COPD exacerbations, lung function or adherence to medication. One study reported that educational interventions may improve patient satisfaction with care. No studies reported adverse outcomes associated with the interventions.

These results must be interpreted with a degree of caution, given the variations in intervention design, reporting of outcomes and risk of bias of included studies, along with the overall low- or very low-quality rating of evidence for most of these outcomes.

Overall completeness and applicability of evidence

Our searches for this review are current to May 2021, and review results are based on 38 studies. Together the trials included addressed all the prespecified primary outcomes, and all but one of the secondary outcomes (we found no studies that reported adverse outcomes/events). However, apart from HRQoL, the outcomes were reported too infrequently and/or inconsistently to enable meta-analyses.

Almost 5000 health professionals were targeted by the interventions, although this number is an underestimation as exact numbers of health professionals were only reported in 19 of 38 studies. Interventions most commonly targeted primary care prescribers, alone or in combination with nurses or allied health professionals. We identified interventions that targeted general practitioners, nurses, nurse practitioners, medical and practice assistants, physiotherapists, interns and pharmacists. Most of the trials were conducted in primary care general practice clinics, but some were in pharmacies, a cancer centre, a specialised pulmonary centre or in conjunction with hospitals.

The trials were undertaken in high-, middle- and low-income countries across six continents, thus the findings should be generalisable.

A wide variety of educational interventions were identified targeting the diagnosis, management and prognosis of COPD. These included face-to-face education sessions, workshops and online modules. Other common intervention elements involved provision of practice support tools, tool kits and/or algorithms to assist with management of patients with COPD, resources related to guidelines and/or guideline dissemination and training on providing and/or interpreting spirometry.

Many of the interventions identified delivered components of the intervention directly to patient participants in addition to the

educational intervention for health professionals. Patient-directed elements of the interventions were not evaluated as part of this review, but may have explained some variation in the results.

Quality of the evidence

We evaluated the certainty of the body of evidence using the GRADE approach for each primary and secondary outcome. Overall, there were serious concerns related to risk of bias and heterogeneity in the definition and reporting of outcomes, resulting in low- or very low-quality evidence for all primary outcomes and most secondary outcomes. We considered the quality of evidence moderate for the proportion of patients with COPD vaccinated against influenza/pneumococcal infection, patient adherence to medications for COPD and patient satisfaction with care provided by health professional.

Most studies had unclear or high risk of bias across multiple domains. We considered at least half of the included studies to have unclear or high risk of bias for the domains of selection, detection, attrition and reporting bias. Furthermore, nearly all studies (87%) had high risk of performance bias, but we acknowledge that blinding of health professionals is often impossible to achieve in pragmatic health service research.

We identified serious concerns related to inconsistencies for most outcomes (72%) in this review, mainly due to heterogeneity in the type, timing and reporting of outcome measures. Concerns related to imprecision were also present for three outcomes due to low study and/or event numbers.

Potential biases in the review process

This is the first systematic review of educational interventions for health professionals managing COPD in primary care. The review is based on a published protocol (Liang 2017). We conducted a comprehensive search of six databases, in addition to searches of the Cochrane Airways Group Specialised Register, and clinical trial registries. Titles, then abstracts and ultimately the full text of eligible studies were independently screened by at least two review authors. Where consensus could not be reached on inclusion or exclusion, a third review author was involved. It is unlikely that we have missed key studies, particularly those published in English, French or German.

However, we did note that the education intervention component delivered to health professionals was sometimes poorly described in the context of large, complex interventions where the majority of the intervention was directed at patients. This was particularly evident when searching clinical trial registries. We did contact study authors where possible, and did receive correspondence to clarify the eligibility of some studies. However, it is possible that potentially relevant studies may have been missed where the health professional-directed intervention component was poorly described, or not described at all.

Agreements and disagreements with other studies or reviews

COPD is a major, burdensome chronic disease, predominantly treated in primary care. In many countries, health professionals are required to undertake continuing professional development. Despite the clear need, these educational interventions for COPD demonstrated little, if any, effect on the outcomes reviewed. While this is the first review to evaluate educational interventions for health professionals managing COPD in primary care, our results do parallel findings in other clinical conditions. For example, Gibson 2002 found that limited asthma education as it has been practised did not appear to improve health outcomes in adults with asthma.

A meta-analysis of the effects of continuing medical education (CME) on physician knowledge, performance and patient outcomes found that educational interventions that were interactive, used multiple methods and were designed for a small group of physicians from a single discipline were associated with better outcomes (Mansouri 2007). On the other hand, an overview of reviews found that collaborative team-based policies involving family physicians, nurses and pharmacists led to increased physician adherence to guidelines (Chauhan 2017). Interactive and multifaceted CME programmes, which included training with audit and feedback, and clinical decision support systems, were found to improve knowledge, optimise prescribing, increase screening rates, enhance patient outcomes and reduce potential adverse events. Similarly, a systematic review of a range of educational interventions designed for GPs in the Australian context found that multifaceted interventions resulted in improved knowledge and change in GP behaviour (Bernardes 2019). However, the effects of multiple contact methods within an intervention and online interventions were inconsistent.

Another important factor that should be considered while evaluating the educational interventions is the complex trajectory between interventions and their outcomes. According to Kirkpatrick's evaluation pyramid (Kirkpatrick 1970), there are four levels of outcome evaluation: 1) reaction (health professionals' reaction to the training programme – satisfaction or happiness); 2) learning (to what extent did the health professional improve knowledge and skills); 3) behaviour (behaviour change as a result of the training – knowledge transfer in the workplace) and 4) results (impact on society). The complexity increases as it moves from a lower to a higher outcome level. For example, it is easy to demonstrate an improvement in knowledge amongst the attendees of a course (knowledge transfer), but implementing the lessons learned (behavioural change) in the context of their busy practices is not easy (Hutchinson 1999). This depends on many environmental factors such as time, availability of resources etc. (Hutchinson 1999). Impact on society (improving public health) is the ultimate aim of any educational initiative, but it is even more difficult as multiple confounding factors affect these outcomes (e.g. sociodemographic factors, health literacy, competing priorities). As the majority of the outcomes in this review were evaluation of behaviour and results, failure to show an effect might be due to any one of these factors.

The null effect of educational interventions identified in this review also might be explained on the basis of complexities associated with the outcomes assessed and with guideline-management of COPD. Spirometry is recommended in all COPD guidelines, but it is very difficult to implement in primary care for various reasons including the availability of spirometers, training, time etc. Spirometers are available in almost all general practices in Iceland, Norway, Sweden and Denmark (Eide 2017). However, spirometry was still underutilised in Iceland (Guðmundsson 2004). Furthermore, even spirometry implemented to then current American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines accompanied by regular medical reviews did not

appear to improve generic quality of life in patients with asthma or COPD recruited from Australian general practices (Abramson 2010). There were also no significant differences in respiratory symptoms, asthma attacks, written asthma action plans, days lost from usual activities or health care utilisation.

AUTHORS' CONCLUSIONS

Implications for practice

Low- or very low-quality evidence for most outcomes means that there is uncertainty about the benefits of any currently published educational interventions for healthcare professionals to improve chronic obstructive pulmonary disease (COPD) management in primary care. Despite a substantial number of studies included in this review, there is still a need for further high-quality evidence, with interventions to be developed adopting adult learning principles and tailored to local COPD guidelines. Many COPD guidelines (e.g. GOLD, COPD-X) are regularly updated and the educational resources also need to be updated.

Implications for research

Further well-designed randomised controlled trials (RCTs) are needed to investigate the effectiveness of educational interventions delivered to health professionals managing COPD in the primary care setting. Whilst it is difficult to conduct blinded educational interventions, consideration should be given to waiting list controls and other innovative study designs that may help minimise performance bias. Three-arm RCTs may also be considered to ensure that the effectiveness of the educational intervention delivered to health professionals can be differentiated from the overall impact of a multi-faceted intervention that may also involve patient-directed elements.

It is important to design a well-accepted and implementable intervention with the best chances of success. The intervention components that were successful in other fields could be considered. Johnson et al explain the relative strengths and weaknesses of different interventions using theoretical frameworks and identify the types and combinations of interventions more likely to be successful in complex organisational environments (Johnson 2015). The authors reported that interventions focusing on action or education such as audit and feedback, reminders and educational outreach offer the best chances of success (Johnson 2015). In addition, utilising the theories of implementation research (Proctor 2011), and identifying the barriers and facilitators of programme implementation, might be helpful to achieve the ultimate goal, improving patient health outcomes.

There is a need for clearer and more consistent reporting of outcomes across studies, perhaps suggesting the need for development of a 'gold standard' list of outcomes for RCTs in COPD, developed in line with key principles of COPD guidelines. This list of outcomes should include process outcomes (e.g. number of health professionals participating, number of health professionals completing training), health professional-level outcomes (e.g. knowledge improvement, adherence to guidelines, referrals made, prescribing patterns) and patient-level outcomes (e.g. COPD diagnosis/management, quality of life changes, exacerbations, adverse outcomes).

Future research could also target health professionals underrepresented in the current evidence base (e.g. trainee GPs, practice nurses, physiotherapists and pharmacists) and/or focus on subgroups of patients (e.g. those with more severe disease or frequent exacerbations).

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Bachmann 2019

Study characteristics	
Methods	***Aim of study:*** to evaluate the effects of PACK (practical approach to care kit) training on the diagnosis, investigation and treatment of asthma and COPD in adults attending Florianópolis municipal clinics. ***Study design:*** pragmatic, parallel-group, superiority cluster-randomised trial ***Geographic location:*** Brazil ***Study setting:*** municipal clinics ***Number of study sites:*** 48 ***Number of arms/groups:*** 2 ***Unit of allocation:*** cluster (clinic) ***Study start date:*** July 2015 ***Study end date:*** March 2018
Participants	***Type of participants:*** patients ***Recruitment method:*** all but one of 49 municipal clinics in Florianópolis were included in the trial; a small mobile clinic was excluded ***Inclusion criteria:*** aged 18 years and over in March 2017, who attended a participating clinic during the first year of the follow-up with a clinical diagnosis of obstructive lung disease (ICD-10 codes 40 to 47) recorded in electronic medical records since 1 July. An additional study population comprised all adults who attended participating clinics during 12 months after training ended, in whom the annual rates of new diagnoses of asthma and COPD were estimated. ***Exclusion criteria:*** none specified ***Number of participants:*** 6666 (3311 intervention, 3355 control) ***Age of participants:*** intervention mean 61.9 (SD 13.4); control mean 62.2 (SD 13.4)
Interventions	**Intervention: PACK (Practical Approach to Care Kit) Adult DSCT (Decision Support Clinic Tools) with training:**

Bachmann 2019 *(Continued)*

	Training was provided in or near the primary care facilities where trainees worked, entailed short interactive group sessions of about 90 minutes, which were repeated about weekly during initial training and fortnightly during maintenance training. Training sessions were led by facility trainers (health workers) who worked in the same facility or within the local health system. Initial training in intervention clinics took place during 12 sessions over 6 months. After a pause of 3 months, 14 maintenance training sessions were delivered over 12 months. Training was delivered to 160 doctors and nurses, all of whose responsibilities included asthma and COPD care. After initial training, the pairs of facility trainers visited each clinic monthly, and the master trainers continued to communicate with facility trainers using email and a WhatsApp group. **Control: PACK without training:** The PACK guide is an integrated, comprehensive clinical decision support tool for use during primary healthcare consultations. The chronic respiratory disease section covers investigation, diagnosis and treatment of asthma and COPD, use of inhalers, spacers and peak flow meters. Unique features of the training in Florianópolis included appointing inter-professional nurse–doctor pairs to deliver outreach sessions, embedding master trainers, responsible for training and supporting the facility trainers, within the Primary Healthcare Department, and a curriculum focused on locally identified priorities, including respiratory conditions, diabetes, hypertension, back pain and tuberculosis. PACK training comprised educational outreach for primary care doctors and nurses on how to use the PACK guide, using clinical case scenarios.
Outcomes	COPD score: at 12 months COPD score: start or change treatment; at 12 months COPD score: spirometry; at 12 months New COPD diagnoses; at 12 months
Notes	***Trial registry:*** NCT02786030 ***Funding source:*** none declared

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Randomisation using a computer randomisation program (nQuery advisor).
Allocation concealment (selection bias)	Low risk	*"To make sure that there is no bias in the group allocation of participants, PHCCs will be selected first before randomisation of clusters takes place."*
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Outcomes were extracted from routine electronic medical records. (Unclear who extracted and whether they were blinded).
Incomplete outcome data (attrition bias)	Low risk	Those who completed follow-up were the study group as per methods. No attrition.

Bachmann 2019 *(Continued)*
All outcomes

Selective reporting (reporting bias)	Low risk	Results appear to match trial registry and protocol.
Baseline outcome measurements similar	Low risk	Baseline 2 outcomes appear similar between groups (no P values). Baseline 1 not comparable, but authors state there was contamination from the intervention in baseline 1. Although there were some differences in asthma and COPD scores between intervention and control, it was adjusted in the analysis.
Baseline characteristics similar	Low risk	Baseline 2 characteristics, presented in Table 1, appear similar although there are no P values.
Protect against contamination	Low risk	Randomisation was by practices - unlikely that control practices would have received the intervention. Unclear if staff worked across multiple clinics (not mentioned).

Boulet 2013

Study characteristics	
Methods	***Aim of study:*** to explore the effectiveness of a multifaceted KT strategy in improving concordance with COPD and asthma guidelines among primary care physicians (PCPs) in Canada ***Study design:*** 2-arm, parallel, randomised controlled trial ***Geographic location:*** Quebec, Canada ***Study setting:*** Canadian primary care ***Number of study sites:*** 25 recruited mentor sites ***Number of study arms:*** 4 (only 2 study arms relevant) ***Study start date:*** September 2009 (mentor and mentee recruitment) ***Study end date:*** March 2010 (study aborted)
Participants	***Type of participants:*** primary care providers, patients ***Recruitment method:*** all physician recruitment performed with help of an independent contract research organisation (CRO) Respirologist (mentor) recruitment: PIs sent letter to candidates explaining study goals along with mentor roles and remuneration (CAD1500 for each of sessions 1 and 2, CAD300 for session 3), estimated time requirements (7 hours for educational sessions plus any additional mentoring time), and contact info for more information. Non-responders were recontacted. Candidates would accept or decline study participation via reply email to the CRO. PCP recruitment: various candidates identified from list purchased from a private company. Postal code matching postal codes of mentor practice addresses randomly identified potential PCPs practising within a 1-hour drive from each location. Recruitment methods included faxing letters and completing online screening questionnaires, mentors approaching PCPs with customised letters/email templates and verbal discussion guides, advertisement in Canadian Thoracic Society newsletter, email invitation to CTS members list Patient participant: enrolled PCPs would recruit 15 consecutive clinic patients at the 2 participant recruitment phases, regardless of reason for clinical visit ***Inclusion criteria:*** **Mentors (respirologists)**: convenience sample identified by PIs, practising respirologist with interest in CME who were not involved in respiratory guidelines development

Boulet 2013 *(Continued)*

	PCPs: managed at least 15 patients with asthma and 15 patients with COPD per month in an office setting; agreed to designate an appropriately trained person at his/her site to identify eligible study patients, collect consent and provide a questionnaire to patients **Patients**: spoke French or English, had diagnosis of asthma or COPD (per PCP) Asthma patients: between 18 and 45 years COPD patients: between 40 and 75 years of age with smoking history of > 10 pack-years ***Exclusion criteria:*** **PCPs:** had presented at a CME event on asthma or COPD in the past year; had completed any speciality training in respiratory diseases or practised primarily at walk-in clinics, with children or in emergency departments **Patients:** had any condition that could interfere with study measurements (per PCP); had any known respiratory disorders other than asthma or COPD; participating in another clinical trial ***Number of participants:*** 92 PCPs
Interventions	***Targeted intervention strategy (TIS) - intervention:*** PCPs received interactive educational interventions; expert mentorship and practice-based tools Interactive educational sessions: 3 x interactive sessions (2 x 3-hour live meetings at Week 16 and 24, 1 x 1-hour teleconference at Week 28) Expert mentorship: each PCP assigned to a specialist mentor and each mentor led a group of 4 to 6 PCPs (a 'quality circle'). Members of quality circle participated in interactive sessions together and could communicate with each other between sessions if they wished. Practice-based tools: copies of most recent Canadian asthma and COPD guidelines, list of useful websites and local resources for healthcare professionals and patients (e.g. referral forms for local pulmonary rehabilitation programmes, smoking cessation programmes and pulmonary function labs), copies of existing action plans for asthma and COPD, office reminder tools and existing practice-based algorithms ***Standard practice group (SP) - control:*** Copy of the latest Canadian asthma and COPD guidelines mailed out to all PCPs in the standard practice (SP) group at the start of the study period. No other intervention offered (intervention offered at end of trial).
Outcomes	***Outcome:*** (planned, but study aborted so no results available for any outcomes) Change in percentage of patients appropriately assessed, patient-reported physician conformity to (COPD specifically): assessment of breathlessness threshold, defined as ascertainment of at least 2 of the following 4 states: at rest, walking, with exercise and with any other type of activity, spirometry performance, inhaler technique review, exacerbation screening, long-acting bronchodilator prescription when indicated, smoking cessation efforts in smokers. ***Time point:*** 12 months
Notes	***Trial registry:*** NCT01766544 ***Funding source:*** conducted with the Canadian Thoracic Society, supported by GlaxoSmithKline Canada

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Stratified physician randomisation would randomly assign 75% of PCPs to the TIS group and 25% to the SP group - not well described.

Boulet 2013 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	Not described.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Due to nature of study, physicians would know which group he/she was in.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Study aborted.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Study aborted.
Selective reporting (reporting bias)	Unclear risk	Study aborted.
Baseline outcome measurements similar	Unclear risk	Study aborted.
Baseline characteristics similar	Unclear risk	Not enough information provided about the 92 recruited physicians.
Protect against contamination	Unclear risk	Not enough information to know this. Physicians could have been in same practice. Physician recruited 15 consecutive clinic patients (not sure if patients could have been seeing a different physician in a different group).
Other bias	Unclear risk	Study aborted - possibly influencing how much information on study processes were provided in the paper.

Bunker 2009

Study characteristics	
Methods	***Aim/hypotheses:*** to assess the effectiveness, feasibility and acceptability of COPD case finding by practice nurses performing spirometry on patients identified as being at risk of developing COPD ***Study design:*** randomised controlled trial ***Geographic location:*** Sydney, Australia ***Study setting:*** general practices in southwest Sydney (New South Wales) ***Number of study sites:*** 4 GP practices ***Number of arms/groups:*** 2 ***Unit of allocation:*** participant randomisation ***Study start date:*** unknown ***Study end date:*** unknown
Participants	***Types of participants:*** GP practice and patients

Bunker 2009 *(Continued)*

	Recruitment method: practice nurses searched computerised medical records to identify random sample of approximately 1010 patients who met the criteria before being screened to identify eligible patients for randomisation ***Inclusion criteria:*** Practices: had computerised medical records, a spirometer and employed a practice nurse Participants: 40 to 80 years of age who were current or ex-smokers ***Exclusion criteria:*** Participants: • cognitive impairment • cannot speak English • no longer active patients (less than 2 visits in the preceding year) • an established diagnosis of COPD ***Number of participants:*** 4 GP practices 808 patients eligible for inclusion
Interventions	***CF appointment invitation - intervention:*** Workshops for PNs and GPs participating in study. Patients attended case finding appointment with PN and spirometry was performed. PNs interpreted spirometry based on algorithm and made diagnosis of COPD based on this and advised those diagnosed with COPD to attend their GP for further assessment and management. Brief smoking cessation intervention for all patients (offer of referral for current smokers, and reinforcement of the behaviours of non-smokers). ***Usual care - control:*** No CF appointment invitation, just searched medical records to determine new diagnosis of COPD
Outcomes	***Outcome measure:*** change in number of new COPD diagnoses using spirometry ***Time point:*** baseline
Notes	***Trial registry:*** not specified ***Funding source:*** supported by a Faculty Research Grant from the Faculty of Medicine, University of New South Wales

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not specified in paper - just says *"eligible subjects were randomised to receive either an invitation to attend a case finding appointment with the practice nurse, or usual care."*
Allocation concealment (selection bias)	Unclear risk	Unknown - unit of allocation was not practices but participants, and there was no mention of the method.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Due to nature of the intervention, it was not possible to conceal the intervention for PNs/GPs and participants.
Blinding of outcome assessment (detection bias)	High risk	Not applicable - outcomes were determined by PNs and GPs.

Bunker 2009 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) All outcomes	Low risk	Non-response to invitation was addressed in manuscript.
Selective reporting (reporting bias)	Unclear risk	No outcomes were specified in the methods section.
Baseline outcome measurements similar	Low risk	Baseline prevalence of COPD was zero in both groups (based on their exclusion criteria of those with an existing diagnosis of COPD).
Baseline characteristics similar	High risk	There is no comparison of baseline characteristics of full intervention vs usual care group; Table 1 only has differences between COPD and no COPD in the intervention group.
Protect against contamination	Unclear risk	It is unlikely that usual care patients received a case-finding appointment invitation, however it is not clear whether PNs and GPs trained were managing patients in both intervention and control groups.

Coultas 2005

Study characteristics	
Methods	***Aim of study:*** to investigate the effectiveness of increasing access to selected components of pulmonary rehabilitation by providing nurse-assisted home care that was composed of patient education, efforts to improve patients' self-management skills and enhanced follow-up ***Study design:*** RCT ***Geographic location:*** USA ***Study setting:*** primary care clinics associated with an urban academic health system ***Number of study sites:*** 17 ***Number of arms/groups:*** 3 ***Unit of allocation:*** participant randomisation ***Study start date:*** September 2000 ***Study end date:*** unknown
Participants	***Type of participants:*** patients ***Recruitment method*:** patients were selected from an electronic claims database and were sent a letter informing them of the study with an invitation to participate; interested persons were asked to answer brief screening questions to determine their eligibility ***Inclusion criteria:*** Patients: ≥ 45 years of age with a physician diagnosis of COPD, and had a ≥ 20-pack-year smoking history, had experienced at least one respiratory symptom (cough, SOB, or wheeze) during the past 12 months, and had airflow obstruction (i.e. FEV_1/FVC ratio, < 70%; FEV_1, < 80%) ***Number of participants:*** 72 intervention 1, 72 intervention 2, 73 usual care
Interventions	***Nurse-assisted medical management (MM) - intervention 1*:** 8-hour training in standardised MM using the GOLD guidelines (2 x 4-hour sessions that included a 3.5-hour lecture and 4.5-hour PBL using 6 case

Coultas 2005 *(Continued)*

	scenarios that re-enforced lecture content) - overall goal of MM intervention was to enhance patient knowledge about COPD, their symptoms and optimal MM ***Nurse-assisted collaborative management (CM) - intervention 2:*** 8-hour training in standardised MM using the GOLD guidelines (2 x 4-hour sessions that included 3.5-hour lecture and 4.5-hour PBL using 6 case scenarios that re-enforced lecture content). 8-hour additional training in 'collaborative care', which is patient-centred and intended to facilitate the adoption of healthy behaviours, including lifestyle and self-management skills. 1.5-hour lectures and 6.5-hour interactive sessions ***Usual care/control*** - 2 educational booklets from the American Lung Association that were relevant to COPD and advised them to follow physician and/or pulmonary physician recommendations
Outcomes	***Outcome measure:*** change in SGRQ total score; change in SGRQ symptoms score; change in SGRQ activity score; change in SGRQ impacts score; change in SF-36 physical functioning; change in SF-36 role physical; change in SF-36 pain; change in SF-36 general health; change in SF-36 vitality; change in SF-36 social functioning; change in SF-36 role emotional; change in SF-36 mental health; change in self-reported healthcare utilisation for lung disease in past 6 months - doctor visits; change in self-reported healthcare utilisation for lung disease in past 6 months - ED visits; change in self-reported healthcare utilisation for lung disease in past 6 months - hospital visits ***Time point:*** 6 months
Notes	***Trial registry:*** none specified ***Funding source:*** Robert Wood Johnson Foundation grant

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"Patients were randomly assigned to one of three intervention groups….using a computer-generated random list".*
Allocation concealment (selection bias)	Low risk	Used a computer-generated list.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Nature of intervention meant it could not be blinded from patients or providers.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	*"Health outcomes in the intervention groups were assessed at baseline and after the 6-month intervention by two different trained interviewers who were not involved in the interventions and were blinded to group assignments."*
Incomplete outcome data (attrition bias) All outcomes	High risk	*"Overall, the demographic characteristics of the patients who dropped out of the study were similar to those who completed the study (data not shown). However, patients who dropped out of the study had more severe airflow obstruction, higher levels of distress, and lower quality of life, as measured with the SGRQ, compared with patients who had completed the study (data not shown)."*
Selective reporting (reporting bias)	Low risk	All outcomes mentioned in the methods section were reported.
Baseline outcome measurements similar	Unclear risk	There are no baseline outcomes presented for the full number of participants randomised - only those that completed both the 6-month intervention and follow-up.

Coultas 2005 *(Continued)*

Baseline characteristics similar	Unclear risk	There are no baseline characteristics presented for the full number of participants randomised.
Protect against contamination	Unclear risk	Unclear randomisation unit patients so potential for contamination.

Cvetkovski 2020

Study characteristics	
Methods	***Aim of study:*** 1) to determine the level of training required for GPs to master and maintain correct IT when using 2 different dry powder inhalers that can be substituted in clinical practice and 2) to determine the number and types of errors made by GPs on each device and inhaler device preference at each training visit ***Study design:*** randomised, parallel-group, cross-over ***Geographic location:*** Australia ***Study setting:*** primary care (GPs) ***Number of study sites:*** 228 (GPs) ***Number of arms/groups:*** 2 ***Unit of allocation:*** GP ***Study start date:*** August 2018 ***Study end date:*** May 2019
Participants	***Type of participants:*** GPs ***Recruitment method:*** the sampling frame was GPs who are registered and currently practising as general medical practitioners in NSW. PHNs within the Sydney metropolitan region were approached to facilitate with distribution of recruitment material. Flyers and advertisements were placed in newsletters and at GP educational events. Snowball recruiting was also encouraged. GPs who were interested in participating were asked to contact the research team via telephone, fax or email and a researcher then scheduled an appointment to screen for eligibility, complete enrolment and conduct the study. ***Inclusion criteria:*** registered, practising GP in the state of NSW, Australia; willing and able to comply with the study protocol for the duration of the study and provided verbal informed consent ***Exclusion criteria:*** if they had asthma or COPD or used an inhaler themselves ***Number of participants:*** 228 (111 intervention 1; 117 intervention 2) ***Age:*** intervention 1 mean: 45.4 (SD 12.7); intervention 2 mean: 45.8 (SD 12.8)
Interventions	***Intervention 1:*** *training with a Spiromax placebo device first* ***Intervention 2:*** *training with a Turbuhaler placebo device first* At visit 1, participants (GPs) were randomly assigned to either Spiromax, training followed by Turbuhaler training or Turbuhaler training followed by Spiromax training, in a cross-over stage design. Training consisted of 5 consecutive steps until device mastery was achieved. At visit 2, which commenced 4 ± 1 week after visit 1, participants undertook the same training procedure A total of 6 levels of assessment and 5 of training were implemented: level 1, intuitive use (no training); level 2, following use of written instruction; level 3, following viewing of instructional video; level 4, ex-

Cvetkovski 2020 *(Continued)*

	pert tuition from the researcher; level 5/level 6, repeats of expert tuition from the researcher when required.
Outcomes	Device mastery at visit 1, level 1; visit 1, level 2; visit 1, level 3 Maintaining device mastery at visit 2, level 1; visit 2, level 2; visit 2, level 3
Notes	***Trial registry:*** ACTRN12618001478202 ***Funding source:*** sponsored by TEVA Pty Ltd

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Participants were randomly assigned - not clear how.
Allocation concealment (selection bias)	Unclear risk	Not clear.
Blinding of participants and personnel (performance bias) All outcomes	High risk	*"Unblinded"* - Impossible to conceal as GPs would know the inhaler they are asked to demonstrate.
Blinding of outcome assessment (detection bias) All outcomes	High risk	*"Unblinded"* - impossible to conceal as outcome assessors would know what inhaler is being assessed.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Dropout 22%, characteristics/reasons not discussed. The effect of attrition on outcomes is unclear.
Selective reporting (reporting bias)	Low risk	Outcomes appear to be reported as per protocol and ANZCTR.
Baseline outcome measurements similar	Low risk	Baseline intuitive use (no training) similar across groups.
Baseline characteristics similar	Unclear risk	Age, gender similar. More participants in the Spiromax group had received training on Spiromax previously.
Protect against contamination	Unclear risk	Cross-over design.

Due 2014

Study characteristics

Methods	***Aim of study:*** to examine the effectiveness of a semi-tailored, facilitator-based intervention developed by the Capital Region of Denmark to support the implementation in general practice of DMPs for chronic obstructive pulmonary disease (COPD) and type 2 diabetes (DM2) ***Study design:*** stepped-wedge randomised controlled trial ***Geographic location:*** Denmark

Due 2014 *(Continued)*

	Study setting: general practices ***Number of study sites:*** 189 ***Number of arms/groups:*** 2 ***Unit of allocation:*** practice - stratified by practice type (solo or group practice) and geographical location; allocation ratio 1:1 ***Study start date:*** December 2010 ***Study end date:*** unknown
Participants	***Type of participants:*** practices ***Recruitment method:*** Facilitators: unknown method of recruitment GP clinics: information about facilitator visits were provided to all GPs in the Region via postal letters, news mails, professional meetings and advertisements on the Region's web pages. All practices were offered up to 3 facilitator visits of each 1 hour. ***Inclusion criteria:*** out of all 762 general practices in the Capital Region of Denmark, they consecutively included practices that signed up for facilitation visits and completed a baseline questionnaire from January 2011 until 189 practices were reached ***Exclusion criteria:*** practices in which a facilitator worked and practices that had participated in a pilot study ***Number of participants:*** 14 GP facilitators, 189 general practices
Interventions	Intervention (facilitator visits in 2011) Two phases: 1) facilitator education and development of a toolbox and 2) facilitator visits Delivered by trained facilitators - up to 3 x facilitator visits each of 1 hour duration Delayed intervention (facilitator visits in 2012) Same intervention but after completion of follow-up of first group
Outcomes	***Outcome measures:*** change in number of annual chronic disease check-ups per 100 patients affiliated with the practice (absolute % and also change in); reduction in the number of practices with less than 1% annual chronic disease check-ups; change in number of spirometry tests per 100 patients affiliated with the practice; change in number of annual check-ups for COPD; sign-up to the Sentinel Data Capture (a software program that automatically collects patient data from the GPs' electronic health record system); changes in the use of ICPC diagnosis coding for COPD; changes in the use of stratification of patients with DM2 and COPD. ***Time point:*** 12 months
Notes	***Trial registry:*** NCT01297075 ***Funding source:*** Danish Research Foundation for General Practice, Health Insurance Foundation, Research Foundation for Primary Care in the Capital Region of Denmark

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not specified in paper - just said *"eligible practices were stratified by practice type (solo or group practice) and geographical location by using SAS version 9.2"*

Due 2014 *(Continued)*

Allocation concealment (selection bias)	Low risk	Unit of allocation was general practices - *"allocation of practices was done by an external organisation (Danish College of General Practitioners) independently of the research group".*
Blinding of participants and personnel (performance bias) All outcomes	High risk	Due to the nature of the intervention, it was not possible to conceal the intervention for the practices and the facilitators.
Blinding of outcome assessment (detection bias) All outcomes	High risk	There is a mix of outcomes, which were self-reported by practices (via follow-up questionnaires) and those that were collected through registry data.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Six practices dropped out from the study, but *''there were no differences in practice characteristics or baseline measures between the analysed practices and those lost to follow-up".* Outcomes that relied on questionnaire data from practices could not be collected for all practices at follow-up - number missing similar in both groups.
Selective reporting (reporting bias)	High risk	Results seem to only show CHANGE in primary outcome. Whereas other secondary outcomes only report absolute numbers as at follow-up and no indication of the change.
Baseline outcome measurements similar	Low risk	Baseline characteristics and outcomes seem to be similar (no significant differences per P values).
Baseline characteristics similar	Low risk	Baseline characteristics and outcomes seem to be similar (no significant differences per P values).
Protect against contamination	High risk	*"In the delayed intervention group, 13 practices received visits during the intervention period, either because they were collaborating with practices in the intervention group or because they did not agree to delay their participation in the intervention."*

Fairall 2005

Study characteristics	
Methods	***Aim of study:*** to develop and implement an educational outreach programme for the integrated case management of priority respiratory disease (practical approach to lung health in South Africa; PALSA) and to evaluate its effects on respiratory care and detection of tuberculosis among adults attending primary care clinics ***Study design:*** pragmatic cRCT ***Geographic location:*** South Africa ***Study setting:*** primary care clinics staffed by nurse practitioners in the Free State province of South Africa ***Number of study sites:*** 40 ***Number of arms/groups:*** 2 ***Unit of allocation:*** primary care clinics - stratified and randomised ***Study start date:*** none specified

Fairall 2005 *(Continued)*

	Study end date: none specified
Participants	***Type of participants:*** clinics and patients ***Recruitment method:*** Clinics: 40 largest eligible primary care clinics based on total annual attendances Patients: trained fieldworker in each clinics' waiting room screened all adults patients (independent of nurse practitioners) for cough or difficult breathing on presentation or within the past 6 months ***Inclusion criteria:*** aged 15 or over with cough or difficult breathing (defined as having any of the following: difficult breathing on the day of interview or during the past 6 months; current cough for 7 days or more; recurrent cough in the past 6 months; and current cough with a temperature above 38 degrees Celsius or a respiratory rate of 30 breaths per minute or more ***Exclusion criteria:*** those patients who had been urgently referred elsewhere by their nurse practitioner ***Number of participants:*** 1999
Interventions	**Educational outreach programme (practical approach to lung health in South Africa) - intervention** Educational outreach sessions (non-commercial, short, face-to-face, in-service interactive education by a trusted outsider) to groups of primary care nurse practitioners delivered by trained nurse supervisors (trained by attending a 5-day workshop on the techniques of interactive educational outreach and the clinical content of guidelines, especially the key messages) 8 senior nurses delivered 3 or 4 educational outreach sessions, each lasting 1 to 3 hours to all clinical staff, in groups, in each of their intervention clinics over a 3-month period. Expanded prescribing provisions to nurse practitioners to include newly inhaled corticosteroids for asthma (with review by a physician within 1 month), short course oral corticosteroids for exacerbations of obstructive lung disease, cotrimoxazole prophylaxis for symptomatic HIV infection, and permitted to renew physician-initiated prescriptions. Colourful, illustrated support materials for outreach sessions: flip chart for nurse trainers and desk blotters (incorporating key message) for the nurse practitioners trained. Locally tailored, evidence-based, brief (22 pages) symptom and sign based guideline on common respiratory conditions in adults (TB, TB/HIV coinfection, respiratory tract infections and obstructive lung disease). An algorithmic guideline was developed; ensures local applicability and consistency with national TB policies and includes essential drugs lists. Usual off-site training, received by fewer than 5% of staff each year, continued in both groups. **No new training - control** No new training. Usual off-site training, received by fewer than 5% of staff each year, continued in both groups.
Outcomes	Prescriptions filled out for inhaled corticosteroids; rate of smoking cessation counselling; self-reported quitting smoking ***Time point:*** 4 months
Notes	***Trial registry:*** ISRCTN13438073 ***Funding source:*** International Development Research Centre, Canada grant; Medical Research Council, South Africa grant
Risk of bias	

Bias	**Authors' judgement**	**Support for judgement**

Fairall 2005 *(Continued)*

Random sequence generation (selection bias)	Low risk	*"Randomisation was stratified by district. Clinics were ranked by size and allocated to intervention or control arms using a random number table in blocks of four."*
Allocation concealment (selection bias)	Low risk	*"Allocation was carried out by a trial statistician before intervention or patient recruitment."*
Blinding of participants and personnel (performance bias) All outcomes	High risk	*"Patients and fieldworkers (responsible for recruiting in waiting rooms) were blind to the intervention status of each clinic. Nurse trainers and nurse practitioners allocated to the intervention arm could not be blinded."*
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Outcome measures were collected by *"… fieldworkers were blind to the intervention status of each clinic".* Prescription data were collected from patient records and dispensed drugs records. Smoking cessation outcomes were self-reported by patients who were blinded to allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing follow-up was similar across both groups.
Selective reporting (reporting bias)	Low risk	All outcomes mentioned in methods section have been reported.
Baseline outcome measurements similar	Unclear risk	No statistics on existing inhaled corticosteroid use in participants at baseline - should really be the change in inhaled corticosteroid prescription that should be reported.
Baseline characteristics similar	Low risk	Baseline characteristics of clinics and patients presented in Table 1 - seemingly similar (no P values reported).
Protect against contamination	Low risk	Allocation was by clinic - control group unlikely to receive intervention.

Fairall 2016

Study characteristics	
Methods	***Aim of study:*** to evaluate the effectiveness of the PC101 (Primary Care 101-page guideline) intervention, which combines provision of an integrated management tool with educational outreach to nurses. ***Study design:*** cRCT ***Geographic location:*** South Africa ***Study setting:*** public sector primary healthcare clinics ***Number of study sites:*** 33 ***Number of arms/groups:*** 2 ***Unit of allocation:*** clinics ***Study start date:*** March 2011

Fairall 2016 *(Continued)*

	Study end date: December 2012
Participants	***Type of participants:*** ***Recruitment method:*** trained fieldworkers invited patients 18 years or older in the waiting room to participate in the study after their clinical consultation, and provide them with an information sheet, allowing them time to consider and discuss possible participation. Interested patients were screened after consultation with the nurse/doctor, and in privacy, in an area of the clinic temporarily allocated to research staff. ***Inclusion criteria:*** age ≥ 18 years, planning to reside in the area for the next year and written consent to participate in the study and self-reported asthma/chronic bronchitis/emphysema on treatment or cough/difficult breathing > 2 weeks (and not on treatment for tuberculosis in the past 3 months) ***Exclusion criteria:*** acute and/or terminal condition precluding participation such as AIDS or cancer. Psychiatric diagnoses precluding participation such as schizophrenia, dementia and other cognitive impairment measured by self-reported or medical history. ***Number of participants:*** *(enrolled)* 586 intervention patients, 571 control patients; *(primary outcome analysed for) Intervention:* 19 clinics, 567 patients from 19 GPs vs *control:* 19 clinics, 555 patients from 19 GPs ***Patient age:*** median (IQR): 51 years (42 to 61) vs 53 (44 to 62) ***Withdrawal:*** 3.2% vs 2.8%
Interventions	***Intervention:*** PC101 intervention. Materials: the main intervention material was a 101-page evidence- and policy-informed algorithmic management tool. Based on PALSA PLUS, it was developed over a period of 5 years (2006 ± 2011) with input from specialist clinicians, primary care doctors and nurses, allied health professionals, managers and representatives of patient advocacy groups. **Training:** 6 health department nurse trainers with experience in primary care delivered 8 short (1.5-hour), on-site, interactive educational outreach sessions using the PC101 management tool and case scenarios to all clinical staff at intervention clinics over several weeks. In addition to on-site training, nurse trainers provided support to staff through regular visits during which they would discuss difficult cases, review folders of patients whose care nurses had changed using PC101, or jointly see patient. ***Control:*** usual care: no training, free service for communicable and NCDs. Patients are seen by a clinician, usually a nurse, and stable patients with NCDs are seen at intervals of 3 to 6 months, but are required to collect medications each month either from the clinic or from an off-site medication pick-up point
Outcomes	Treatment intensification, SGRQ symptoms, SGRQ activity, SGRQ, proportion who smoke, proportion who quit smoking, number of units smoked per day, readiness to quit smoking ***Time point:*** 14 months
Notes	***Trial registry:*** ISRCTN20283604 ***Funding source:*** the US NHLBI Contract No. HHSN268200900030C (http://www.nhlbi.nih.gov/); the UK Department for International Development; and the University of Cape Town Lung Institute, South Africa

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"Randomisation was completed by the trial statistician using nQuery Advisor after recruitment of clinics, independently of the managers giving permission for the clinics to be included in the trial, and prior to patient recruitment and implementation of the intervention."*

Fairall 2016 *(Continued)*

Allocation concealment (selection bias)	Low risk	*"Randomisation was completed by the trial statistician using nQuery Advisor after recruitment of clinics, independently of the managers giving permission for the clinics to be included in the trial, and prior to patient recruitment and implementation of the intervention."*
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of the intervention was not possible at the clinic level due to the nature of the intervention.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear - fieldworkers recruited from local communities were trained to collect the trial data.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Minimal withdrawal (3.2% intervention, 2.8% control).
Selective reporting (reporting bias)	Low risk	As per trial registry and methods.
Baseline outcome measurements similar	Low risk	Baseline patient characteristics were generally well balanced between arms.
Baseline characteristics similar	Low risk	Baseline patient characteristics were generally well balanced between arms.
Protect against contamination	Low risk	Cluster-randomised.

Freund 2016

Study characteristics	
Methods	***Aim of study:*** to determine whether a medical assistant-based scripted care management intervention (primary care-based care management PraCMan) would reduce hospitalisations in primary care patients with type 2 diabetes, COPD or CHF who had a high predicted risk for future hospitalisation. ***Study design:*** 2-year cluster-randomised clinical trial ***Geographic location:*** Germany ***Study setting:*** primary care practices in Germany ***Number of study sites:*** 115 primary care practices ***Number of arms/groups:*** 2 ***Unit of allocation:*** primary care practices ***Study start date:*** July 2010 ***Study end date:*** June 2013
Participants	***Type of participants:*** practices, PCPs, medical assistants ***Recruitment method:*** informed all 1177 primary care physicians within the health plan of AOK Baden-Wurttemberg about the study and invited all interested physicians to participate in the study

Freund 2016 *(Continued)*

	Inclusion criteria: Practices: employed at least 1 primary care physician (such as a GP or general internist) and at least 1 medical assistant and if both were willing to participate in the study Primary care physicians: had to be enrolled in the primary care-centred care contract of a large health plan in Germany (AOK BadenWurttemberg) Medical assistant: as defined in Germany as a health profession Patients: • aged 18 years or older and were receiving medical treatment for at least 1 of the following index conditions: type 2 DM, COPD, or CHF; and • had a high risk for future hospitalisation (i.e. a predicted likelihood of hospitalisation within the upper quartile of the total population of health plan patients, as determined by analysis of data from the preceding 18 months). ***Exclusion criteria:*** Patients: active cancer (cancer diagnosis and current receipt of radiotherapy or chemotherapy), moderate to severe dementia, permanent residency in a nursing home, participation in a concurrent clinical trial (including telemonitoring studies), severe physical and mental disorders (such as dementia, psychotic disorder or palliative care needs), or other problems that hindered active participation in the intervention (such as language barriers), as assessed by the primary care physician. ***Number of participants:*** 115 practices, 132 PCPs, 138 medical assistants
Interventions	**Care management (intervention)** Training of medical assistants - 2-day course using a training manual and 20 hours of self-study Primary care physicians and patients negotiated patient-specific goals, with a special emphasis on self-management tasks. Medical assistants developed specific action plans to achieve these goals together with patients and caregivers. A folder that included health information and an optional emergency plan was offered to all patients. Medical assistants monitored goal achievement and symptom deterioration either face-to-face with patients in the clinic or by telephone using paper-based checklists. Monitoring intervals were tailored to the patient's health status but were scheduled at least once every 6 weeks. Primary care physicians met with medical assistants weekly to review patient progress. We fixed the maximum caseload for medical assistants at 20 patients (in addition to their daily duties, such as reception and phlebotomy). **Usual care - control** Received best primary care according to evidence-based practice guidelines
Outcomes	***Outcome measure:*** number of COPD-related hospitalisations; number of COPD-related hospital days; number of all-cause hospitalisations; number of all-cause hospital days ***Time point:*** 12 and 24 months
Notes	*Trial registry:* ISRCTN56104508 *Funding source:* AOK Baden-Wurttemberg and AOK Bundesverband (but had no role in analysis, interpretation, or publication of the data)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"Block randomisation with variable block lengths to ensure study groups of approximately equal size".*

Freund 2016 *(Continued)*

		"Computer generated randomisation lists (SAS Version 9.2). Separate randomisation lists were prepared for urban and rural practices".
Allocation concealment (selection bias)	Low risk	*"Central randomisation was performed by a research assistant who was not involved in the project.''* *"We concealed the allocation to intervention or control groups until each practice completed patient enrollment and baseline assessment."*
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of either patients or practice teams was not possible due to the characteristics of the intervention.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	*"…observers will be blinded during data collection regarding primary and secondary endpoints."*
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Greater missing follow-up in intervention group. No information on the characteristics of those lost to follow-up vs those who were able to be followed up.
Selective reporting (reporting bias)	High risk	Outcomes reported in the protocol: PACIC, MARS, PHQ-9, self-management capabilities, RAPA, ADL/IADL, mortality, healthcare utilisation, total healthcare costs and those in Table 1 of protocol paper: do not seem to have been reported in the results paper - could be in subsequent papers?
Baseline outcome measurements similar	Low risk	Baseline mean all-cause hospitalisations similar across groups.
Baseline characteristics similar	Unclear risk	*"Slightly higher proportion of patients with COPD in the intervention group and a higher proportion from ethnic minorities in the usual care group. More patients enrolled in the care management group due to a higher number of group practices (each with up to 2 teams recruiting patients) in that group".*
Protect against contamination	Low risk	Allocation was by practices and usual care group unlikely to have received the intervention.
Other bias	Low risk	Bias associated with incentives? *"We financially incentivized intervention practice teams by providing $135 per enrolled patient per year to cover staff costs."*

Gruffydd-Jones 2013

Study characteristics	
Methods	***Aim of study:*** to investigate the impact of the CAT on the quality of primary care consultations in COPD patients ***Study design:*** single-visit randomised (1:1) open parallel-group study ***Geographic location:*** Europe (Austria, France, Germany, Ireland, UK) ***Study setting:*** simulated standardised primary care setting ***Number of study sites:*** 2 or 4 geographically spread locations in each country, depending on number of physicians required ***Number of arms/groups:*** 2

Gruffydd-Jones 2013 *(Continued)*

	Unit of allocation: primary care physicians ***Study start date:*** October 2010 ***Study end date:*** not specified
Participants	***Type of participants:*** primary care physicians ***Recruitment method:*** primary care physicians identified across 5 countries (UK, Ireland, France, Germany and Austria) and contacted by local market research agency and screened by telephone interview. Questions were asked across various disease and patient-reported outcome measures so physicians could not tell the study was about CAT and COPD. ***Inclusion criteria:*** primary care physicians: reported experience of managing COPD patients (at least 3), but not of using the CAT ***Exclusion criteria:*** none specified ***Number of participants:*** 165 recruited physicians
Interventions	**CAT+ arm** Reading material on topics and encouraged to discuss the information between them. 1. Received brief training on COPD 2. Received brief training on the CAT - 15 minutes of background information, how to interpret overall scores, and how to identify specific areas of concern for the patient, no specific guidelines were provided on actions to take based on the CAT score) **CAT- arm** Reading material on topics and encouraged to discuss the information between them. 1. Received brief training on COPD
Outcomes	**Outcome measure:** global score (total of sub-score A and B) (adjusted); ability to identify and address patient issues (sub-score A); review of standard COPD aspects (sub-score B). ***Time point:*** after training
Notes	*Trial registry:* none specified *Funding source:* GSK

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	*"A 2-level hierarchical design was used, with a randomisation block size of two, without stratification, such that one group was randomised to each arm at each location."*
Allocation concealment (selection bias)	Unclear risk	The recruiters were blinded to the randomisation.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Blinding of physician was not possible as they needed to conduct the interview with or without the CAT questionnaire.

Gruffydd-Jones 2013 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	High risk	Assessors presumably will be unblinded based on observations of the recorded consultations - it will be evident if physician has used the CAT questionnaire during consultation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All excluded patients and excluded consultation videos were accounted for and similar across both groups.
Selective reporting (reporting bias)	Low risk	All specified outcomes are seemingly reported in the results.
Baseline outcome measurements similar	Low risk	*"The evaluable physicians represent a broad range of experiences, with no major differences between the arms."*
Baseline characteristics similar	Low risk	*"The evaluable physicians represent a broad range of experiences, with no major differences between the arms."*
Protect against contamination	Low risk	Allocation was by groups of physicians. Highly unlikely that there could be contamination resulting from this.

Hilberink 2011

Study characteristics	
Methods	***Aim of study:*** to evaluate 2 counselling programmes in general practice to help smokers with COPD to quit smoking ***Study design:*** cRCT ***Geographic location:*** Netherlands ***Study setting:*** GP practice ***Number of study sites:*** 74 randomised, 68 baseline data ***Number of arms/groups:*** 3 (2 intervention, 1 control) ***Unit of allocation:*** practice (cluster) ***Study start date:*** intervention started 2001 ***Study end date:*** intervention ended 2002
Participants	***Type of participants:*** GPs, patients ***Recruitment method:*** a convenience sample was recruited in 9 Dutch districts from general practices using one of 4 widely used general practice electronic record systems. The general practitioners (GPs) had to confirm the diagnosis before inviting patients to participate. ***Inclusion criteria:*** patients: age 35 years or more, diagnosis recorded as COPD (or relevant ICPC code), and at least 3 prescriptions of bronchodilators and/or anti-inflammatory medication in the preceding year. ***Exclusion criteria:*** nil specified ***Number of participants:*** 21 practices (252 patients) vs 25 practices (291 patients) vs 22 practices (154 patients) ***Patient age:*** mean (SD): 58.0 (12.2) vs 60.7 (11.2) vs 60.1 (11.5)

Hilberink 2011 *(Continued)*

	Withdrawal: 3.5% vs 5.2% vs 3.8%
Interventions	**Intervention 1: counselling strategy + NRT (CN):** the general practice team received a 4-hour group training session about COPD and smoking cessation. An outreach visitor provided additional individual support at the practice location (3 visits). The patient education tools consisted of a leaflet especially developed for COPD smokers and a videotape. The first visit to the GP took place within 1 month after baseline measurement. Aspect of intervention for the different motivational stages (Preapres, contemplators, Precontemplators): the first appointment, leaflet and videotape, self-efficacy enhancing information, information about NRT, new appointment in 2 weeks, planned quit day and follow-up visits, proactive telephone calls **Intervention 2: counselling strategy + NRT + buproprion-SR (CNB):** patients in the CNB program were also advised to use bupropion-SR (in addition to CN intervention). The patients paid for the pharmacological aids themselves. **Control: usual care of smoking cessation (UC):** usual care
Outcomes	***Outcomes:*** self-reported smoking cessation rates, biochemically verified smoking cessation rates using urine sample ***Time point:*** 12 months
Notes	***Trial registry:*** N/A ***Funding source:*** 2005 and 2006 papers: financed by the Dutch Asthma Association, Netherlands Organisation for Health Research and Development (ZonMW), Pharmacia, and Glaxo SmithKline 2011 paper: nil mentioned

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No details on how practices were randomised.
Allocation concealment (selection bias)	Unclear risk	No details. Randomisation did occur before patient identification procedure.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Self-reported smoking cessation and patients were not blinded. Biochemical analysis of urine would be less likely to be biased by no blinding.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Six clinics dropped out before baseline (3 in control). Minimal drop out post baseline, but *"dropout was associated with being assigned to the CNB program, and, at baseline, little motivation to quit and less positive attitude towards quitting (Chi2 = 23.0, df = 5, p < 0.001, and R2 = 0.06)."*
Selective reporting (reporting bias)	Low risk	Reported as per methods.

Hilberink 2011 *(Continued)*

Baseline outcome measurements similar	Low risk	All smoking with similar numbers of cigarettes/day and similar nicotine dependence.
Baseline characteristics similar	Low risk	Mostly balanced. Mean age in CN programme lower than in CNB programme (P = 0.028).
Protect against contamination	Low risk	Cluster-randomised at practice level.

Hurlimann 2015

Study characteristics	
Methods	***Aim of study:*** to perform a cluster-randomised intervention study to analyse the influence of detailed antibiotic prescription guidelines on prescription behaviour, i.e. to simultaneously reduce antibiotic prescription rates and modify the antibiotics used in the 2 most important infections (upper RTIs and uncomplicated lower UTIs) ***Study design:*** open, prospective, cluster-RCT ***Geographic location:*** Switzerland ***Study setting:*** Swiss general practices ***Number of study sites:*** 140 ***Number of arms/groups:*** 2 ***Unit of allocation:*** primary care physicians ***Study start date:*** not specified ***Study end date:*** not specified
Participants	***Type of participants:*** sentinel members ***Recruitment method:*** all registered sentinel members of the Swiss Sentinel Surveillance Network as of May 2010 were evaluated for participation in this study ***Inclusion criteria:*** members of the Swiss Sentinel Surveillance Network (covering 3.1% of all Swiss practitioners) ***Exclusion criteria:*** • Members of the programme committee • Non-regularly reporting members, defined as members not reporting at least 1 physician-patient contact in at least 75% of the weeks from August 2009 to July 2010 ***Number of participants:*** 140 clinics randomised, 136 analysed (69 intervention, 67 control) Patients: 15,625 intervention, 13,327 control
Interventions	**Intervention:** primary care physicians were provided guidelines on treatment of respiratory tract infections and uncomplicated lower urinary tract infections, coupled with sustained, regular feedback on individual antibiotic prescription behaviour during 2 years. Guidelines included indications for antibiotic use as well as information on the preferred antibiotic regimen. The main focus of the guidelines was to restrict prescriptions to bacterial infections and to preferentially prescribe narrow-spectrum antibiotics (namely penicillins for respiratory tract infections).

Hurlimann 2015 *(Continued)*

	Control: usual care
Outcomes	***Outcome measure:*** percentage of prescriptions of penicillin for all treated RTIs; percentage of trimethoprim/sulfamethoxazole prescriptions for uncomplicated lower UTIs over all uncomplicated lower UTIs in adults treated with antibiotics; percentage of quinolones for COPD exacerbation in adults; percentage of antibiotic prescriptions for sinusitis and other upper RTIs over all diagnosed sinusitis and other upper RTIs ***Time point:*** 24 months
Notes	***Trial registry:*** NCT01358916 ***Funding source:*** Swiss Centre for Antibiotic Resistance (www.anresis.ch)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	*"Stratified randomisation was performed to randomly allocate the practices to the intervention or control arm in a 1:1 ratio."* Unclear as it did not actually specify the method of random sequence generation.
Allocation concealment (selection bias)	Unclear risk	Did not specify how allocation was concealed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Practices were not blinded to allocation.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	*"At the end of the study all data were delivered by the Swiss Federal Office of Public Health to the Clinical Trials Unit Bern, University of Bern, in Excel form"* - did not use research assistants to collect data.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All excluded practices and ineligible prescriptions were clearly stated.
Selective reporting (reporting bias)	Low risk	All specified outcomes are seemingly reported in the results.
Baseline outcome measurements similar	Unclear risk	Did not specify what the prescription rates were at baseline.
Baseline characteristics similar	Low risk	Baseline characteristics presented in Table 1 of the paper. There were minor differences between control and intervention groups.
Protect against contamination	Low risk	Allocation was by practices. It is not stated whether practitioners worked across practices or not.

Khan 2019

Study characteristics

Khan 2019 *(Continued)*

Methods	***Aim of study:*** to assess whether enhanced care at public health facilities resulted in better control of COPD, treatment adherence and smoking cessation ***Study design:*** cluster-RCT ***Geographic location:*** Pakistan ***Study setting:*** public health facilities (23 primary, 7 secondary) ***Number of study sites:*** 30 ***Number of arms/groups:*** 2 ***Unit of allocation:*** facility (cluster) ***Study start date:*** October 2014 ***Study end date:*** December 2016
Participants	***Type of participants:*** patients ***Recruitment method:*** Sites: in consultation with the 3 district health offices, all 32 rural health centres and 9 sub-district hospitals were listed, assessed and found eligible to participate on the basis of being functional (that is, having basic clinical and laboratory services in place). From the list of 41 eligible facilities, the required number of facilities (n = 30) were selected randomly. Patients: all the patients attending trial facilities who met the criteria and consented to participate were recruited into the trial between 18 July 2015 and 10 March 2016. ***Inclusion criteria:*** Sites: in consultation with the 3 district health offices, all 32 rural health centres and 9 sub-district hospitals were listed, assessed and found eligible to participate on the basis of being functional (that is, having basic clinical and laboratory services in place). Patients: eligible if they were newly diagnosed with COPD and this was based on the guidelines of the GOLD, which are as follows: aged 18 years old, and currently residing (and expected to continue residing for the next 12 months) in the catchment area of the respective health facility. ***Exclusion criteria:*** nil ***Number of participants:*** 30 public health facilities (23 primary and 7 secondary) 159 intervention and 154 control patients
Interventions	**Intervention: integrated COPD management care (case management desk guide and counselling tools)** The intervention arm facilities were provided with contextualised care protocols and tools, 2-day training of doctors and allied staff on full set of care tasks, and materials including inhalers and mobile phones. Strengthened to diagnose and manage asthma and COPD patients mainly includes availability of context-sensitive guidelines and materials for case management; health staff trained on operational guidelines and materials; supplement material support for managing asthma and COPD including patient education tools for asthma and COPD awareness and smoking cessation; standardised recording and reporting; enhanced facility monitoring; facilitated referral linkages with DHQ hospital; and better retrieval of patients with delayed follow-up visits. In both arms, the doctors and allied staff were enabled to screen (on the first visit) and diagnose patients with COPD. They could also maintain the chronic disease card for each patient (with a line to record clinical changes per attendance). Additionally, in the intervention arm, the facility staff were enabled to enhance COPD treatment and follow-up care.

Khan 2019 *(Continued)*

	Intervention arm facilities: • Case management desk guide and counselling tool • Full care tasks: screen on the first visit, diagnose and maintain patient records; use provided desk guide on how to prescribe, educate, follow-up and retrieve patients • Peak flow meter, recording tools; also salbutamol and ipratropium inhalers, mobile reminders for patient retrieval **Control: traditional approach in COPD Continuing Medical Education (CME) course for GPs** Routine care for asthma and COPD case management at facilities and introduction of standard diagnosis and recording practices for asthma/COPD patients attending these control facilities and continued provision of essential drugs (i.e. routine care) Control arm facilities: • None • Limited care tasks: screen on the first visit, diagnose and maintain patient records only • Peak flow meter and recording tools only
Outcomes	BODE index score; COPD control; quit rate among smokers; follow-up adherence (≥ 3 of 5 required) ***Time point:*** 6 months
Notes	***Trial registry:*** ISRCTN17409338 ***Funding source:*** COMDIS-HSD, a research consortium funded by UK aid from the UK government (reference number: COMDIS-HSD RGNUID 480650)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Lottery method: *"The selection and randomisation of facilities into intervention and control arms (in a 1:1 ratio) was done at the central trial unit of the Association for Social Development, and was monitored by the trial steering committee. The selection of the 30 trial facilities was carried out by listing all 41 eligible facilities in sealed opaque envelopes before shuffling and randomly selecting 30 of them."*
Allocation concealment (selection bias)	Low risk	Sealed, opaque envelopes and randomisation at the central trial unit presumably before the intervention began.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded - it was not possible to blind individual patients or healthcare providers.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Outcome assessors were not blinded, but data analyst was blinded to the treatment allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	The patient loss to follow-up rate was modest and similar in both arms.
Selective reporting (reporting bias)	Unclear risk	Main outcomes described in the protocol are reported in the outcome paper. Three secondary outcomes were added post-protocol.

Khan 2019 *(Continued)*

Baseline outcome measurements similar	Low risk	The baseline characteristics of individuals in both arms appeared to be well balanced.
Baseline characteristics similar	Low risk	The baseline characteristics of individuals in both arms appeared to be well balanced.
Protect against contamination	Low risk	Clusters geographically separate.

Kruis 2014

Study characteristics	
Methods	***Aim of study:*** to assess whether integrated disease management implemented in primary care is effective in improving the quality of life of COPD patients. To investigate the long-term effectiveness of integrated disease management delivered in primary care on quality of life in patients with COPD compared with usual care. ***Study design:*** 24-month, multicentre, pragmatic cRCT ***Geographic location:*** Netherlands ***Study setting:*** general practices ***Number of study sites:*** 40 ***Number of arms/groups:*** 2 ***Unit of allocation:*** practices ***Study start date:*** practice recruitment started September 2010 to September 2011 ***Study end date:*** not specified
Participants	***Type of participants:*** GP practices, patients ***Recruitment method:*** Practices: study was embedded in the Leiden Primary Care Research Network (LEON), which is managed by the department of Public Health and Primary Care of the Leiden University Medical Center. This network consists of some 100 GP practices in the western region of the Netherlands, in which these practices signed an agreement to collaborate in scientific research. Participants: patient were selected from electronic medical records of general practices. Attempted to verify COPD diagnosis by lung function according to GOLD, if spirometry data were not available then lung function testing was performed. ***Inclusion criteria:*** Practices: they were willing to create an integrated COPD management team, in which each member has responsibility for their respective areas of expertise. Practices had to include at least 1 GP, 1 practice or extramural respiratory nurse, and 1 physio specialised in COPD care. Participants: all patients who were diagnosed with COPD by their treating physician. ***Exclusion criteria:*** participants: terminally ill patients, dementia or cognitive impairment, inability to fill in Dutch questionnaires and hard drug/alcohol abusers ***Number of participants:*** total GP practices: 40; patients: 1086
Interventions	**Integrated Disease Management (IDM):** 2-day training course on incorporating integrated disease management in practice delivered to GPs, practices nurses and specialised physiotherapists (dietician

Kruis 2014 *(Continued)*

	or pulmonary specialist could attend if expressed interest). Development of a specific time contingent plan in group discussion with their multidisciplinary members with feedback from experts guiding the training. Implementation of IDM programme: by multidisciplinary team in general practice (at least 3 members; GP, practice nurse, co-operating physio with specific certified training in COPD care) Refresher course: after 6 and 12 months Feedback: teams received practice-tailored benchmark reports at baseline and at 6 and 12 months. **Usual care:** *a*sked to continue their usual care, based on Dutch general practice COPD guidelines, in line with GOLD guidelines. PNs received course on technical performance of spirometry only, to divert attention from topics related to the intervention.
Outcomes	***Outcome measure:*** change in health-related quality of life on the Clinical COPD Questionnaire (CCQ); change in health-related quality of life on EQ-5D-3L VAS score; change in health-related quality of life on SGRQ score; change in health-related quality of life on SF-36 questionnaire (physical component); change in health-related quality of life on SF-36 questionnaire (mental component); change in proportion of current smokers; change in rate of moderate exacerbations; change in rate of severe exacerbations; change in PACIC, MRC, SMAS, IPAQ, hospital admission days. ***Time point:*** at 6, 9, 18, 12 and 24 months
Notes	***Trial registry:*** Netherlands Trial Register NTR2268 ***Funding source:*** independent research funded by the Netherlands Organisation for Health Research and Development (Zon-MW), sub-programme Effects and Costs (project number 171002203), and Stichting Achmea Gezondheidszorg, a Dutch Healthcare insurance company. Throughout the RECODE intervention period, physiotherapists in the intervention group received supplementary funding for providing a COPD specific exercise training programme in patients with MRC scores >2. This fund is provided by 2 local Dutch healthcare insurers: *"Centraal Ziekenfonds (CZ) Zorgverzekeringen"* and *"Zorg en Zekerheid."* All other components of the integrated disease management programme were financially covered by the patients' basic insurance scheme.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Blinded researcher stratified and matched participating clusters according to a set criteria. *"Following this procedures, the same blinded researcher randomised matched clusters in pairs by using a computer generated list in four blocks of 10"*
Allocation concealment (selection bias)	Low risk	Blinded researcher and computer-generated random number list.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Because of the nature of the intervention, participating healthcare providers and patients could not be blinded.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	*"Blinded research nurses assessed outcomes to minimise detection bias. Patients were instructed not to report on their type of management to these research nurses."*
Incomplete outcome data (attrition bias) All outcomes	High risk	*"Patients who dropped out at 24 months were signicantly older and had worse scores on the CCQ, EQ-5D, PACIC, SF-36, SGRQ, and MRC questionnaires at baseline".*
Selective reporting (reporting bias)	High risk	Some outcomes for 6-, -9 and 18-month time points (as stated in the protocol) have not been reported in the final paper.

Kruis 2014 *(Continued)*

Baseline outcome measurements similar	Low risk	Baseline outcome measurements of interest were similar across groups.
Baseline characteristics similar	Low risk	Baseline characteristics were similar (except for gender). Data fully presented in table. Results were adjusted for gender as well.
Protect against contamination	Low risk	Randomisation of clusters (practice teams).

Latzke-Davis 2011

Study characteristics	
Methods	***Aim of study:*** to examine whether exposure to the Spirometry Fundamentals CD-ROM results in improved quality of spirometry testing in primary care ***Study design:*** RCT ***Geographic location:*** USA ***Study setting:*** primary care practices ***Number of study sites:*** 51 ***Number of arms/groups:*** 2 ***Unit of allocation:*** practices ***Study start date:*** start of practice enrolment (March 2007) to end (March 2008) ***Study end date:*** not specified
Participants	***Type of participants:*** primary care practices, study subjects (i.e. per practice: a spirometry test interpreter - usually physician- and a spirometry coach - usually medical assistant or registered nurse) ***Recruitment method*:** use of various practice-based research networks across the USA and ndd ("new diagnostic designs") sales representatives or their customer warranty mailing list ***Inclusion criteria:*** eligible if any of the following were applicable: • those who purchased an EasyOne Diagnostic spirometer made by ndd during the previous year (March 2006 to March 2007) • those who purchased an EasyOne Diagnostic spirometer between March 2007 and March 2008 • those who belonged to one of 2 practice-based research networks and decided to either purchase or borrow a spirometer from the project team in order to take part in the study ***Exclusion criteria:*** none specified ***Number of participants:*** 51 primary care practices randomised (39 practices analysed); 102 study subjects (i.e. per practice: a spirometry test interpreter - usually physician - and a spirometry coach - usually medical assistant or registered nurse)
Interventions	***Intervention:*** standard training on use of spirometry by the vendor. • Multimedia CD-ROM (Spirometry Fundamentals: a basic guide to lung function testing) - 70-minute tutorial with interactive action-orientated delivery involving video, audio, animation and text. Organised into 10 short individual learning modules (2 to 11 minutes each). Each module concludes with a short series of content-based questions and immediate feedback on response correctness. Gives flexibility to pace their learning and review individual modules as needed. Practices received 2 copies of the CD and a letter instructing viewing of this within a 3-week period.

Latzke-Davis 2011 *(Continued)*

	• Received EasyData (spirometry curve uploading software to facilitate transmission of de-identified spirometry testing session data to project team on weekly basis) training by project staff. • Performed spirometry and submitted weekly data for 4 months. ***Control*:** usual care, 3 weeks after receipt of spirometer and/or installation of the EasyData software, control sites were instructed to perform spirometry as clinically indicated. Performed spirometry and submitted weekly data for 4 months.
Outcomes	***Outcome measure:*** percentage of spirometry testing sessions collected during 4 months of study participation, which were assigned a 'pass' grade (Grade A or B) ***Time point:*** 4 months
Notes	***Trial registry:*** NCT01152320 ***Funding source:*** American Thoracic Society Grant #A26829; CD-ROM development funded by the Centers for Disease Control and Prevention

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Assignments were determined before beginning enrolment using a random number generator.
Allocation concealment (selection bias)	Low risk	*"Practices were randomised at the time of enrolment. The research coordinator determined randomisation by retrieving the next envelope from a box of envelopes containing consecutive study group assignments."*
Blinding of participants and personnel (performance bias) All outcomes	High risk	This intervention cannot be blinded as they received a physical CD-ROM.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Inspection of spirometry quality grade was blinded - *"Each transmitted testing session was also over-read by a physician member of the project team (KS) who was blinded to study allocation"*
Incomplete outcome data (attrition bias) All outcomes	Low risk	Incomplete valid data transmission addressed in text.
Selective reporting (reporting bias)	Low risk	All stated outcomes are reported.
Baseline outcome measurements similar	Unclear risk	Did not specify baseline spirometry testing (in those already with a spirometer).
Baseline characteristics similar	Low risk	Baseline characteristics reported and are similar.
Protect against contamination	Low risk	Randomisation of practices.
Other bias	Unclear risk	1."*We assumed that a site had watched the CD upon receipt of the completed evaluation survey or at the end of the 3-week period (whichever occurred first)*" - assumption that this was done, not necessarily the case? Acknowledged in limitations section in text.

Latzke-Davis 2011 *(Continued)*

	2. Clinics already with a spirometer were recruited ... these may have better technique already?

Liang 2019

Study characteristics	
Methods	***Aim of study:*** to determine the efficacy, for patients with COPD, of an interdisciplinary model of care (RADICALS — Review of Airway Dysfunction and Interdisciplinary Community-based care of Adult Long-term Smokers) compared with usual care on health-related quality of life (HRQoL), measured at 6 months using the St George's Respiratory Questionnaire (SGRQ) ***Study design:*** cRCT ***Geographic location:*** Australia ***Study setting:*** GP practices ***Number of study sites:*** 43 ***Number of arms/groups:*** 2 ***Unit of allocation:*** GP practice ***Study start date:*** March 2015 ***Study end date:*** April 2018
Participants	***Type of participants:*** ***Recruitment method:*** **Practices**: eligible practices were identified through advertisements and consultation with the Eastern Melbourne PHN and key informants. Direct approaches to clinics (telephone contact, direct emails with study information, brief presentations at GP continuing professional development events, door knocking and so on) could also be employed. The practice was formally enrolled into the study upon receipt of a signed practice agreement form. **Eligible patient participants** are identified through searching of the practice clinical database by an RA employed at each site or trained practice staff. Practice staff are also informed of the study and asked to refer patients who meet the eligibility criteria. Letters with an Expression of Interest form are sent from the practice to eligible patients formally inviting them to take part in the study. Those interested in the study are asked to return the completed form in a reply-paid envelope. Non-respondents are sent up to 2 reminders. ***Inclusion criteria:*** **Clinic**: group or solo primary care practices with at least 1000 patients in their databases are eligible for inclusion in the trial. Primary care practices must also be willing to accommodate research staff at the practice or have personnel at the practice willing to undertake training and dedicate time to specific tasks of the research project. **Patients**: current or ex-smokers with a history of at least 10 pack-years of smoking, aged 40 years or older, including those with an existing diagnosis of COPD, who had 2 or more visits to the practice in the previous 12 months, are included. Two or more visits will indicate patient engagement with the practice. Those with no history of smoking are eligible only if they have spirometry-confirmed COPD. ***Exclusion criteria:*** **Patients**: exclusion criteria include patients with a terminal illness (anticipated survival < 12 months), those unable to provide informed consent (e.g. cognitive impairment), those with pre-existing interstitial lung disease, unstable cardiovascular status, comorbidities preventing participation in an exercise training programme or contraindications to spirometry (including abdominal/thoracic/neurosurgery/ocular surgery in the preceding 6 weeks, pneumothorax in the preceding 6 weeks, haemoptysis of unknown origin, open pulmonary tuberculosis, thoracic/abdominal/cerebral aneurysms, angiogram in the previous 24 hours, recent pulmonary embolus and others listed in the American Thoracic Society/European Respiratory Society (ATS/ERS) guidelines 46). Those patients who have completed a pulmonary rehabilitation programme in the previous 24 months are also excluded from the study.

Liang 2019 *(Continued)*

	Number of participants: 1050 patients (618 intervention vs 432 control), 272 had COPD (157 intervention vs 115 control)
Interventions	**Intervention: RADICALS Interdisciplinary model of care:** in addition to usual care, GPs and other staff from intervention group practices were given training on spirometry and the COPD-X guidelines and smoking cessation guide. Smokers participants were offered individualised smoking cessation support using QUIT resources. HMR was performed by an accredited consultant pharmacist and consisted of an interview with participants at their homes. The 8-week, home-based pulmonary rehabilitation (HomeBase) programme delivered by a specifically trained physiotherapist, consisted of 1 home visit and weekly follow-up telephone calls. Participants were followed at 6 and 12 months after baseline. Follow-ups (telephone and/or face-to-face) involved completion of a structured questionnaire with outcomes of interest, post-bronchodilator spirometry testing and exhaled carbon monoxide (CO) testing in smokers (if self-reported not smoking in the previous 7 days) **Control: usual care:** GPs in usual care practices continued to provide routine care to their patients. Copies of the COPD-X Plan and the Smoking Cessation guide were provided to clinic staff. Spirometry results and interpretation were made available for GPs to review. Participants were given the Lung Foundation Australia booklet "Better Living with Chronic Obstructive Pulmonary Disease – A Patient Guide". Quitline referral was provided to those who were smokers
Outcomes	***Outcomes:*** SGRQ score; CAT score; mMRC grade; HADS score ***Time point:*** 6 months and 12 months ***Outcomes:*** lung function (FEV_1%) predicted ***Time point:*** 6 months
Notes	***Trial registry:*** ACTRN12614001155684 ***Funding source:*** *"We wish to thank all our funding bodies and partner organisations for supporting the trial (Boehringer Ingelheim, Eastern Melbourne PHN, Lung Foundation Australia and National Health and Medical Research Council). Lung Foundation Australia and Eastern Melbourne PHN were involved in project design and conduct, and contributed to data interpretation and writing of manuscripts. Boehringer Ingelheim was involved in project discussions, planning and progress review, but had no involvement in the design of the intervention programme and did not contribute to decisions regarding data analysis and dissemination of findings. B. Bonevski is supported by an Australian National Health and Medical Research Council Career Development Fellowship (GNT1063206) and a Faculty of Health and Medicine, University of Newcastle Gladys M Brawn Career Development Fellowship. J. Liang is the recipient of the Cyril Tonkin Scholarship 2014 (Faculty of Pharmacy and Pharmaceutical Sciences Foundation Board, Monash University). Funding information for this article has been deposited with the Cross ref Funder Registry."*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"Primary care clinics are block-randomised, using block sizes of four and six, into ICG or UCG using a web-based randomisation program managed by an independent agency."*
Allocation concealment (selection bias)	Low risk	Externally managed web-based randomisation, then clinics informed.
Blinding of participants and personnel (performance bias)	High risk	Unblinded.

Liang 2019 *(Continued)*

All outcomes		
Blinding of outcome assessment (detection bias) All outcomes	Low risk	All outcome measure assessments were conducted by research assistants blinded to treatment allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Loss to follow-up significant (28% and 33%), but balanced across groups. Intention-to-treat analysis.
Selective reporting (reporting bias)	Low risk	Appears as per protocol and trial registry.
Baseline outcome measurements similar	Low risk	Outcomes comparable at baseline.
Baseline characteristics similar	Unclear risk	Some staff had received training in past 2 years, unclear if that was balanced across both groups. Patients: at baseline, the groups appeared similar, although intervention group participants were older and more likely to have a trade rather than university education, but less likely to be current smokers than the usual care group.
Protect against contamination	Low risk	Cluster-randomisation.

Lou 2015

Study characteristics	
Methods	***Aim of study:*** to determine whether a health management programme, with a focus on behavioural intervention and rehabilitation training, would improve outcomes in patients with COPD in rural communities in China ***Study design:*** community-based, parallel-group, pragmatic RCT ***Geographic location:*** China ***Study setting:*** community health centres ***Number of study sites:*** 14 ***Number of arms/groups:*** 2 ***Unit of allocation:*** healthcare centre ***Study start date:*** January 2008 ***Study end date:*** May 2012
Participants	***Type of participants:*** community health centres, patients with COPD ***Recruitment method:*** Practices: not specified; was from 28 communities in Xuzhou city Patients: not specified; participants were recruited by their family physicians from the 14 healthcare centres ***Inclusion criteria:*** participants: diagnosis of COPD according to GOLD criteria

Lou 2015 *(Continued)*

	Exclusion criteria: participants: presence of fever, active tuberculosis, changes in radiographic images or medication in the 4 weeks immediately preceding recruitment, primary diagnosis of asthma or obvious bronchiectasis, cystic fibrosis, interstitial lung disease, previous lung-volume-reduction surgery, lung transplantation, pneumonectomy, uncontrolled or serious conditions that could potentially affect spirometry tests, and refusal to fill out psychological questionnaires. ***Number of participants:*** 14 community health centres; 8217 patients with COPD
Interventions	***Management group:*** health management programme for 4 years ***Control group:*** usual care for 4 years
Outcomes	***Outcome measure:*** change in BODE index score; change in 6MWD; change in MMRC; change in BMI; change in FEV_1; change in immunomodulators (includes influenza/pneumonia vaccine, bronchitis vaccine, immunoglobulin etc.); change in respiratory medication (long-acting beta-agonists, inhaled corticosteroids, chronic systemic corticosteroids, theophylline) ***Time point:*** 4 years
Notes	***Trial registry:*** Chinese Clinical Trial Registry - ChiCTR-TRC-12001958 ***Funding source:*** Science and Technology Projects of Xuzhou City in 2007 (XM07C037)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Does not specify how random sequence was generated, just: *"centres with experience and those without were then randomly allocated separately into the health management and control groups…"*
Allocation concealment (selection bias)	Unclear risk	Does not specify who performed the randomisation, and how the allocation was concealed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	This intervention cannot be blinded as participants will need to undergo the health management programme.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unclear whether these outcomes were obtained by RAs blinded to allocation. The only mention of how they were obtained was *"changes in hospital admissions and emergency department visits, as well as changes in medication regimens, were obtained by subject interview, health-care databases, or prospectively from diary cards, and frequency was recorded."*
Incomplete outcome data (attrition bias) All outcomes	High risk	Control group had higher dropout rate. *"In both groups, compared with the subjects who completed the study, those who failed to complete the study were older, less educated, less likely to be married, more likely to be smokers, and more likely to be associated with coal and/or biomass smoke exposure and had lower incomes, lower BMI, and higher comorbidity rates (all P<0.001)".* However, *"for the 6221 analysed subjects, no significant differences were observed between the 2 groups (all P>0.05)"* (data are not shown).
Selective reporting (reporting bias)	Low risk	All specified outcomes are seemingly reported in the results.
Baseline outcome measurements similar	Low risk	Baseline outcome measurements of interest are seemingly similar across groups

Lou 2015 *(Continued)*

Baseline characteristics similar	Unclear risk	Baseline characteristics of participants and healthcare units appear similar (except for COPD awareness scores), however no mention of adjustments for clustering.
Protect against contamination	Low risk	Allocation was based on healthcare unit, participants were recruited from healthcare units. Unlikely to have received the intervention.

Lusuardi 2006

Study characteristics	
Methods	***Aim of study:*** to assess in a very large number of general practices in Italy the feasibility of office spirometry on a day-by-day basis and, as a primary endpoint, to verify whether conventional evaluation (history and physical examination) followed by spirometry may be better than conventional evaluation alone in identifying patients with different chronic obstructive airways disorders. ***Study design:*** prospective randomised controlled comparative trial ***Geographic location:*** Italy ***Study setting:*** specialist centres ***Number of study sites:*** 57 ***Number of arms/groups:*** 2 ***Unit of allocation:*** patients ***Study start date:*** November 2002 ***Study end date:*** July 2003
Participants	***Type of participants:*** Italian reference specialist centres, GPs ***Recruitment method:*** a simple questionnaire concluded the run-in period to evaluate the opinion of each GP on the feasibility and usefulness of office spirometry and to identify doctors willing to participate in the randomised comparative trial. As an alternative to the randomised study, the GPs were also invited to continue for a period of 9 months with the application of office spirometry as part of a parallel observational study on the simple feasibility and self-rated usefulness of the test. ***Inclusion criteria:*** patients: consecutive subjects aged from 18 to 65 years and with symptoms suggestive of asthma or COPD (cough, dyspnoea, wheezing, chest tightness) without a previous diagnosis were considered. ***Exclusion criteria:*** patients: a previous diagnosis of asthma or COPD; history of cardiac failure; neuromuscular or autoimmune disorders; present cancer; interstitial lung disease; thoracic surgery in the previous 6 months; present infectious disorders; or respiratory infection in the month before entering the study ***Number of participants:*** 57 Italian reference specialist centres, 570 GPs
Interventions	**Conventional evaluation with spirometry:** case history supported by questionnaire and physical examination delivered by GPs plus spirometry **Conventional evaluation without spirometry:** case history supported by questionnaire and physical examination delivered by GPs without spirometry
Outcomes	***Outcome measure:*** comparison of diagnosis (agreement or disagreement) between GPs and Specialist in Pulmonary Medicine in all patients with complete evaluation; comparison of diagnosis (agreement or disagreement) between GPs and Specialist in Pulmonary Medicine in all patients with missing diag-

Lusuardi 2006 *(Continued)*

	nosis; comparison of diagnosis (agreement or disagreement) between GPs and Specialist in Pulmonary Medicine in only nonrandom violators; comparison of diagnosis (agreement or disagreement) between GPs and Specialist in Pulmonary Medicine in non-random violators except those with missing diagnosis; frequency of diagnosis by GPs and pulmonary specialist in the subgroup of 224 patients completing the study. ***Time point:*** 9 months
Notes	***Trial registry:*** not specified ***Funding source:*** unrestricted grant by SIMESA SpA (Astra Zeneca Group)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"The study population was randomized 1:1 into two groups (by means of an interactive voice responding system [IVRS]): conventional evaluation without spirometry vs conventional evaluation with spirometry. The size of randomization-balanced blocks was 10 patients within study."*
Allocation concealment (selection bias)	Unclear risk	No details.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Spirometry delivery would mean both doctor and patient would be unblinded.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	The specialist was blinded to have a final diagnosis that was sent to the data centre.
Incomplete outcome data (attrition bias) All outcomes	Low risk	*"Owing to the presence of random violators and missing diagnosis, an intention-to-treat and a per- protocol analysis along with a power calculation was carried out on the case series at different levels as shown in Table 2. The results show that in any case (all patients, all patients except those with missing diagnosis, only nonrandom violators, only nonrandom violators except those with missing diagnosis), the level of agreement between GPs and specialists did not change significantly whether or not spirometry was used in the GP's office."*
Selective reporting (reporting bias)	Unclear risk	Appears to be as per methods, but no trial registry or protocol.
Baseline outcome measurements similar	Unclear risk	No details provided.
Baseline characteristics similar	Unclear risk	No comparison of characteristics of GPs between groups.
Protect against contamination	Low risk	Randomised at level of GP.

Markun 2018

Study characteristics

Markun 2018 *(Continued)*

Methods	***Aim of study:*** to test whether an intervention focusing on general practice teams including implementation of a COPD care bundle along with specific coaching to support organisational and behavioural changes would result in an increased implementation rate of key elements of COPD care. ***Study design:*** cRCT ***Geographic location:*** Switzerland ***Study setting:*** GP practice ***Number of study sites:*** 33 ***Number of arms/groups:*** 2 ***Unit of allocation:*** *GP* ***Study start date:*** December 2013 ***Study end date:*** January 2016
Participants	***Type of participants:*** GPs and practice assistants, patients ***Recruitment method*:** recruitment of GPs started in 2013 by mass mailings and visits at GP network meetings. ***Inclusion criteria:*** 1) primary care physician in the canton of Zurich and 2) board certification in general medicine or internal medicine. GPs approached consecutive patients aged at least 45 years, with at least 10 pack-years smoking history, and proposed to perform spirometry. If airflow obstruction (FEV_1/FVC < 0.7) was confirmed, GPs gained informed consent if available and performed formal study inclusion. ***Exclusion criteria:*** emergency consultations, insufficient German language skills to complete study questionnaires, asthma or hay fever, or estimated life expectancy < 6 months ***Number of participants:*** 33 GPs were randomised (16 in the intervention group and 17 in the control group); 101 patients intervention, 115 patients control ***Age median (IQR):*** GPs: 50 (44 to 59); patients: 68 (63 to 75) ***Number of participant completed:*** 14 GPs (69 patients) intervention vs 16 GPs (92 patients) control
Interventions	**Intervention: 'QualiCCare' - COPD Care Bundle:** practices in the intervention group got detailed information on evidence-based COPD management and 'QualiCCare' training sessions and instruments to induce organisational and behavioural changes. Then, GPs and practice assistants were to discuss and tailor their individual pathways of COPD care. Case vignettes and role plays were used to actively involve GPs and practice assistants with tasks and responsibilities. After 6 months, a 3-hour refresher workshop was delivered to the practice teams again using case vignettes and role plays after conducting a survey among practice teams to inform about their specific needs for support. The 'QualiCCare' implemented the recommended clinical process in primary care for patients that includes: smoking cessation counselling, yearly influenza vaccination, counselling to increase motivation for physical activity and pulmonary rehabilitation, self-management education with a written action plan to do the right thing at the right time in case of an exacerbation; appropriate pharmacologic treatment for stable and exacerbated COPD, and proactive, collaborative COPD care. **Control: usual care:** the GPs of the control group applied 'care as usual' without receiving the 'QualiCCare' training and implementation tools
Outcomes	All outcomes measured at 12 months: Difference in proportions of GOLD group C&D who received referral to pulmonary rehabilitation; written action plan for exacerbation management; difference in symptom severity (QoL) using CAT; number

Markun 2018 *(Continued)*

	of planned practice visits; difference in 'quality of care process'/key elements of COPD care (including smoking cessation advice, smoking cessation intervention, influenza vaccination, ensuring correct inhalation technique, appropriate pharmacological treatment, assessment of physical activity/advice for physical activity, patient education class referral, assessment of exacerbation frequency)
Notes	***Trial registry:*** NCT01921556 ***Funding source:*** the Swiss Federal Office of Public Health (BAG), the Swiss Medical Association (FMH) and the Dept of Health of the Canton of Zurich. *"Support statement: this project was supported by grants from the Swiss Federal Office of Public Health (BAG), and by unrestricted grants for Chronic Care and Patient Education from AstraZeneca Switzerland, Boehringer Ingelheim Switzerland and Novartis Switzerland."*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"A researcher not involved in this study produced the random sequence using Stata (StataCorp, College Station, TX, USA)."*
Allocation concealment (selection bias)	Low risk	*"The randomisation of GPs was performed 6 months after initiation of patient recruitment to minimise the effect of the openly labelled treatment group allocation on recruitment performance."*
Blinding of participants and personnel (performance bias) All outcomes	High risk	Open-labelled trial.
Blinding of outcome assessment (detection bias) All outcomes	High risk	Likely to be performed by GPs who were not blinded.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	*"When testing dropout counts, a significant between-group difference appeared (intervention group n=32 versus control group n=23; p=0.049). Active withdrawal of patients was the most common reason for discontinuation; however, there was no significant between-group difference in reasons for discontinuation (p=0.165)."*
Selective reporting (reporting bias)	Low risk	Appears to be as per protocol.
Baseline outcome measurements similar	Unclear risk	*"Per chance, the intervention group had less severe obstruction (median FEV1 % pred 70% versus 65%; p=0.035) and a lower CAT summary score (median 9 versus 12; p=0.033)."*
Baseline characteristics similar	Unclear risk	Mostly balanced characteristics, but control group was sicker.
Protect against contamination	High risk	18 GPs (contributing 111 patients) from the intervention and control groups were co-located in group practices.

Martens 2006

Study characteristics

Martens 2006 *(Continued)*

Methods	***Aim of study:*** to assess the effects of a dissemination strategy of multidisciplinary guidelines on the volume of drug prescribing ***Study design:*** quasi-experimental pre-/post-study with nested RCT within intervention group ***Geographic location:*** Netherlands ***Study setting:*** GP primary practice ***Number of study sites:*** 53 GPs ***Number of arms/groups:*** 3 (total in pre-/post-study); 2 in RCT component ***Unit of allocation:*** GP ***Study start date:*** 2002 ***Study end date:*** 2004
Participants	***Type of participants:*** GPs ***Recruitment method:*** pre-/post-study: GPs in Maastricht region, identified through insurance company data. Intervention RCT: GPs invited from pre-/post-intervention group ***Inclusion criteria:*** GP: completeness of GP data (no missing data per GP for more than 1 year) and ≥ 500 patients in GP practice ***Exclusion criteria:*** none specified ***Number of participants:*** 53 GPs within the intervention arm of the RCT component (27 intervention GPs, 26 control GPs)
Interventions	**Guideline dissemination and GPs were encouraged to comment on the guideline:** conceptual guideline mailed to GPs and GPs were asked to comment and encouraged to do so. The guideline committee stressed the importance of knowing the GPs' comments, and that the comments would be taken very seriously in finalising the guideline. **Guideline dissemination only:** conceptual guideline mailed to GPs; GPs not asked for comments
Outcomes	***Outcome measure:*** proportion of change in mean total number of drug prescriptions for SABA for COPD per GP per year, standardised per 1000 enlisted patients; proportion of change in mean total number of drug prescriptions for ICS for COPD per GP per year, standardised per 1000 enlisted patients ***Time point:*** 12 and 24 months
Notes	***Trial registry:*** not specified ***Funding source:*** 2 health care insurance companies (funding the study and 2 authors); Academic Hospital Maastricht (funding other authors)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Randomisation method not specified.
Allocation concealment (selection bias)	Unclear risk	Not specified.

Martens 2006 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Low risk	*"GPs in both pre/post study and RCT study were not aware of the fact that they were in an evaluation study, because only anonymous volume data were collected from an existing database."*
Blinding of outcome assessment (detection bias) All outcomes	Low risk	GPs were not aware of the fact that they were in an evaluation study. The data were collected from existing insurance database.
Incomplete outcome data (attrition bias) All outcomes	High risk	*"Less than 10% of the GPs that were invited to play a greater role actually commented on the conceptual guideline."*
Selective reporting (reporting bias)	Unclear risk	Outcomes not clearly described in methods.
Baseline outcome measurements similar	Low risk	Prescribing data collected pre- and post-intervention (retrospectively).
Baseline characteristics similar	Unclear risk	Only age reported; unclear if age is related to the RCT subgroup.
Protect against contamination	Unclear risk	Unclear if it was one GP or entire practice.
Other bias	High risk	No conflicts of interest were stated; however, insurance company was funding the study.

Morganroth 2016

Study characteristics	
Methods	***Aim of study:*** to assess whether performance improvement interventions (the COPD CareManager module) would improve COPD care and outcomes (before-after study), and whether the addition of other educational, care management and CareManager training would further improve care (RCT) ***Study design:*** RCT ***Geographic location:*** USA ***Study setting:*** primary care clinics ***Number of study sites:*** 12 ***Number of arms/groups:*** 2 ***Unit of allocation:*** clinic ***Study start date:*** June 2011 ***Study end date:*** June 2012
Participants	***Type of participants:*** clinics, patients ***Recruitment method:*** clinics: recruitment method not specified for PMG-Oregon clinics Patients: EMR entries of patients who met study inclusion criteria

Morganroth 2016 *(Continued)*

	Inclusion criteria: clinics: PMG-Oregon clinics that refer patients for pulmonary consultation to the Oregon Clinic, which is a free-standing subspecialty clinic Patients: experienced 2 outpatient COPD exacerbations or 1 ED visit or 1 hospitalisation for COPD exacerbation during the 1 year before the study ***Exclusion criteria:*** patients: poorly controlled, serious illness that would likely cause ED visits and hospitalisations beyond those triggered by COPD exacerbations. A serious illness was defined as one that resulted in > 6 office visits, > 1 ED visit or 1 hospitalisation in the 6 months before study enrolment. Other exclusions: pulmonary resection, cerebrovascular accident or MI in prior year, active malignancy not in remission during the previous 5 years; or any mental or physical impediments that would prohibit ambulatory office visits or medication use. ***Number of participants:*** 12 clinics (4 intervention, 8 control), 1218 patients (706 intervention, 512 control) ***Loss to follow-up:*** 25 intervention vs 16 control
Interventions	**Intervention: case management, physician education on COPD and physician education on accessing CareManager COPD:** 1) 60-minute F2F training on CareManager COPD module point of care decision support functionality, purpose and accessibility, population-based reporting and audit and feedback resources, 2) 3 x 2-hour educational sessions by a single pulmonary physician on guideline management of COPD and use of the COPD CareManager module that included didactic presentations and QA discussions, 3) F2F instructions and email reminders on how to access online COPD educational videos created by TOC pulmonary pulmonologists that reviewed guideline recommendations for COPD care; 4) access to central case management resources that employed a medical assistant stationed remotely who used the EMR and CareManager tools to track and triage care opportunities for patients with COPD, harmonise specialist consultants with primary care physician management and contact patients for any management needs using a predefined workflow protocol. **Control: access to CareManager COPD module online**
Outcomes	***Outcome measure:*** mean total exacerbations per patient (inpatient/ED or outpatient); flu vaccination; pneumococcal vaccination; prescription of bronchodilators; prescription of ICS/TIO; prescription of LABA + ICS; prescription of LABA/ICS + TIO; prescription of TIO; pulmonary rehabilitation; smoking cessation advice provided ***Time point:*** 12 months
Notes	***Trial registry:*** not specified ***Funding source:*** supported by Providence Medical Group, The Oregon Clinic, Providence Health Plan, CareOregon and an independent investigator-initiated grant from Novartis

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	*"12 clinics were distributed randomly in a geographically overlapping manner".*
Allocation concealment (selection bias)	Unclear risk	Not detailed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	GPs aware of study and allocation; a 'physician compensation model' was adopted within the first months of the study that based 20% of physician pay on quality performance indicators. Investigators encouraged intervention patients to undergo spirometry at study enrolment so these patients would know their allocation.

Morganroth 2016 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	No details on blinding.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Lost to follow-up similar in both groups.
Selective reporting (reporting bias)	Low risk	Outcomes reported as outlined in methods.
Baseline outcome measurements similar	Low risk	No significant difference in baseline measurements (except baseline depression screening and end of life planning).
Baseline characteristics similar	Low risk	No significant difference in patient characteristics.
Protect against contamination	Low risk	Randomisation process at the clinic level and *"PMG clinics have a standardized physician structure, patients rarely change clinics".*

Naidoo 2014

Study characteristics	
Methods	***Aim of study:*** to evaluate the impact of the 'Primary Care 101' chronic disease management guideline and training on nurses' knowledge of chronic diseases management. ***Study design:*** population-based, unblinded, stratified, cluster-RCT ***Geographic location:*** South Africa ***Study setting:*** primary health clinics ***Number of study sites:*** 30 ***Number of arms/groups:*** 2 ***Unit of allocation:*** clinics ***Study start date:*** 2012 ***Study end date:*** not specified
Participants	***Type of participants:*** primary health clinics, nurses ***Recruitment method:*** in the health districts, a complete list of primary health clinics was obtained, and clinics were randomly chosen to receive the intervention. ***Inclusion criteria:*** **clinics:** intervention clinics were 20 sites in which the Integrated Chronic Disease Management model was being implemented; control clinics were primary health clinics that did not receive the intervention. **Nurses:** all nurses working in the 30 clinics were invited to participate ***Exclusion criteria:*** not specified ***Number of participants:*** 30 clinics

Naidoo 2014 *(Continued)*

Interventions	**Primary Care 101 guideline training (intervention):** training material that made use of PC 101 guideline AND training process and method of training. In May 2012, staff from the Knowledge and Translation Unit at University of Cape Town trained master and facility trainers and professional nurses on using PC 101 guideline and training manual. Master and facility trainers had to conduct 8 training sessions at each intervention primary health clinic over a 6-month period. The 8 sessions were used as a method of reinforcing initial training nurses had received in May 2012. **Usual care (control):** usual care
Outcomes	***Outcome measure:*** nurses knowledge on asthma/COPD management (15 questions of a larger 150 question self-administered questionnaire that assessed knowledge on managing chronic diseases). Mean total knowledge percentage scores. ***Time point:*** *at* 6 months
Notes	***Trial registry:*** not specified ***Funding source:*** United States Agency for International Development through the Rapid Response Mechanism for HIV and AIDS via Pact Prime Award No 647-A-00-08-00001

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Clinics were randomly chosen to receive the intervention.
Allocation concealment (selection bias)	Unclear risk	Not detailed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Participating staff and the study team were aware of which primary health clinics were receiving the intervention.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	*"Independent evaluation"* but no mention of blinding.
Incomplete outcome data (attrition bias) All outcomes	High risk	T1 = 171, T4 = 109, T1&T4 = 70; there are no clear details on numbers of participants involved and also no reasons provided for nurses not participating in different phases.
Selective reporting (reporting bias)	Low risk	Outcomes reported as per methods, but unclear why expressed in tables (n, %).
Baseline outcome measurements similar	Low risk	Mean total knowledge percentage scores comparable at baseline.
Baseline characteristics similar	Unclear risk	Not detailed.
Protect against contamination	High risk	During site visits it was established that nurses were being rotated through clinics in the district. *"The potential for cross-over bias that may occur in a randomised controlled trial did exist in this study". "There were nurses who had been trained at T1 from the intervention who may have been rotated to control clinics, and the researchers had no control over this. These nurses could have shared information with nurses at the control clinics."*

Poels 2008

Study characteristics	
Methods	***Aim of study:*** to assess the impact of expert support for the interpretation of spirometry tests on GPs' diagnostic achievements and decision-making processes when diagnosing chronic respiratory disease. ***Study design:*** simulated, cluster-randomised trial ***Geographic location:*** Netherlands ***Study setting:*** general practice ***Number of study sites:*** 78 GPs ***Number of arms/groups:*** 2 ***Unit of allocation:*** GP ***Study start date:*** GPs were enrolled between January and October 2006 ***Study end date:*** not specified
Participants	***Type of participants:*** GPs, patient cases ***Recruitment method:*** GPs from the catchment area of the Radboud University Nijmegen Medical Centre and from a specific GP network of the present authors' department at this hospital were invited to participate by postal mailing ***Inclusion criteria:*** in catchment area of the Radboud University Nijmegen Medical Centre or from a specific GP network of the authors' department at the hospital ***Exclusion criteria:*** not specified ***Number of participants:*** 78 GPs, 780 cases, 774 actual analysed cases
Interventions	**Computerised spirometry expert interpretation support group:** GPs received the spirometry test results, the flow-volume curve, and the graphical interpretation and textual interpretation notes. Research assistant visited participating GP in their practice. During a 90-minute audiotaped session, an example case and 10 standardised cases were presented on a laptop computer using PowerPoint slides. GPs worked through the cases in a random order. For each case, a concise medical history, the results of physical examination and the medication were presented to the GP first. Spirometry test results were then provided and GPs were asked to consider diagnosis and management. Then graphical and textual expert support was provided and GPs were again asked to reconsider diagnosis and management. **Control group:** GPs received the spirometry test results, and the flow-volume and volume-time curves. During a 90-minute audiotaped session, an example case and 10 standardised cases were presented on a laptop computer using PowerPoint slides. GPs worked through the cases in a random order. For each case, a concise medical history, the results of physical examine and the medication were presented to the GP first. Spirometry test results and GPs were asked to consider diagnosis and management. Sham information was introduced in the control group to be able to compare GPs reassessment of a diagnosis in the control group in the same way as in the expert support group.
Outcomes	***Outcome measure:*** agreement of the COPD case diagnoses between GPs and expert panel judgement before and after interpretation of spirometry; probability of ordering additional diagnostic tests ***Time point*** **:** before and after additional information ***Outcome measure:*** probability of medication (stopping or lowering treatment with ICS or bronchodilators; the commencement of bronchodilator, ICS, oral corticosteroid or combination drug treatment); probability of non-medication changes (giving smoking cessation advice)

Poels 2008 *(Continued)*

	Time point: after additional information
Notes	***Trial registry:*** not specified ***Funding source:*** Netherlands Asthma Foundation grant and Netherlands Organisation for Health Research and Development grant.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Restricted randomisation (minimisation) with a computer program on a laptop computer using the following 3 stratification factors: 1) GP's prior experience with the specific computerised spirometry interpretation support package, 2) the average number of spirometry tests a GP reported to interpret per week, 3) a GP's experience (in years) with spirometry.
Allocation concealment (selection bias)	Low risk	Unclear - but assume allocated after consent given; randomisation was on laptop.
Blinding of participants and personnel (performance bias) All outcomes	Low risk	Control group received sham information to allow diagnosis reassessment like the intervention group.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	*"The researchers and the statistician were blinded while assessing and reporting all outcomes."*
Incomplete outcome data (attrition bias) All outcomes	Low risk	All participating GPs completed all of the 10 cases.
Selective reporting (reporting bias)	Low risk	Outcomes were prespecified.
Baseline outcome measurements similar	Low risk	Baseline results were comparable.
Baseline characteristics similar	Low risk	Table 1 characteristics appear similar (although no P values).
Protect against contamination	Low risk	Unclear if GPs were in separate clinics. However, cases were in random order and intervention/results happened simultaneously.

Salisbury 2018

Study characteristics

Methods	***Aim of study:*** to implement, at scale, a new approach to managing patients with multi-morbidity in primary care and to assess its effectiveness ***Study design:*** cRCT ***Geographic location:*** UK ***Study setting:*** GP Practice

Salisbury 2018 *(Continued)*

	Number of study sites: 33 ***Number of arms/groups:*** 2 ***Unit of allocation:*** practice (cluster) ***Study start date:*** May 2015 ***Study end date:*** March 2017
Participants	***Type of participants:*** GPs, patients ***Recruitment method:*** **GPs:** potentially interested GPs were identified by the NHS Clinical Research Networks in England and the Scottish Primary Care Network. Local researchers met with key stakeholders at the practice (practice manager, GPs, practice nurses) to explain the study and its requirement of a commitment to organisational and procedural change. **Patients:** practices used EMIS electronic medical record system to identify patients with any of the 17 major chronic conditions from those included in the UK Quality and Outcomes Framework (QOF) pay-for-performance programme. ***Inclusion criteria:*** **GPs:** had at least 2 physicians and 4500 registered patients and used the EMIS electronic medical records system. **Patients:** 18 years or older, with at least 3 types of chronic condition from those included in the National Health Service (NHS) Quality and Outcomes Framework ***Exclusion criteria:*** patients who had a life expectancy of less than 12 months, were at serious suicidal risk, were known to be leaving the practice within 12 months, were unable to complete questionnaires in English, were taking part in another healthcare research project, lacked the capacity to give consent (in Scotland only, for legal reasons), or if their general practitioner deemed them unsuitable to be invited for other reasons ***Number of participants:*** 33 GPS (17 intervention, 16 control) and 1546 patients Note: from 1546 patients recruited only 382 (51%) in control and 388 (49%) in intervention who had COPD/asthma. COPD patients not specifically reported.
Interventions	**Intervention: 3D (dimensions of health, drugs, depression):** practice-level change: training for clinicians and receptionists. Clinicians trained on eliciting of patient concerns, exploring strategies to promote patient-centred care, ways to improve continuity of care, negotiating a patient health plan, improving medication adherence, the aims of the 3D reviews and use of the 3D review template. A substantial element of the training was devoted to promoting attitudinal change among clinicians towards identifying and responding to patients' own priorities and problems with broader quality of life, as organisational change is unlikely to be effective unless clinicians 'buy into' the underlying philosophy of the new approach. Practice receptionists were also offered training in promoting continuity of care and offering longer appointments to patients with multi-morbidity. The 3D intervention is based on a patient-centred care model and seeks to improve continuity, co-ordination, and efficiency of care by replacing disease-focused reviews of each health condition with one 6-monthly comprehensive multidisciplinary review. Each 3D review consisted of 2 appointments (with a nurse and then a named responsible physician, both existing members of practice staff) and a records-based medication review by a pharmacist (who might or might not have previously worked with the practice). All 3 stages of the 3D review were based on an electronic template integrated within the EMIS electronic medical records system. **Control:** general practices in the control group continued to provide usual care.
Outcomes	***Outcome measure:*** EQ-5D-5L for patient ***Time point:*** 15 months

Salisbury 2018 *(Continued)*

	Outcome measure: EQ-5D-5L for carer; self-rated health; Bayliss measure of illness burden; HADS anxiety score; Multimorbidity Treatment Burden Questionnaire score; MMAS; PACIC; Consultation and Relational Empathy (CARE); patients discussed most important problem (number reporting 'almost always'); care joined up (number reporting 'almost always'/total number); overall satisfaction (number reporting 'very satisfied'/total number) ***Time point:*** 9 months
Notes	***Trial registry:*** ISRCTN06180958 ***Funding source:*** National Institute for Health Research.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"Random allocation of practices (clusters) was stratified by area and minimised by practice deprivation and list size. The randomisation system was run from the Bristol Randomised Trials Collaboration by the trial statistician, who was masked to practice identifiers."*
Allocation concealment (selection bias)	Low risk	*"Allocations were done in blocks of two in each area, with an intervention and a control practice allocated simultaneously so that concealment of allocation was maintained. Patients were informed of their allocation by post, by the research team."* *"Practice randomisation occurs after patient recruitment, and it then takes approximately 3 months to train practices to deliver the 3D intervention."*
Blinding of participants and personnel (performance bias) All outcomes	High risk	Not blinded - because of the nature of the intervention, practices and participants were aware of their treatment allocation.
Blinding of outcome assessment (detection bias) All outcomes	High risk	*"Outcome data were self-reported or based on automated extraction of data from the electronic medical records, except for details of hospital use, which were collected manually by researchers who were aware of practice allocation".*
Incomplete outcome data (attrition bias) All outcomes	Low risk	Intention-to-treat, missing data imputed.
Selective reporting (reporting bias)	Low risk	Appears to be reported as per protocol paper.
Baseline outcome measurements similar	Low risk	Both practices and patients had similar characteristics at baseline in each study group.
Baseline characteristics similar	Low risk	Both practices and patients had similar characteristics at baseline in each study group. Participating patients had similar characteristics to non-participants, apart from being less likely to have dementia.
Protect against contamination	Low risk	Cluster-randomised with unit practice.

Sandelowsky 2018

Study characteristics	
Methods	***Aim of study:*** (2018): to compare the effects of CME on the topic of COPD, delivered in the form of praxis-typical, short (1– to 2-hour) sessions of either CM (case method learning) or TL (traditional lecture), tailored for and targeted to GPs (2020): to compare and describe the effects of 2 educational methods used for GPs' education in COPD, regarding patient outcomes including health status, symptoms, patients' perceived information needs about COPD, exacerbations, smoking and healthcare visits ***Study design:*** pragmatic cluster-RCT with separate non-randomised control group ***Geographic location:*** Sweden ***Study setting:*** primary healthcare centres (PHCCs) ***Number of study sites:*** 35 (2020 paper: 24) ***Number of arms/groups:*** 3 (2020 paper: 2) ***Unit of allocation:*** healthcare centre (cluster) ***Study start date:*** 2014 ***Study end date:*** 2017
Participants	***Type of participants:*** GPs, patients ***Recruitment method:*** email invitation to all 80 PHCCs in Stockholm, inclusion of first 24 (12 case seminars, 12 traditional lectures) who agreed to participate. New email invite sent to non-responding PHCCs, and first 11 consecutive PHCCs that agreed to participate acted as reference group. ***Inclusion criteria:*** PHCC: > 10,000 patients listed, > 70% permanent employed general practitioners Patients: diagnosis of COPD registered. Grade of COPD 2 to 3 (GOLD) at the latest spirometry completed since 2008. ***Exclusion criteria*:** nil ***Number of participants:*** GPs: 87 intervention arm 1, 93 intervention arm 2, 75 reference group Patients: 273 intervention 1; 269 intervention 2 Age: patients: intervention 1: median 72.6 (IQR 71.4 to 73.7); intervention 2: 71.0 (69.9 to 72.1)
Interventions	**Intervention 1: Continuing Medical Education (CME) by Case Method (CM):** the CME sessions took place at the PHCCs. Five CME leaders, all GPs competent and experienced in COPD management ran 2 x 2-hour sessions at each PHCC, at a maximum of 3 months apart. Each PHCC was assigned the same CME leader and CME method (either CM or TL). Thus, 4 TL leaders taught at 2 to 4 PHCCs each, and 1 CM leader taught at all 12 PHCCs that received CM. John Biggs' educational theory of constructive alignment was used to align the intended learning outcomes, learning activities and assessments. After an initial 20-minute introduction to the topic via a TL, the CME leader started presenting a case seminar. The intended eLearning outcomes (ILOs) of the CME were derived from the pre-2015 COPD guidelines and from a 2013 qualitative study of GPs in Stockholm that described barriers to and facilitators of the COPD guideline implementation process. The Bigg's Structure of Observed Learning Outcomes (SOLO) taxonomy was used to help mapping levels of understanding that can be built into the ILOs. The leaders were also allowed to use their own presentation materials, such as slide shows and handouts. This group received CME at SOLO levels 1 to 5 (S1-S5), with more focused on levels S3-S5.

Sandelowsky 2018 *(Continued)*

	Intervention 2: CME by Traditional Lecture (TL): lectures delivered in a didactic style, one-way communication, CME leader as an academic expert. This group received CME at SOLO only levels 1 to 3 (S1-S3) **Reference group:** received no education
Outcomes	**Outcome measure:** Physician Questionnaire score ***Time point*** **:** 12 months ***Outcome measure:*** CCQ score; CAT score; LINQ score; number of current smokers; COPD exacerbations (1 or more in past 6 months); hospital admissions (1 or more in past 6 months); assigned GP ***Time point:*** 18 months
Notes	***Trial registry:*** NCT02213809 ***Funding source:*** this work was supported by employment in and grants from the Stockholm County Council (grand register number LS 1110-1339, LS 1301-0078 and LS 1411-1373), employment in Dalarna County Council, and an unrestricted research grant from AstraZeneca Inc.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Non-randomised reference group for GPs (high risk - but data not considered in this review) 2020 paper: low risk, as 2 intervention groups randomised using a computer program (nQuery Advisor)
Allocation concealment (selection bias)	Low risk	Non-randomised reference group for GPs (high risk - but data not considered in this review) 2020 paper: low risk: to make sure that there is no bias in the group allocation of participants, PHCCs selected first before randomisation of clusters took place.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Health professionals unblinded. Patients blinded (2020 paper: low risk, *"the patients who agree to participate and have signed Informed Consent Forms will fall under the cluster of their PHCCs, but will only be informed about their physicians receiving a CME in COPD and not about which study arm they will be part of."*)
Blinding of outcome assessment (detection bias) All outcomes	High risk	GP knowledge unblinded: high risk Patient outcomes (2020 paper): low risk
Incomplete outcome data (attrition bias) All outcomes	High risk	2018: high = study authors report that attrition was high and may have affected the outcome. 2020: low = the dropout rate between baseline and 18 months was independent of CME arm.
Selective reporting (reporting bias)	Low risk	Outcomes appear to be reported as planned.
Baseline outcome measurements similar	Low risk	2018: outcome measures adjusted for clusters and baseline scores. 2020: there were no important differences in the baseline characteristics of the patients in the 2 study arms.

Sandelowsky 2018 *(Continued)*

Baseline characteristics similar	Unclear risk	2018: baseline scores are not compared between groups. 2020: Table 1, slightly more younger patients in intervention 2, but rest of characteristics similar.
Protect against contamination	Low risk	Randomisation was by practices - unlikely that control practices would have received the intervention. Unclear if staff worked across multiple clinics - no mention.

Shelesky 2012

Study characteristics	
Methods	***Aim of study:*** to determine the effect of direct observation and formal feedback (DO-FF) as a formative tool in the training of family medicine interns ***Study design:*** stratified, single-blinded, RCT ***Geographic location:*** USA ***Study setting:*** community-based residency programme ***Number of study sites:*** 14 interns ***Number of arms/groups:*** 2 ***Unit of allocation:*** intern ***Study start date:*** not specified ***Study end date:*** not specified
Participants	***Type of participants:*** family medicine interns ***Recruitment method:*** incoming intern class; they were given the option to opt out ***Inclusion criteria:*** incoming intern class ***Exclusion criteria:*** not specified ***Number of participants:*** 14 interns
Interventions	**Augmented practice (DO-FF):** intervention group received DO-FF 4 times/month on their inpatient history and physicals (H&Ps) for the first 3 months of their internship by a SFMR or faculty development fellow who was on call with them. Formal feedback was written and verbal, facilitated by a feedback form internally developed. All SFMR participated in a 'How to Give Effective and Useful Feedback' workshop administered by the primary investigator. This consisted of a 10-minute lecture followed by 3 x 10-minute role-plays. All interns were videotaped while on-call at the beginning, middle and end of the study period. **Routine practice:** all interns were videotaped while doing H&Ps at the beginning, middle and end of the study.
Outcomes	***Outcome measure:*** assessment of intern clinical skills (management of COPD) on a 9-point scale at 6 weeks (part of the validated internal medicine resident evaluation form). Videos validated by independent assessors. ***Time point:*** 6 and 12 weeks
Notes	***Trial registry:*** not specified

Shelesky 2012 *(Continued)*

Funding source: not specified

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"Randomized to one of two groups (ie, DO-FF or routine) using a random number generator".*
Allocation concealment (selection bias)	Low risk	*"Order of the rotations was independently determined by the chief resident for Scheduling and the residency program director."*
Blinding of participants and personnel (performance bias) All outcomes	Low risk	*"Allocation concealment was maintained throughout the study period by interns never knowing to what group they were assigned."*
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Two blinded, independent reviewers evaluated videotaped inpatient H&Ps. The video reviewers were blinded to each other, the treatment group and date of the video.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No attrition. *"All 14 interns completed study. One member of the medium group only had call four times instead of the predicted 10 because there was an injury in the intern class requiring a rotation change."*
Selective reporting (reporting bias)	High risk	Raw data not provided; only graphical representation provided, and only for outcomes where there was a significant difference.
Baseline outcome measurements similar	Low risk	No statistical difference in baseline IMREF scores.
Baseline characteristics similar	Low risk	No statistical difference between treatment groups or strata with respect to demographic characteristics, initial PCCS scores or initial IMREF scores.
Protect against contamination	High risk	Some people in the control group received DO-FF. How often this may have happened is unknown.
Other bias	High risk	To encourage participation, incentives were provided.

Shrestha 2006

Study characteristics

Methods	***Aim of study:*** to assess the impact of Practical Approach to Lung Health (PAL) guidelines on prescription behaviour and the total cost of prescriptions for patients with asthma, chronic obstructive pulmonary disease and pneumonia ***Study design:*** pre- and post-intervention in a cluster-RCT ***Geographic location:*** Nepal ***Study setting:*** health and sub-health posts ***Number of study sites:*** 40 ***Number of arms/groups:*** 2

Shrestha 2006 *(Continued)*

	Unit of allocation: health facility ***Study start date:*** baseline prescriptions from February to May 2002 ***Study end date:*** post-intervention prescriptions from October 2002 to January 2003
Participants	***Type of participants:*** health facilities ***Recruitment method:*** of the 76 facilities in district of Nawalparasi, 40 were included in the study on the basis of highest patient attendance. Of these, there were 7 health posts and 33 sub-health posts. ***Inclusion criteria:*** in district of Nawalparasi, included based on highest patient attendance ***Exclusion criteria:*** not specified ***Number of participants:*** 7 health and 33 sub-health posts
Interventions	**Practical Approach to Lung health (PAL) Nepal guideline training:** received a copy of the standard treatment schedule (DDA 1997a) before the study. PAL guidelines adapted to Nepal, 5 days of training for health workers at the district level, and examination formats & wall posters supplied in intervention facilities. **Usual practice control:** received a copy of the standard treatment schedule (DDA 1997a) before the study, otherwise usual care
Outcomes	***Outcome measure:*** number of prescriptions for COPD ***Time point:*** pre- and-post study
Notes	***Trial registry:*** not specified ***Funding source:*** Wotro (Netherlands Foundation for the Advancement of Tropical Research for financial support and INRUD, Nepal)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	*"In the eligible health facilities, seven health posts and 33 subhealth posts, were stratified by type and subsequently randomized into PAL intervention and usual practice control groups."*
Allocation concealment (selection bias)	Unclear risk	Not detailed.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Healthcare workers not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Carbon copy prescription pads were used to assess outcome, but unsure whether field assistants who were collecting the used pads were blinded or not.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Not detailed but patient demographics were reported to be different pre- and post-intervention group.
Selective reporting (reporting bias)	High risk	Values of pre- and post- prescriptions are not the same between table 1 and table 2.

Shrestha 2006 *(Continued)*

Baseline outcome measurements similar	High risk	Considerable difference in pre prescriptions (total 155 vs 84, COPD 24 vs 35).
Baseline characteristics similar	Unclear risk	Limited details provided.
Protect against contamination	Unclear risk	Unclear if health professionals worked at multiple sites or if patients changed sites.
Other bias	High risk	Pre (February to May) and post (October to January) time periods are different times of the year, which could affect prescribing patterns and symptom prevalence (e.g. different seasons, holiday period).

Smidth 2013

Study characteristics	
Methods	***Aim of study:*** to investigate the impact of an active implementation model for a disease management programme for COPD as measured by specific indicators to determine to which degree the GPs follow the recommendations; and to determine the extent of healthcare utilisation in primary and secondary care for patients with COPD ***Study design:*** cRCT (with additional external control group) ***Geographic location:*** Denmark ***Study setting:*** GP practices ***Number of study sites:*** 16 (+ 9 acted as external control) ***Number of arms/groups:*** 2 (+ 1 external control) ***Unit of allocation:*** GP clinic ***Study start date:*** November 2008 ***Study end date:*** December 2010
Participants	***Type of participants:*** GPs and patients ***Recruitment method:*** all GP practices in the region were included in the study. The COPD patients were identified using a validated algorithm. Eligible patients were sent a baseline questionnaire. The study population consisted of responders who confirmed their COPD diagnosis. ***Inclusion criteria:*** patients 35 years old or older, registered with a GP practice in the patient's residing municipality. Patients were identified using the COPD algorithm; they had been hospitalised during the past 5 years with a lung-related diagnosis, had redeemed prescriptions on lung medication at least twice during the past year or had had their lung function tested at their GP on 2 different occasions during the past year. ***Exclusion criteria:*** patients who died during the intervention period were excluded ***Number of participants:*** 1372 participants (mean age 66.9) from 25 GP clinics 21 GPs in intervention arm, 17 in control and 25 in external control. Male 40 (63.5%), mean age 50.9 (range: 32 to 65).
Interventions	***Intervention:*** using an active structured programme. The intervention comprised components from the main areas of the Chronic Care Model (CCM) - Policies and Resources, Self-Management Support, Delivery System Design, Organisation of Healthcare and Clinical Information System. The intervention

Smidth 2013 *(Continued)*

	practices were invited to participate in 4 x 2.5-hour sessions. The Breakthrough Series was used as a framework for the implementation of planned and targeted changes. All meetings were chaired by experts and experienced facilitators, who were all clinically educated and experienced in aiding change in practice. Targeted self-management support for patients was an integral part of the strategy. The study website facilitated the process. ***Control:*** using standard programme (***External control:***not randomised)
Outcomes	***Outcome measures:*** number of patients who had a spirometry performed at the GP practice (intervention vs control, and intervention vs external control); PACIC score ***Time point:*** 12 months
Notes	***Trial registry:*** NCT01228708 ***Funding source:*** funded by the Ringkoebing-Skjern Municipality, the Central Denmark Region and the Medical Research Fund at Aarhus University, Denmark

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	*"An independent researcher drew slips that were matched to an eletronic record of all GP practices in the Ringkoebing-Skjern Municipality. "* (Note: external control group not randomised, but those data not used for this review).
Allocation concealment (selection bias)	Low risk	Independent researcher.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No blinding.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No blinding.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No follow-up.
Selective reporting (reporting bias)	Low risk	The primary outcomes described in the trial registry are reported in the outcome paper.
Baseline outcome measurements similar	Unclear risk	It seems like there is some imbalance in some aspects of the outcome measure.
Baseline characteristics similar	Unclear risk	There was some imbalance in the baseline characteristics of GPs (e.g. number of patients per GP, percentage not performing spirometry routinely).
Protect against contamination	Low risk	Cluster-randomisation.

Soler 2010

Study characteristics	
Methods	***Aim of study:*** we hypothesised that primary diagnosis of COPD and adequate management of COPD patients in primary care would change after an accurate training exercise based on the application of the Spanish Society for Pulmonology and Thoracic Surgery (SEPAR) guidelines and the introduction of office spirometry, especially for symptomatic cases with unsuspected airflow obstruction. ***Study design:*** RCT (Phase 2) ***Geographic location:*** Spain ***Study setting:*** general practice, both rural and urban ***Number of study sites:*** 2624 physicians who were GPs in primary care centres in 40 populations in Spain ***Number of arms/groups:*** 3 ***Unit of allocation:*** GP ***Study start date:*** data were collected from October 2004 ***Study end date:*** competed data collection in December 2005
Participants	***Type of participants:*** GPs, patients ***Recruitment method:*** GP: a representative sample of Spanish GPs from general practices in both rural and urban populations. In order to obtain a representative sample of patients, each participating GP selected the 5 first patients with COPD or suspected COPD in their general practice. ***Inclusion criteria:*** GP: a representative sample of Spanish GPs Target patient population: over 35 years of age, diagnosed COPD or current smokers with suspected COPD, who agreed to participate ***Exclusion criteria:*** GPs: phase 1 included 3254 GPs, 630 declined to participate and were excluded from Phase 2 (no details given); 2624 physicians in Phase 2 (RCT) Patients: not specified ***Number of participants:*** 2624 physicians and 12835 patients
Interventions	**Control group (G1):** usual care, no training **Training group (G2):** SEPAR guidelines and training **Training group + portable device for spirometry (G3):** SEPAR guidelines and training, + portable spirometer
Outcomes	***Outcome measure:*** change in primary diagnosis of COPD; change in number of spirometric studies, blood gas tests, chest X-rays; drugs prescribed for mild COPD (anticholinergic + SABA, LABA + corticosteroids, SABA, LABA, anticholinergic agents, theophylline, oral corticosteroids, ICS, antibiotics); drugs prescribed for moderate to severe COPD (anticholinergic + SABA, LABA + corticosteroids, SABA, LABA, anticholinergic agents, theophylline, oral corticosteroids, ICS, antibiotics) ***Time point:*** after training session
Notes	***Trial registry:*** not specified ***Funding source*** **:** supported by Spanish Public Health Services Research grant PI041136 and CIBER de Enfermedades Respiratorias (CIBERES)

Soler 2010 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No details.
Allocation concealment (selection bias)	Unclear risk	No details.
Blinding of participants and personnel (performance bias) All outcomes	High risk	GPs not blinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	GPs 'selected' the first 5 patients with COPD or suspected COPD seen consecutively in their respective offices. Not sure if assessors were blinded.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Table 1 numbers of participating GPs in Phase I not consistent with flow chart.
Selective reporting (reporting bias)	Unclear risk	Method not well described.
Baseline outcome measurements similar	Unclear risk	No P values provided in text in terms of baseline outcome measurements.
Baseline characteristics similar	Unclear risk	Similar according to Table 2, but no P values provided. Authors report no statistically significant differences in GPs, however differences apparent (e.g. in % urban centres).
Protect against contamination	Unclear risk	No details.

Terry 1981

Study characteristics	
Methods	***Aim of study:*** to evaluate the effectiveness of audio-visual programs in increasing the knowledge and changing the practice habits of physicians. The following hypotheses were tested: 1) information gained from a home-study CME course will be retained and utilised during patient visits, and 2) the additive effects of educational elements (physician participation in choosing educational elements will result in a ranking of retained knowledge in the experimental groups. ***Study design :*** cluster-RCT ***Geographic location:*** USA ***Study setting:*** primary care ***Number of study sites:*** 15 geographic clusters ***Number of arms/groups:*** 5 ***Unit of allocation:*** geographic clusters

Terry 1981 *(Continued)*

	Study start date: not specified ***Study end date:*** not specified
Participants	***Type of participants:*** GPs ***Recruitment method*:** all primary care practitioners (general, family, internal medicine) who provided services to at least 5 patients with COPD reimbursed by the United Mine Workers Health and Retirement Funds, in a 10-county area in a coal mining region of western Pennsylvania ***Inclusion criteria:*** GPs: all primary care practitioners who provided services to at least 5 patients with COPD reimbursed by the United Mine Workers Health and Retirement Fund, in a 10-county area in a coal mining region of western Pennsylvania ***Exclusion criteria:*** not specified ***Number of participants:*** 144 GPs
Interventions	**E1 - Entire program:** group meetings, AV program, questionnaires and feedback **E2 - Entire program but no feedback:** group meetings, AV program, questionnaires **E3 - Entire program but group meetings:** AV program, questionnaires and feedback **E4 - Entire program but no group meetings or feedback:** AV program, questionnaires **C – Control:** questionnaires, unrelated pulmonary AV program
Outcomes	***Outcome measure:*** self-assessment questionnaire (SAQ) testing physicians knowledge and judgement related to diagnosis and treatment of chronic bronchitis and emphysema. 25 questions (of the total 44 baseline questions) ***Time point:*** 9 and 18 months
Notes	***Trial registry:*** not specified ***Funding source:*** United Mine Workers Health and Retirement Funds

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No details.
Allocation concealment (selection bias)	Unclear risk	No details.
Blinding of participants and personnel (performance bias) All outcomes	Low risk	All groups received each part of the 'intervention', but some groups received sham information (i.e. unrelated pulmonary AV program instead of AV program tested).
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Self-administered questionnaire.
Incomplete outcome data (attrition bias) All outcomes	High risk	383 eligible physicians in the 10-county area, 144 filled out first SAQ, 63 completed the 2 AV programs and all 3 SAQs. 44 of 63 participated in simulation patient visits.

Terry 1981 *(Continued)*

Selective reporting (reporting bias)	High risk	Exact SAQ scores not given for individual experimental groups (only mean provided in graphic representation).
Baseline outcome measurements similar	Unclear risk	No significant differences when the aggregated experimental groups who completed ALL the SAQs were compared with the control group who completed ALL the SAQs. No details provided for entire 144 cohort that filled out first SAQ.
Baseline characteristics similar	Unclear risk	No details provided in paper. Paper does say no significant difference between those that dropped out and those who completed entire study.
Protect against contamination	Low risk	Geographic clusters were unit of allocation.
Other bias	High risk	Site for study chosen because of funding body's offer to help in contacting physicians treating miners.

Thoonsen 2015

Study characteristics	
Methods	***Aim of study:*** does early identification and proactive palliative care planning of palliative patients by the GP influence: 1) place of death, number of transitions and number of contacts with the out of hours primary care service? 2) QoL of patients and their informal caregivers and prescriptions? 3) GP satisfaction with the delivered palliative care, and their own assessment of their ability to provide palliative care? ***Study design:*** 2-armed cluster-RCT ***Geographic location:*** Netherlands ***Study setting:*** Comprehensive Cancer Centres ***Number of study sites:*** 159 GPs from 2 comprehensive cancer centres ***Number of arms/groups:*** 2 ***Unit of allocation:*** GP ***Study start date:*** February 2009 ***Study end date:*** February 2011
Participants	***Type of participants:*** GPs ***Recruitment method:*** GPs in 2 comprehensive cancer centres were invited by mail to participate in the study. After 1 month a reminder was sent to non-responders. ***Inclusion criteria:*** GPs in 2 comprehensive cancer centres involved in the study, who wanted to participate ***Exclusion criteria:*** GPs who were consultants in palliative care or who were locums ***Number of participants:*** 159 GPs
Interventions	**Intervention group:** 5 hours training from experienced GP (including use of 2 tools to assist identifying patients and structuring discussion with patients), coaching session with palliative care physician and 2 peer group sessions (with other GPs) 8 and 10 months later

Thoonsen 2015 *(Continued)*

	Control group: usual care
Outcomes	***Outcome measure:*** number of contacts with the out-of-hours GP co-operative; hospital admissions ***Time point:*** in the last 3 months
Notes	***Trial registry:*** NTR2815 ***Funding source:*** the Netherlands Organisation for Health Research and Development (ZonMw)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"Randomly assigned to the intervention or the control condition by an independent statistician. Borland C software was used to randomly allocate GPs, as sequentially numbered containers, to the strata of one of both groups."*
Allocation concealment (selection bias)	Unclear risk	Limited details. Independent statistician.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded.
Blinding of outcome assessment (detection bias) All outcomes	High risk	GPs (unblinded) recorded data from medical records, also unclear if those that analysed results were blinded or not.
Incomplete outcome data (attrition bias) All outcomes	High risk	> 50% attrition for both groups.
Selective reporting (reporting bias)	Unclear risk	Some outcomes not reported just for COPD patients, unclear if this was planned.
Baseline outcome measurements similar	Unclear risk	Not reported.
Baseline characteristics similar	Low risk	Baseline characteristics comparable.
Protect against contamination	Low risk	To prevent contamination, those GPs working together in the same practice were placed in the same study group.

Tinelli 2003

Study characteristics

Methods	***Aim of study:*** to verify the applicability of the guidelines in routine practice of GPs and to evaluate whether adherence to the guidelines increases the efficacy of treatment of patients, as demonstrated by a decrease in exacerbations, hospital admissions, use of drugs and outpatient appointments and an improvement in QoL. ***Study design:*** cRCT

Tinelli 2003 *(Continued)*

	Geographic location: Italy ***Study setting :*** primary care GP clinics ***Number of study sites:*** 22 (GPs) ***Number of arms/groups:*** 2 ***Unit of allocation:*** GP ***Study start date:*** June 1998 ***Study end date:*** June 2000
Participants	***Type of participants:*** GPs, patients ***Recruitment method:*** **GPs:** of 117 GPs working in the catchment area, 58 who are part of a scientific group of GPs were contacted, and of these 22 agreed to enter the study. **Patients:** once GPs were randomised, all the GP's patients with COPD who fulfilled inclusion criteria were enrolled and followed for 1 year under natural conditions ***Inclusion criteria:*** all patients with COPD seen by participating GP between June 1998 and June 1999 ***Exclusion criteria:*** altered mental state or those who did not provide written consent ***Number of participants:*** intervention: 12 GPs, 72 patients (mean ± SD age 67.8 ± 10.7, 76.4% male); control: 10 GPs, 51 patients (mean ± SD age 69.7 ± 10.1, 47.1% male)
Interventions	**Intervention: yes-guidelines (GL):** guideline provision and consultable algorithm. GPs asked to apply the guidelines. GPs were provided with a programme presenting the guidelines as an easily consultable algorithm. **Control: no-GL:** usual care. GPs asked to continue current clinical practice.
Outcomes	***Outcome measures:*** SF-36 questionnaire (Italian); number of episodes of exacerbations (categorised as none, low (1 to 2) and high (3+)); number of admissions to hospital because of COPD (categorised as none, low (1 to 2) and high (3+)); severity of COPD (mild, moderate, severe); FEV_1 tested (yes/no); number of drugs prescribed by the GP for COPD ***Time point:*** 12 months
Notes	***Trial registry:*** N/A ***Funding source:*** supported by a grant (Ricerca corrente 1998) from the IRCCS Policlinico S. Matteo, Pavia, Italy

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	No details on randomisation.
Allocation concealment (selection bias)	Unclear risk	No details on allocation concealment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded.

Tinelli 2003 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	GPs collected data? Unclear who analysed data and if they were blinded.
Incomplete outcome data (attrition bias) All outcomes	Low risk	No reported attrition, except for SF36 (35% and 29%).
Selective reporting (reporting bias)	Unclear risk	Reported as per methods, but no trial registry or published protocol.
Baseline outcome measurements similar	Unclear risk	Limited baseline details for outcomes, FEV_1 unbalanced.
Baseline characteristics similar	Unclear risk	Male/female distribution different, and distribution of smoking habits unbalanced. Unclear impact.
Protect against contamination	Unclear risk	No details provided.

Torres-Robles 2021

Study characteristics	
Methods	***Aim of study:*** to evaluate the effectiveness of a community pharmacist-led medication adherence management intervention for adult patients being treated with hypertension, asthma or COPD medications on medication adherence and clinical outcomes compared with usual care ***Study design:*** cluster-RCT ***Geographic location:*** Spain ***Study setting:*** pharmacy ***Number of study sites:*** 98 randomised (94 at baseline) ***Number of arms/groups:*** 2 ***Unit of allocation:*** cluster (pharmacy) ***Study start date:*** 29 September 2017 ***Study end date:*** 30 April 2018
Participants	***Type of participants:*** pharmacists, patients ***Recruitment method:*** **Pharmacies:** an invitation letter to enrol in the study was sent to all the pharmacies in each province by the local pharmacy professional body. **Patients** were recruited consecutively in the participant community pharmacies for 2 months. Filling a prescription (for new or/and existing prescribed medications) was the prompt for the pharmacist to initiate a conversation about the study with potential eligible patients ***Inclusion criteria:*** **pharmacies:** availability of a counselling area; availability of at least one pharmacist to provide the intervention; and the attendance of all pharmacists to an initial training session before the beginning of the study. **Patients'** inclusion criteria were: 18 years or older; signature of the informed consent; ability to complete EuroQol-5D, Morisky-Green Levine Medication Adherence Questionnaire (MGL MAQ), Asthma

Torres-Robles 2021 *(Continued)*

	Control Questionnaire (ACQ) or CCQ; and to have a prescribed medication for hypertension, asthma or COPD ***Exclusion criteria*:** patients: collecting someone else's medication; were pregnant or lactating; could not attend the pharmacy on a regular basis; had previously participated in any adherence education programme or study; had communication limitations or any other impairment the recruiting pharmacist considered as precluding them from participating in the study ***Number of participants:*** **intervention:** analysed: 50 pharmacies, 69 pharmacists, 633 patients. Total number with COPD: 145 (22.9%); **control:** analysed: 44 pharmacies, 65 pharmacists, 553 patients. Total number with COPD: 154 (27.8%).
Interventions	**Intervention: medication adherence management intervention.** Pharmacists in the IG received an initial training that covered the following topics: study protocol, management of the targeted conditions, frameworks for changing patient behaviour and educational skills to provide the intervention, over a 2-day session. Patients attended 6 F2F monthly visits, undertaken in the pharmacy counselling area. Intervention for patients included: 1) Pharmacist interview to assess adherence to medications for asthma, COPD or hypertension using the MGL MAQ. 2) Classification of patients as non-adherent (non-intentional, intentional or combined) or adherent. 3) Identification of barriers for medication adherence. Barriers could be practical, defined as gaps in knowledge or skills; or perceptual, namely those associated with the patient's health beliefs and perceptions about the condition and their medications. 4) Intervention proposal using strategies tailored to the type of non-adherence and identified barriers. 5) Application of the trans-theoretical model of behavioural change by which the pharmacist elicited the patient's readiness to change while discussing the proposed strategies. 6) Follow-up through monthly scheduled visits to review patient progress and provide feedback or new strategies to improve or maintain adherence. 7) Application of motivational interviewing principles and skills during the patient–pharmacist interaction. **Control: usual care - defined as supply of medicines and medication-taking advice**. Pharmacists in the control group were only trained in data collection and study procedures.
Outcomes	***Outcome measures:*** EQ-5D; MGL MAQ; CCQ ***Time point:*** 6 months
Notes	***Trial registry:*** ACTRN12618000410257 ***Funding source:*** funded and supported by Laboratorios Cinfa

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"They were assigned by an independent researcher after they agreed to participate in the study to either an intervention group (IG) or control group (CG) using a computer-generated list of random numbers with ratio 1:1."*
Allocation concealment (selection bias)	Unclear risk	Not specified.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Pharmacists unblinded, patients blinded.
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Patients self-completed questionnaires, patients meant to be blinded to group allocation.

Torres-Robles 2021 *(Continued)*

Incomplete outcome data (attrition bias) All outcomes	Low risk	Small level of attrition, explained in study flow chart.
Selective reporting (reporting bias)	Unclear risk	Additional outcomes listed on trial registry (e.g. proportion of days covered adherence) not mentioned. EQ-5D and economic outcomes not yet published.
Baseline outcome measurements similar	Low risk	Appear similar.
Baseline characteristics similar	Low risk	Appear similar.
Protect against contamination	Low risk	Cluster-randomised to minimise contamination.

Uzzaman 2020

Study characteristics	
Methods	***Aim of study:*** to assess the feasibility of a blended learning approach to a COPD CME course for GPs in Bangladesh ***Study design:*** RCT ***Geographic location:*** Bangladesh ***Study setting:*** primary care (GPs) ***Number of study sites:*** 49 (GPs) ***Number of arms/groups:*** 2 ***Unit of allocation:*** GP ***Study start date:*** July 2019 ***Study end date:*** August 2019
Participants	***Type of participants:*** GPs ***Recruitment method:*** the COPD course, which was provided free of charge, was advertised nationally through the training management portal of the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b), and social media was used to disseminate the course advertisement. Potential participants applied through the icddr,b portal. ***Inclusion criteria:*** GPs providing public and private primary healthcare services in Bangladesh were invited to participate. GPs in Bangladesh have an MBBS (Bachelor of Medicine and Surgery) are registered by the Bangladesh Medical and Dental Council, have at least 2 years' experience of clinical service but with no specialist post-graduate training ***Exclusion criteria:*** GPs who had previously participated in post-graduate COPD training at any time ***Number of participants:*** 50
Interventions	***Intervention:*** blended learning in COPD CME course for GPs: the total training was 40 hours in both blended and traditional learning approaches. Online plus classroom-based face-to-face, 40 hours: online 16 hours; face-to-face 24 hours. The courses contained the same content: components aimed at enhancing COPD knowledge (16 hours) and skills (24 hours). A private Facebook group was created to

Uzzaman 2020 *(Continued)*

	provide online learning support for both groups monitored by a tutor and for peer discussion. The tutors were GPs with expertise in respiratory care and had considerable experience of delivering training. ***Control:*** traditional approach in COPD CME course for GPs. Only classroom-based F2F: 40 hours F2F, 5 consecutive days F2F; and private Facebook group.
Outcomes	***Outcome measures:*** COPD-PPAQ score; confirm diagnosis by pulmonary function tests; assess level of function and disability; document frequency and severity of COPD exacerbations; prescribe at least one long-acting bronchodilator; prescribed ICS + LABA in combination and TIO if MRC > 3 + exacerbations (> 1/year); provide an exercise prescription to promote regular physical activity; refer to pulmonary rehabilitation programme if MRC > 3; provide written referral for structured patient education; provide a written action plan for exacerbation management; provide smoking cessation counselling and pharmacological intervention if smoking; assess inhaler/device technique (or refer to COPD educator) at each visit; refer to specialist if diagnosis is uncertain, if clinical deterioration is rapid or if home oxygen or surgical options are being considered ***Time point:*** 1 month
Notes	***Trial registry:*** N/A ***Funding source:*** MNU was supported by a Fellowship from the NIHR Global Health Research Unit on Respiratory Health (RESPIRE) at the University of Edinburgh: 16/136/109. RESPIRE is funded by the National Institute of Health Research using Official Development Assistance (ODA) funding

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Computer-generated randomisation list.
Allocation concealment (selection bias)	Unclear risk	No detail specified.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Unblinded, self-assessed outcome.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	24% vs 16% dropout, no comparison of characteristics between groups.
Selective reporting (reporting bias)	Unclear risk	No trial registration information or protocol to check, results in paper appear to match methods.
Baseline outcome measurements similar	Unclear risk	Supplementary 4 - overall groups similar, but some individual items quite different between groups.
Baseline characteristics similar	Unclear risk	Two groups seem to be slightly unbalanced - especially years of experience, no. of COPD patients per month.
Protect against contamination	Low risk	Two types of learning, no risk of contamination between groups.

Walters 2008

Study characteristics	
Methods	***Aim of study:*** to compare the effects of 2 practice-based models of spirometry delivery, opportunistic spirometry by visiting trained nurse and "usual care" in practices provided with equipment, training and payment, on spirometry uptake and application in patients at risk of COPD and translation into new diagnoses of COPD recorded by GPs ***Study design:*** cRCT ***Geographic location:*** Australia ***Study setting:*** primary care practices (6 urban, 2 rural) ***Number of study sites:*** 8 ***Number of arms/groups:*** 2 ***Unit of allocation:*** practice ***Study start date:*** November 2004 ***Study end date:*** December 2005
Participants	***Type of participants:*** GPs ***Recruitment method:*** **Practices:** recruited through a newsletter distributed to all practices in Southern Tasmania (74 urban, 20 rural) ***Inclusion criteria:*** **Patients:** > 35 years, and ever smoked regularly ***Exclusion criteria:*** nil mentioned ***Number of participants:*** 48 GPs - intervention: 29 GPs, 531 patients received spirometry (mean ± SD age 56.0 ± 21.0, 48.6% male); usual care; 19 GPs, 87 patients received spirometry (mean ± SD age 57.4 ± 21.0, 47.1% male)
Interventions	**Intervention:** trained nurse model (TN): trained spirometry nurses visited practices to perform opportunistic patient testing. Spirometry advertisement in practice. Nurses trained in spirometry testing visited each practice for 2 x 3-hour sessions per week to perform opportunistic testing. Practice staff invited any patient in the target group who attended during a spirometry session to undergo lung function testing. Spirometry was also advertised by posters or performed at the request of GPs. Printed spirometer output (without classification or interpretation) was faxed to GPs within 48 hours. **Usual care:** spirometer provided to practice and education and spirometry training given. AUD 10 reimbursement for spirometry (comparable to Medicare). A spirometer was provided to the practice and education and spirometry training given. After training, spirometry was performed by a GP or practice nurse/assistant according to the usual practice protocol. Practice publicity was discretionary. Practices retained spirometry trace for GP interpretation and received reimbursement for patients tested in the target group (AUD 10). **Both groups:** GPs and other nominated staff were trained during a 2-hour workshop by a physiologist and respiratory specialist physician in performance of spirometry, interpretation and criteria for diagnosing COPD according to GOLD and Australian guidelines.
Outcomes	***Outcome measures:*** Number of spirometry tests performed in 6 months and proportions of eligible target group tested ***Time point:*** 6 months Impact of spirometry on the diagnosis of COPD. Number of people who consulted with GP by 3 months after spirometry and had a new doctor recorded diagnoses of COPD.

Walters 2008 *(Continued)*

	Time point: 3 months
Notes	***Trial registry:*** ACTRN12605000019606 ***Funding source:*** *"JAW was the recipient of a 2006 GSK Australia postgraduate support grant"*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Practices randomised using a random numbers table.
Allocation concealment (selection bias)	Unclear risk	No details on allocation concealment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	Unblinded, could have changed practice (e.g. encouraging patients to do spirometry).
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Not specified who extracted computer records, or if those that reviewed spirometry results were blinded.
Incomplete outcome data (attrition bias) All outcomes	High risk	52% and 45% of spirometry results did not meet the prespecified spirometric criteria for proceeding to practice record extraction (for impact of spirometry outcomes).
Selective reporting (reporting bias)	Low risk	As per methods, and trial registered.
Baseline outcome measurements similar	Low risk	FEV_1% predicted - no statistical difference between groups.
Baseline characteristics similar	Unclear risk	Characteristics similar - differences in self-reported respiratory diagnosis and self-report of COPD. Unclear of impact as self-reported taken out of analysis before "impact of spirometry" outcome assessed.
Protect against contamination	Unclear risk	Practice is unit of allocation. Possible that GPs could work at multiple sites, especially given Tasmania geography.

Walters 2013

Study characteristics

Methods	***Aim of study:*** to investigate the hypothesis that telephone-delivered health mentoring by nurses in community-recruited patients with stable moderate or severe COPD would increase self-management capacity and improve QOL and psychological well-being ***Study design:*** cRCT ***Geographic location:*** Australia ***Study setting:*** general practice ***Number of study sites:*** 31

Walters 2013 *(Continued)*

	Number of arms/groups: 2 ***Unit of allocation:*** GP clinic ***Study start date:*** May 2008 ***Study end date:*** December 2010
Participants	***Type of participants:*** nurses, patients ***Recruitment method:*** all practices using a computerised patient database in the 3 divisions of general practice were invited to participate. An investigator presented information to GPs, practice managers and practice nurses and obtained consent. Patients were identified by the GPs through database searches based on a diagnostic code for COPD or prescription of tiotropium. Eligible patients were mailed information and responders screened by telephone and by spirometry to confirm eligibility. ***Inclusion criteria:*** **Patients:** smoking history > 10 pack-years, post bronchodilator FEV_1/FVC ratio < 0.7 and FEV_1 30% to 80%, able to complete procedures and provide informed consent ***Exclusion criteria:*** unable to participate in self-care activities due to mental or physical incapacity, end-stage cancer, poor English language skills and nursing home resident ***Number of participants:*** 182 participants (92 in usual care and 90 in HM group) from 31 GP clinic (13 in usual care and 18 in HM group) ***Mean age (SD) of patients:*** 67.3 (7.6) in usual care and 68.2 (7.9) in HM group ***Number completed:*** 80 in usual care and 74 in HM group
Interventions	**Intervention: Health Mentor (HM) Group:** health mentoring has a cognitive behavioural basis and involves 5 core components to support self-management: 1) Psychoeducation about common psychological reactions to COPD diagnosis and treatment; 2) self-management skills training, including goal setting, action planning and problem solving skills to manage setbacks; 3) cognitive coping skills training to identify and challenge negative COPD-related cognitions that impede self-management; 4) communication skills to facilitate discussion between the health mentor (HM) and the patient; and 5) promoting self-efficacy to manage chronic illness. For the study, community health nurses undertook 12 hours of HM training over 2 days that covered COPD management (1 hour), chronic disease self-management and health behaviour change components including practice role plays (7.25 hours), online training and study methods (3.75 hours). Community health nurses employed by state community health services (n = 31) were trained as HMs and received ongoing support during the study, via a resource manual and through regular meetings with each other facilitated by the trainers. **Control: usual care group:** patients in the control group received their usual care as provided by a GP plus regular monthly phone calls from a research nurse, to avoid confounding by difference in periodic contact. The telephone calls did not provide specific psychological advice or skills training but were recorded for content analysis.
Outcomes	***Outcome measure*:** SGRQ; SF-36 (physical component summary); SF-36 (mental health component summary); adherence to medications ***Time point:*** baseline, 6 months and 12 months ***Outcome measure:*** hospital admission for COPD ***Time point:*** 12 months
Notes	***Trial registry:*** ACTR 12608000112369 ***Funding source:*** National Health and Medical Research Council (NHMRC) project grant ID490028 and a Royal Hobart Hospital Research Foundation grant and a University of Tasmania Institutional Research Grant

Walters 2013 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	After recruitment, practices were randomised using a code generated by investigators from a random numbers table stratified in blocks of 4 by Rural, Remote and Metropolitan Areas (RRMA) classifications in Tasmania.
Allocation concealment (selection bias)	Low risk	Allocation occurred independently using sequentially numbered, opaque and sealed envelopes.
Blinding of participants and personnel (performance bias) All outcomes	High risk	No blinding.
Blinding of outcome assessment (detection bias) All outcomes	High risk	No blinding.
Incomplete outcome data (attrition bias) All outcomes	Low risk	13% dropout in usual care and 18% in HM group, unsure about its impact but not too high.
Selective reporting (reporting bias)	Low risk	The primary outcomes described in the trial registry are reported in the outcome paper.
Baseline outcome measurements similar	Low risk	Outcome measures matched at baseline.
Baseline characteristics similar	Low risk	The baseline characteristics of individuals in both arms appeared to be well balanced.
Protect against contamination	Low risk	Cluster-randomisation.

Weinberger 2002

Study characteristics	
Methods	***Aim of study:*** to assess the effectiveness of pharmaceutical care for adults with reactive airways disease ***Study design:*** RCT ***Geographic location:*** USA ***Study setting:*** pharmacy ***Number of study sites:*** 36 ***Number of arms/groups:*** 3 ***Unit of allocation:*** pharmacy ***Study start date:*** July 1998 (enrolment ended December 1999)
Participants	***Type of participants:*** pharmacists, patients

Weinberger 2002 *(Continued)*

	Recruitment method: **Pharmacies:** unclear how they were recruited, all same chain of pharmacies. **Patients:** CVS programmers queried their database for eligible customers, mailed letters to potential participants, attempted telephone call to non-responders, once signed opt-in form received patient details were released to project manager. Project manager conducted telephone screening. ***Inclusion criteria:*** patients: ≥ 18 years old who had filled a prescription for a breathing medication (methyxanthines, ICS, inhaled or oral sympathomimetics, inhaled parasympathetic antagonists, inhaled cromolyn sodium) at any study drug store within the previous 4 months, received ≥ 70% of their medications from a single study drug store, reported no significant impairment in vision/hearing/speech, did not reside in an institution (e.g. nursing home) and provided written consent ***Exclusion criteria:*** N/A ***Number of participants:*** 36 pharmacies (12 vs 12 vs 12), 1113 patients (447 vs 363 vs 303) Intervention = COPD (n = 185): mean ± SD age 62.2 ± 11.0, 63.8% women Control 1 = COPD (n = 130): mean ± SD age 62.9 ± 10.3, 66.2% women Control 2 = COPD (n = 138): mean ± SD age 62.2 ± 11.9, 67.4% women ***Withdrawal:*** intervention: 91 vs control 1: 67 vs control 2: 57
Interventions	**Intervention:** pharmaceutical care programme: pharmacist training, study computer, educational materials, resource guide and ongoing support + peak flow meter. Pharmacist training: investigators representing several backgrounds presented 1) an overview of pharmaceutical care and its application to reactive airways disease, 2) an orientation to the study computer and available patient-specific data, 3) explanation for interpreting and using these data for pharmaceutical care, 4) appropriate techniques for measuring PEFR, 5) study materials resources and handouts when interacting with patients; and 6) strategies to implement the programme. Study computer: when study patient filled any prescription, drugstore computer alerted pharmacists to review patient-specific data contained in a separate study computer behind the counter (e.g. dates and locations of ED visits, breathing medications, compliance). Written patient educational materials: 1-page handout, easily understood by patients. Resource guide: laminated pages with practical suggestions to help pharmacists implement the programme. Ongoing support: on-call investigator, investigator made personal visits to stores every 1 to 2 months, periodic newsletter, weekly faxed lists of recent patient activity, telephone appointment scheduling cards to facilitate interactions with patients. Patients received a peak flow meter, instructions about its use, monthly calls from research personnel to obtain current PEFR results (and data provided to pharmacists). **Control 1:** Peak Flow Monitoring Control Group. Peak flow meter but results not provided to pharmacy. Otherwise usual practice. Patients received peak flow meter, instructions about its use, monthly calls from research personnel to obtain current PEFR results but results not provided to pharmacy. Pharmacists received 4-hour training session although the topics were different and they received no components of the pharmaceutical care programme. Otherwise usual practice. **Control 2:** usual care control group. Usual care (no peak flow meters). Monthly telephone interviews did not enquire about PEFR results. Pharmacists received 4-hour training session although the topics were different and they received no components of the pharmaceutical care programme.
Outcomes	***Outcome measures:*** PEFR (transformed into the percentage of maximum predicted value based on patient's sex, age and height); disease-specific HRQoL (7-point Likert format); medication compliance with breathing medications using a single-item indicator (proportion of non-compliance); medication compliance with breathing medications over the previous month was assessed using a 4-item scale ranging from 0 (low) to 4 (high); patient satisfaction with health assessed using a validated 4-item global measure ***Time point:*** 6 months and 12 months ***Outcome measures*** **:** breathing related ED or hospital visits ***Time point:*** 12 months
Notes	***Trial registry:*** N/A

Weinberger 2002 *(Continued)*

Funding source: grant from the Agency for Healthcare Research and Quality and the Health Services Research and Development Service, Department of Veterans Affairs. This material is based on work supported in part by the Office of Research and Development, HSR&D Service, Department of Veteran Affairs

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	*"Within each triplet, we used a random number chart to assign drug stores to 1 of 3 study groups".*
Allocation concealment (selection bias)	Low risk	Blinded baseline interviewers. After interview laptop computer revealed the patient's study group assignment.
Blinding of participants and personnel (performance bias) All outcomes	Low risk	While not blinded to allocation, sufficient 'sham info' so as not to affect outcomes.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Interviewers, blinded to study group assignment, conducted baseline interviews. Unsure about ongoing interviews - assume not blinded. Unclear if this impacted.
Incomplete outcome data (attrition bias) All outcomes	Unclear risk	Two drug stores (both control) were closed during the study. Patients transferred pharmacies, but original study group was retained for analyses. (Intention-to-treat). 6-month interviews 85.1%, 12-month interviews 80.7%. Patients not completing more likely to report a hospital/ED visit in month prior to enrolment.
Selective reporting (reporting bias)	High risk	Satisfaction scores not fully reported, only P values.
Baseline outcome measurements similar	Low risk	Comparable, except for PEFR (COPD only). Results controlled for this factor.
Baseline characteristics similar	Low risk	Study groups comparable at baseline.
Protect against contamination	Unclear risk	Patients had to get > 70% of scripts from study pharmacy, assume some cross-over.
Other bias	Unclear risk	*"During the final year of the study, we paid pharmacists $50 per month for high rates of compliance with the pharmaceuitcal care protocol). Patients received $20 gift certificate for each interview completed."*

Zwar 2016

Study characteristics

Methods	***Aim of study:*** PELICAN study aimed to assess the effectiveness of PN-GP teams developing and implementing an evidence-based disease management plan for patients newly diagnosed with COPD. It was hypothesised that this intervention would lead to improved HRQoL and greater adherence to clinical practice guidelines for patients with newly diagnosed COPD, compared to usual care ***Study design:*** pragmatic, cRCT

Zwar 2016 *(Continued)*

	Geographic location: Sydney, Australia
	Study setting: general practices
	Number of study sites: 36
	Number of arms/groups: 2
	Unit of allocation: practices
	Study start date: February 2011
	Study end date: August 2013
Participants	***Type of participants:*** practices and patients
	Recruitment method: **Practices:** invited to participate with assistance from primary care organisations and through email to members of the Australian Primary Healthcare Nurses Association. **Patients:** searching of clinical information systems to identify patients meeting criteria; letter was sent to patients, and non-responders were followed up by practice staff through telephone
	Inclusion criteria: **Practices:** had computer-based patient records, employed at least one PN and had a spirometer. **Patients:** had attended the practice at least twice, with at least one visit in the preceding 12 months, and had risk factors for COPD (aged 40 to 85 years and with a documented smoking history)
	Exclusion criteria: **Patients:** had a recorded diagnosis of COPD, were unable to understand English sufficiently to complete study questionnaires or procedures or had cognitive impairment (as assessed by the nurse and GP)
	Number of participants: 36 randomised practices; 1631 patients who attended case-finding interview and subsequently 287 with a new COPD diagnosis (of which 254 attended baseline interview)
Interventions	**Case-finding training + practical education in team-based management of COPD (intervention):** all PNs completed 8 hours of training in case-finding for diagnosis of COPD including training in performance and interpretation of spirometry plus provision of a computer-based toolkit from LFA to assist with interpretation of spirometry and COPD diagnosis. In addition: further 1-day PN training, computer-based distance learning activity, care plan templates, 3-hour combined workshop for GPs and PNs, copy of COPD-X guidelines
	Case-finding training + usual care and mailed copy of COPD-X guidelines (usual care): all PNs completed 8 hours of training in case-finding for diagnosis of COPD including training in performance and interpretation of spirometry plus provision of a computer-based toolkit from LFA to assist with interpretation of spirometry and COPD diagnosis No further training, and mailing of COPD-X guidelines
Outcomes	***Outcome measure:*** SGRQ; CAT; self-report quit rate/current smoking rate; self-report influenza vaccination status; self-report pneumococcal vaccination status; correct inhaler technique; self-report PR completion; COPD knowledge questionnaire score; general health status (preliminary question from SGRQ - well or very well); post-bronchodilator FEV_1; health care utilisation for lung condition (yes or no); aware of COPD diagnosis (yes or no)
	Time point: 12 months
Notes	***Trial registry:*** ACTRN12610000592044
	Funding source: NHMRC Project Grant

Risk of bias

Bias	Authors' judgement	Support for judgement

Zwar 2016 *(Continued)*

Random sequence generation (selection bias)	Low risk	*"Randomisation was undertaken after PNs had completed spirometry and case-finding training. Randomisation and group allocation of GP practices was performed by an independent statistician using a computer-generated randomisation program, with a minimisation algorithm to ensure a balance of practice characteristics that could potentially affect study outcomes."*
Allocation concealment (selection bias)	Low risk	Randomisation was by practices and done before participant recruitment.
Blinding of participants and personnel (performance bias) All outcomes	High risk	*"In this pragmatic trial participating GPs, PNs and patient were not blind to the aims of the study or to their randomisation group."*
Blinding of outcome assessment (detection bias) All outcomes	Low risk	Project officers, who collected study outcome measures were blind to group allocation.
Incomplete outcome data (attrition bias) All outcomes	Low risk	Missing follow-up was similar across both groups.
Selective reporting (reporting bias)	High risk	Some outcomes were seemingly not reported. - 6-month outcomes - Participation in smoking cessation programme - Use of CO-verification for smoking abstinence - Appropriateness of prescribing against COPD-X guidelines - Number completed pulmonary rehabilitation changed to number attended PR - Extra outcomes not mentioned in protocol
Baseline outcome measurements similar	Low risk	Baseline primary outcome presented, outcome measures have been adjusted for baseline values.
Baseline characteristics similar	Low risk	Baseline characteristics were presented in tables and confirmed in text. Baseline characteristics differences between groups were not substantial.
Protect against contamination	Low risk	Randomisation was by practices - unlikely that control practices would have received the intervention.

AV: audio-visual; BMI: body mass index; BODE: body mass index (B), degree of obstruction (O), dyspnoea (D) and exercise capacity (E); CAT: COPD assessment test; CCQ: clinical COPD questionnaire; CI: confidence interval; CHF: chronic heart failure; CM: case method; CME: continuing medical education; COPD: chronic obstructive pulmonary disease; cRCT: cluster-randomised controlled trial; DM2: diabetes mellitus type 2; DO-FF: direct observation and formal feedback; ED: emergency department; EMR: electronic medical records; F2F: face-to-face; FEV_1: forced expiratory volume in 1 second; FVC: forced vital capacity; GOLD: Global Initiative for Chronic Obstructive Lung Disease; GP: general practitioner; HADS: Hospital Anxiety and Depression Scale; HMR: home medication review; HRQoL: health-related quality of life; ICPC: international classification of primary care; ICS: inhaled corticosteroid; IDM: integrated disease management; IG: intervention group; ILO: intended learning outcomes; IPAQ: International Physical Activity Questionnaire; IQR: interquartile range; LABA: long-acting beta agonist; LINQ: Lung Information Needs Questionnaire; MGL MAQ: Morisky-Green Levine Medication Adherence Questionnaire; MM: medical management; MRC: Medical Research Council; mMRC: modified Medical Research Council; NHS: National Health Service; PACIC: patient assessment of chronic illness care; PBL: problem based learning; PC: primary care; PCP: primary care physician/provider; PEFR: peak expiratory flow rate; PHCC: primary healthcare centre; PHNs: primary health networks; PIs: project investigators; PNs: practice nurses; PPAQ: physician practice assessment questionnaire; PR: pulmonary rehabilitation; QA: question and answer; QoL: quality of life; RTI: respiratory tract infection; SABA: short-acting beta agonist; SD: standard deviation; SF-36: short form-36; SFMR: senior family medical resident; SGRQ: St George's Respiratory Questionnaire; SMAS: self-management assessment scale; TIO: tiotropium; TL: traditional learning; VAS: visual assessment scale; 6MWD: six-minute walk distance

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Abdulameer 2018	Not a RCT
Aboumatar 2019	Not a primary care setting
Angus 2012	Not a RCT or cluster-RCT
Ashmore 2013	Educational component is targeted at patient, not health professionals
Balakrishnan 2020	Not a RCT
Bitter 2019	Intervention not targeted to COPD
Bourne 2018	Intervention not targeted at health professionals
Cameron-Tucker 2016	No education component targeted to health professionals
Casey 2011	Not a RCT (qualitative analysis paper)
Casey 2013	Education component targeted to patients, not health professionals
Cave 2010	Education component directed to patients, not health professionals
Cerdan 2018	Intervention not aimed at health professionals; not conducted in a primary care setting
Chee 2019	Not a primary care setting - nurses recruited were from general ward units in an acute care tertiary hospital
Dheda 2014	No educational component directed to patients
Djibo 2018	Intervention does not target health professionals; not conducted in a primary care setting
Dominelli 2012	Not in primary care; medical students not yet health professionals
Elliot 2016	Educational component is targeted to patients, not health professionals
Fang 2011	Educational component delivered to physicians in hospitals; study design of physician training intervention was cross-over comparison, not typical cluster-randomisation design
Fortin 2016	COPD subgroup data not available
ISRCTN13367735	Not primary care (Chest Clinic in Sri Lanka)
ISRCTN20669629	Not a RCT
Janmeja 2009	No educational component; not conducted in primary care
Jans 2000	Non-randomised before-after study
Jeong 2019	Intervention is not education of health professionals
Jia 2020	Not a RCT
Jiang 2015	Quasi-randomised controlled trial

Study	Reason for exclusion
Kennedy 2013	COPD subgroup data not available
Kocks 2013	Intervention is more of a decision support tool rather than educational
Kuilboer 2006	Intervention is more of a decision support tool rather than educational
Leigh 2019	Not a RCT
Marques 2018	No educational component for health professionals (as confirmed by author Alda Marques)
Martens 2007	Intervention is more of a decision support tool rather than educational
NCT01107613	Educational component not clear; study discontinued
NCT04206735	Not primary care (same as Stefan 2020)
NCT04256070	Not directed at health professionals (author confirmed intervention purely directed at patients)
NCT04260178	Intervention was not targeted to health professionals
NCT04437238	Intervention was not targeted to health professionals
Nduaguba 2021	Not a RCT
Peikes 2009	No educational component targeted to health professionals
Porter 2021	Not a RCT
Rabow 2004	Conducted in a tertiary care setting
Rea 2004	No health professional educational component
Rebuck 1996	Conducted in a tertiary care setting
Roberts 2010	Conducted in tertiary hospital setting
Rowe 2010	No published COPD results - only published asthma results (Cross 2014); unsure if COPD aspect of study completed
Sajith 2020	Not a RCT
Sanaie 2019	Intervention was not targeted to COPD
Schouten 2007	Conducted in a tertiary hospital setting
Schroedl 2020	Not a primary care setting
Simms 2012	Conducted in a tertiary hospital setting
Slok 2016	Intervention is more of a decision support tool rather than educational
Smeele 1999	COPD subgroup data not available
Solomon 1998	Conducted in ambulatory care setting; mixture of both primary and secondary care

Study	Reason for exclusion
Stefan 2020	Not a primary care setting
Stross 1983	Conducted in a community hospital setting - not a primary care setting
Tabak 2014	No health professional educational component
Tierney 2005	Hospital-based study; intervention is more of a decision-support tool rather than educational
Valenza 2018	Educational intervention was targeted at patients hospitalised with acute exacerbation of COPD
Valero 2009	No randomisation
van den Bernt 2009	Intervention is more of a decision-support tool rather than educational
van Mourik 2012	Intervention is diagnostic screening, rather than health professional education
Vastrad 2021	Not a primary care setting
Verstappen 2003	COPD/asthma joint group data; included tests are more relevant for asthma condition
Wahlberg 2015	Intervention is use of referral templates, not health professional education
White 2019	Not a RCT
Wiegers 1993	Article in Dutch; from abstract translation: asthma study conducted with children
Wood-Baker 2012	Study design - not a RCT
Zwar 2012	No education component targeted to health professionals

COPD: chronic obstructive pulmonary disease; RCT: randomised controlled trial

Characteristics of studies awaiting classification *[ordered by study ID]*

ACTRN12618001105235p

Methods	***Aim of study:*** to assess the impact that an enhanced intervention has on medication adherence when compared with usual care and the current adherence intervention provided through utilisation of GuildCare software ***Study design:*** cluster-RCT ***Geographic location:*** Australia ***Study setting:*** pharmacy ***Number of study sites:*** 69 pharmacies ***Number of arms/groups:*** 3 ***Unit of allocation:*** cluster (pharmacy)
Participants	***Inclusion criteria:*** age > 18 years, signed consent form, signed data linkage consent form, able to complete questionnaires, prescribed either/or a blood pressure, cholesterol, depression, anxiety or COPD medication, eligibility identified via GuildCare software, medication possession ratio < 70%

ACTRN12618001105235p *(Continued)*

	Exclusion criteria: collecting someone else's medication, communication limitations or other impairments the recruiting pharmacist considers could preclude them from participating
Interventions	***Arm 1:*** patient-tailored brief complex interventions with monthly follow-up over 12 months to improve, reinforce and maintain adherence behaviour and their impact in clinical, economical and humanistic outcomes. Community pharmacists will be trained in 2 x 4-hour sessions on the study process, data collection, and behavioural change theoretical framework by study investigators trained in practice change facilitation. The training will be delivered via power point with printed materials and motivational interviewing practice sessions. ***Arm 2:*** GuildLink software educational intervention as a guided counselling session to improve adherence behaviour and their impact in clinical, economical and humanistic outcomes. Pharmacists in the GuildLink programs will be trained in the study process and data collection only. ***Arm 3:*** usual care, patients in the control group will follow the same 12 monthly interviews with the pharmacist but only sociodemographic and clinical control data will be collected and usual care will be provided. Pharmacists in the control group will be trained on the study process and data collection only.
Outcomes	***Outcome measures:*** medication adherence (medication possession ratio and Morisky 4-item questionnaire); CCQ; EQ-5D; number of hospital admissions ***Time point:*** every 3 months over 12 months
Notes	Anticipated first patient enrolment September 2018, no linked studies found Dr Elyssa Wiecek, elyssa.wiecek@uts.edu.au

Bourne 2017

Methods	***Aim of study:*** to explore the feasibility, acceptability and efficacy for the intervention to be delivered and supported by HCPs and to examine whether group-based delivery of Self-Management Programme of Activity Coping and Education (SPACE) for COPD(C), with sustained support, improves patient outcomes following the SPACE for COPD(C) intervention ***Study design:*** RCT ***Geographic location:*** UK ***Study setting:*** unclear - recruited from primary care clinics, conducted in 'community venues' ***Number of arms/groups:*** *2* ***Study start date:*** January 2015 ***Study end date:*** September 2017
Participants	Healthcare professionals and patients ***Inclusion criteria:*** patients with established diagnosis of COPD ***Exclusion criteria:*** unable to participate in exercises component of rehabilitation, unable to read English to the level of an 8-year old, unwilling to take part, or has received or participated in the Pulmonary Rehabilitation or received the SPACE manual within the last 12 months
Interventions	***Intervention (SPACE FOR COPD):*** participants in the intervention group receive a SPACE for COPD(C) manual and are asked to attend the SPACE for COPD(C) group-based self-management programme usually within 1 month of their baseline appointment. The programme is facilitated by 2 trained HCPs (e.g. physiotherapists, respiratory specialist nurses, occupational therapists and health psychologists) to groups of up to 10 participants and delivered through 6 x 2-hour sessions, over a 5-month period.

Bourne 2017 *(Continued)*

	Control: usual care - usual care, no SPACE for COPD manual
Outcomes	***Outcome measures:*** CAT, CRQ-SR, PAM, HADS, BCKQ, EQ-5D, healthcare utilisation, smoking status ***Time point:*** 6 months and 9 months
Notes	Unclear if fully based in primary care - awaiting publishing results to complete classification Contact: Sally Singh, Sally.Singh@uhl-tr.nhs.uk

Costa 2015

Methods	***Aim of study:*** implementation of disease integrated care intervention (ICI) might improve the clinical outcomes and decrease the economic burden in COPD ***Study design:*** prospective study of 201 patients with follow-up of 2 years ***Geographic location:*** Italy
Participants	Patients with a hospitalisation for acute exacerbation of COPD and followed-up for 2 years at Massa-Carrara sanitary district
Interventions	***Arm 1 (Group-ICI):*** received ICI (shared between primary care and hospital base specialists; included home visits and phone contacts by nurse care team, educational programme with individually tailored care plan and specialist supervision during scheduled visits) ***Arm 2 (Control Group):*** attended by general practitioners only
Outcomes	Hospitalisations per patient, hospitalisation days, time to first hospitalisation, disease cost
Notes	Abstract of study presented at ERS Congress 2016 - unable to obtain further details of study

ISRCTN10521920

Methods	***Study title:*** assess the feasibility and acceptability of a community based pulmonary rehabilitation programme incorporating dancing for people with COPD in Colombo district in Sri Lanka: Global RECHARGE Sri Lanka ***Aim of study:*** to develop and assess the feasibility and acceptability of a culturally appropriate pulmonary rehabilitation service in Sri Lanka ***Study design:*** feasibility RCT ***Geographic location:*** Sri Lanka ***Study setting:*** community ***Number of arms/groups:*** 2
Participants	Inclusion criteria: patients aged 18 and over with COPD
Interventions	***Intervention:*** pulmonary rehabilitation (PR): the PR programme consists of 6 weeks of disease-related education and exercises conducted twice weekly. Participants are encouraged to undertake exercise whilst at home too. Participants are asked to attend an appointment at the time of entry into the study (baseline) and at the end of the programme (6 weeks).

ISRCTN10521920 *(Continued)*

	Control: usual care
Outcomes	***Outcome measures:*** MRC dyspnoea scale, CAT, CCQ, lung health, assessed by spirometry, impulse oscillometry and diffusing capacity for carbon monoxide ***Time point:*** baseline and 6 weeks
Notes	Study dates: April 2018 to March 2021 **Participant recruitment suspended and the study closed during the coronavirus (SARS-CoV-2) pandemic** Unclear if intervention involves health professional education - investigator has stated that "*As part of the broader project (NIHR Global RECHARGE), there are some elements of training and teaching*". We will await final publication before confirming if eligible. Dr Mark Orme, mwo4@leicester.ac.uk

ISRCTN12995230

Methods	***Aim of study:*** to evaluate the effectiveness and mechanisms of action of a complex, multi-component ACP intervention, called ACP-GP, for patients with chronic, life-limiting illness(es), in the general practice setting, aimed at improving the readiness of patients to engage with ACP ***Study design:*** cluster-RCT ***Geographic location:*** Belgium ***Study setting:*** general practice ***Number of arms/groups:*** 2 ***Unit of allocation:*** cluster
Participants	36 GPs, 108 patients Inclusion criteria: Dutch-speaking GPs working in Flanders and Brussels, Belgium, are eligible to participate. GPs may practice in a group or solo setting, in urban, semi-urban or rural areas. To reduce contamination risk, 1 GP per practice will be included. In order to participate, GPs also must be able to identify and include at least 3 eligible patients. Eligible patients are those with a chronic, life-limiting illness for whom the GP answers “no” to the “surprise question”: “Would I be surprised if this patient were to die within the next 12 to 24 months?”
Interventions	***ACP-GP intervention:*** the ACP-GP intervention is designed to 1) train GPs to conduct ACP discussions with eligible patients, 2) prepare patients for the conversation by providing them with a workbook about ACP, 3) facilitate at least 2 ACP conversations between GP and patient (and SDM if present), and 4) document the outcomes of the discussion in the patient electronic medical file with the help of a structured template. ***Usual care:*** participating GPs will not receive the training or the conversation guides, and patients will not receive the workbook developed for the intervention
Outcomes	QoL using SF-12 at baseline, 3 months and 6 months
Notes	No results yet - awaiting classification as unclear how much will be COPD-specific

ISRCTN17941313

Methods	***Title:*** determining trustworthiness and safety of remote consulting during the COVID-19 pandemic in primary healthcare for chronic disease populations in Nigeria and Tanzania ***Study design:*** multi-centre international stepped-wedge cluster-randomised trial ***Geographic location:*** Nigeria and Tanzania ***Study setting:*** health clinics ***Number of study sites:*** 20 ***Number of arms/groups*** : 2 ***Unit of allocation:*** cluster (GP practice)
Participants	***Inclusion criteria:*** adult patients receiving healthcare for type 2 diabetes, hypertension, COPD and/or coronary heart disease from participating care facilities
Interventions	***Intervention:*** involves REaCH training for healthcare workers to deliver remote consulting via mobile phone to patients ***Control:*** usual care
Outcomes	Patient trust in healthcare provider, F2F consultation rate; remote consultation rate; prescribing rate defined as the number of prescriptions issued and collected; patient engagement with their health measured using the PAM-13; patient safety assessed from the number of investigations processed by the facility monthly
Notes	From August 2020 to February 2022 Awaiting classification as unclear how much data will be COPD-specific. This study will look in particular at patients with type 2 diabetes, hypertension, COPD and/or coronary heart disease

ISRCTN30110012

Methods	***Study design:*** RCT ***Geographic location:*** UK ***Study setting:*** primary care ***Number of arms/groups:*** 2
Participants	***Inclusion criteria*** **:** 18 years and older; completed PR within the last 4 weeks; clinical diagnosis of COPD; able to read and write English to the age of an 8-year-old
Interventions	***Intervention: SPACE for COPD maintenance programme.*** Those randomised to the intervention will be introduced to the SPACE FOR COPDÂ© manual at their first group session. The SPACE FOR COPDÂ© manual is divided into 4 stages and has 176 pages, providing an exercise programme and covering several education topics, with goal-setting text, case studies and activities to encourage problem solving and support behaviour change. The text is interspersed with photographs, diagrams and 'top tips' boxes. There is a single A4 sheet action plan with a sputum colour chart to manage exacerbations. For the purposes of this trial, another single page insert will be devised to facilitate longer-term goal setting. The content has been approved by the Plain English Campaign and received the Crystal Mark for clarity of British English (appropriate for an 8-year old to read). The manual will be introduced by Health Care Professionals (HCP), who have expertise in the management of COPD, the SPACE FOR COPDÂ© programme and skills in motivational interviewing. HCPs will advise patients on how to use the manual and follow it independently at home. Partic-

ISRCTN30110012 *(Continued)*

	ipants will be expected to complete an exercise diary at home. Once at home, patients will have the opportunity to contact their HCP with questions via telephone. There will be follow-up maintenance group sessions (5 to 10 participants per group), at the recruiting centres based on a previously successful format. ***Control: u sual care.*** Plus referral to a community exercise programme
Outcomes	***Outcome measures:*** endurance walking distance; EQ-5D; symptoms (breathlessness, fatigue, sputum production, cough, sleep, chest tightness) measured using the CRD; patient activation (knowledge, skills and confidence to manage COPD) measured using the PAM-13; FEV_1; adherence to the SPACE FOR COPD maintenance programme in terms of sessions attended, completion of the programme and exercise diary entries ***Time point:*** 12 months
Notes	Unclear if health professionals receive educational intervention - have emailed Dr Linzy Houchen-Wolloff, linzy.houchen@uhl-tr.nhs.uk Study dates: August 2019 to September 2022

ISRCTN44976471

Methods	***Title :*** is it possible to introduce a palliative care approach to primary care clinics to improve the quality of life of patients with chronic lung disease in South Africa? ***Aim of study:*** to assess whether it is possible to incorporate a palliative care approach into primary care (for example, GP clinics) for chronic lung disease in Western Cape. ***Study design:*** cluster stepped wedge feasibility hybrid type 2 RCT ***Geographic location:*** UK ***Study setting:*** 3 facilities: False Bay Hospital, Delft Community Health Centre and Heideveld Community Day Centre ***Number of study sites:*** 3
Participants	Patients (chronic lung disease and COPD) and family caregivers ***Inclusion criteria:*** **Patients:** 1. Adults (aged at least 18 years) attending primary care with diagnosed COPD or chronic lung disease (CLD) on the basis of the likely aetiological determinants in South Africa, namely cigarette or other smoking history, biomass fuel smoke exposure, history of previous pulmonary tuberculosis or other respiratory infections and occupational dust exposure 2. Eligible for palliative care on the basis of disease severity, with at least one of the following (breathless at rest or on minimal exertion, on home oxygen, 3 or more hospital admissions in the last year, more than 3 emergency centre (EC) visits in the last month, Karnofsky Performance Status of 50 or less, Dependence on others for activities of daily living (ADLs) 3. Able to communicate in English, Afrikaans or Xhosa 4. Able to give informed consent **Family members/caregivers:** primary caregiver to be identified by the patient, in line with the definition of caregiver: *"Unpaid, informal providers of one or more physical, social, practical and emotional tasks. In terms of their relationship to the patient, they may be a friend, partner, ex-partner, sibling, parent, child or other blood or non-blood relative."*; adult aged at least 18 years; able to communicate in English, Afrikaans or Xhosa; able to give informed consent

ISRCTN44976471 *(Continued)*

	Exclusion criteria: **Patients:** housebound and unable to attend primary care; unable to give informed consent due to loss of capacity; unable to communicate in English, Afrikaans or Xhosa; asthma **Caregivers:** paid caregivers such as nurses or social workers; aged under 18 years; not involved in day-to-day care for the COPD or CLD patient
Interventions	The study involves training, providing mentorship and support to health care professionals (working at 3 facilities in Western Cape: False Bay Hospital, Delft Community Health Centre and Heideveld Community Day Centre) to provide person-centred care to patients with chronic lung disease and their family caregivers
Outcomes	***Outcome measures:*** emergency hospital or clinic visits for dyspnoea relief recorded using the CSRI and patient diaries; health status assessed using the CAT; patient's assessment of their condition and healthcare experience assessed using the Picker Patient Experience questionnaire (PPE-15); health service and informal care usage assessed using the CSRI ***Time point*** **:** monthly intervals
Notes	Awaiting classification - unclear if all set in primary care, and how much will be COPD-specific Trial dates: 2019 to 2022

Serlin 2019

Methods	RCT
Participants	Patients
Interventions	***Intervention:*** a pharmacist and pharmacy resident within a suburban family medicine clinic offered a new service to improve the care of patients with COPD. The pharmacist interventions focused on comparing current COPD inhaler treatment with the GOLD guidelines and recommending any changes to the patient's primary care provider; assessing inhaler adherence using the 4-point validated MMAS-4; evaluating inhaler technique; providing smoking cessation education, if applicable; recommending pneumococcal and influenza vaccinations; and providing a COPD action plan. ***Control:*** usual care
Outcomes	CAT; vaccinations; smoking cessation education; inhaler adherence using MMAS-4
Notes	Awaiting classification - no full results, unclear details regarding health professional education component.

ACP: advance care planning; BCKQ: Bristol COPD Knowledge Questionnaire; CAT: COPD assessment test; CCQ: clinical COPD questionnaire; COPD: chronic obstructive pulmonary disease; CRD: chronic respiratory disease; CRQ-SR: Chronic Respiratory Questionnaire Self Report; CSRI: Client Services Receipt Inventory; F2F: face-to-face; HADS: Hospital Anxiety and Depression Scale; ICI: integrated care intervention; EQ-5D: Euro-Qol five-dimension; ERS: European Respiratory Society; FEV_1: forced expiratory volume in 1 second; HCP: healthcare professional; MMAS-4: Morisky Medication Adherence Scale; MRC: Medical Research Council; PAM: patient activation measure; PR: pulmonary rehabilitation; QoL: quality of life; RCT: randomised controlled trial; SPACE: Self-Management Programme of Activity Coping and Education

Characteristics of ongoing studies *[ordered by study ID]*

Banda 2015

Study name	Informal Health Provider and Practical Approach to Lung Health interventions to improve the detection of chronic airways disease and tuberculosis at primary care level in Malawi: study protocol for a randomised controlled trial
Methods	***Aim of study:*** to determine the effect of Informal Health Provider and Practical Approach to Lung Health interventions on the detection and management of CAD and TB at primary care level in Malawi ***Study design:*** 3-arm cRCT ***Geographic location:*** Malawi ***Study setting*** **:** primary health centres ***Number of study sites:*** 27 ***Number of arms/groups:*** 3 ***Unit of allocation:*** cluster
Participants	***Type of participants:*** informal providers, patients ***Recruitment method:*** ***Inclusion criteria*****:** health facilities that offer out-patient services only, run by low-level and middle-level healthcare workers. Patients aged 15 years and above. ***Exclusion criteria:*** health facilities offering in-patient services, or run by qualified medical doctors. Patients < 15 years, those refusing to participate or those visiting members of the household. ***Number of participants:*** 27 clusters, 30 villages from each cluster, 7 households from each village (total 5670 households)
Interventions	***Intervention arm 1:*** health centres implementing the PAL intervention. No informal provider intervention. ***Intervention arm 2:*** health centres implementing the PAL intervention. Informal provider intervention. ***Control arm:*** no intervention at health centre or informal provider level. Routine standard care will be provided.
Outcomes	Proportion of population with a chronic cough who have a TB diagnosis or airway disease(s) recorded in their health passports; proportion of population with a chronic cough on salbutamol/corticosteroid inhaler indicated in their health passports; proportion of the population with a chronic cough with a diagnosis of TB or airway disease among patients with chronic cough attending primary health care recorded in patient registers at intervention facilities; proportion of people with disabilities with a diagnosis of TB or airway disease recorded in their health passports in all arms of the study.
Starting date	The project is planned to run from January 2014 to December 2016
Contact information	Banda Hastings, hastings@reachtrust.org
Notes	Protocol for effectiveness study and cost-effectiveness analysis published (Gama 2015) No final results published as yet PACTR201411000910192--21

Broese 2020

Study name	COPD Palliative and Supportive care Implementation
Methods	***Aim of study:*** 1. Investigate the effect of the implementation of integrated palliative care on patient, informal caregiver and healthcare professional outcomes. 2. Investigate the effect of the multifaceted implementation strategy on implementation outcomes and explore what barriers hamper the implementation of integrated palliative care in routine COPD care. 3. Explore the relationship between implementation level and patient outcomes. ***Study design:*** cluster-RCT ***Geographic location:*** Netherlands ***Study setting:*** pulmonary care departments of hospitals ***Number of study sites:*** 8 ***Number of arms/groups:*** 2 ***Unit of allocation:*** hospital (cluster) ***Study start date:*** 16 April 2019 ***Study end date:*** 31 December 2020
Participants	***Type of participants:*** patients ***Recruitment method:*** hospitals: invitational letters will be sent to the heads of departments of respiratory medicine of all hospitals in the Netherlands. Patients: diagnosed with COPD and admitted to the hospital for an acute exacerbation will be invited to participate in the study. ***Inclusion criteria:*** health professionals: working at one of the participating hospitals. Patients: diagnosed with COPD and admitted to a participating hospital with an acute exacerbation. After completion of the baseline questionnaire, patients will be screened using the Propal-COPD tool. Patients with a positive Propal-COPD score will be included in the effectiveness study. ***Exclusion criteria:*** patients not able to complete questionnaires in Dutch, patients with severe cognitive decline (e.g. dementia) and patients on the waiting list for lung transplantation. ***Number of participants:*** 347 (planned)
Interventions	***Intervention:*** **integrated palliative care intervention and multifaceted implementation strategy compared to usual care (COMPASSION study)** The training consists of 2 sessions of 3 hours and addresses the core elements of integrated palliative care and its implementation. Training will be delivered by experienced training actors whose training sessions have been well received in previous research on advanced care and planning in dementia The intervention will cover: 1. Implementation Strategy: multidisciplinary regional team, website with information and guidance on palliative care in COPD, information on the project, instruction the Propal-COPD tool, multidimensional assessment (physical, psychological, social, spiritual), communication training, non-pharmacological and pharmacological dyspnoea management 2. Integrated palliative care intervention: calculation of Propal-COPD score, assessing palliative care, non-pharmacological and pharmacological treatment for breathlessness, education about the illness, individual care plan, information exchange and cooperation with GPs, planning a consultation, planning an evaluation

Broese 2020 *(Continued)*

	Control: usual care All healthcare professionals have online access to all existing guidelines on palliative care (including dyspnoea) and COPD, possibility to consult specialised palliative care teams in primary care as well as in hospitals. After the recruitment of participants has been completed, professionals of the control group will be offered similar training as the intervention group received, and they will get access to the online toolbox.
Outcomes	Quality of life as measured with the Functional Assessment of Chronic Illness Therapy Palliative care (FACIT-Pal) scale Disease-specific health-related quality of life (clinical COPD questionnaire) Unplanned healthcare use Professionals' self-efficacy and role identity with providing palliative care and discussing end-of-life Hospital Anxiety and Depression Scale (HADS)
Starting date	16 April 2019
Contact information	Johanna Broese (email: j.m.c.broese@lumc.nl)
Notes	***Trial registry:*** NL7644 ***Funding source:*** the Netherlands Organization for Health Research and Development (ZonMw)

Drennan 2014

Study name	Expanding Paramedicine in the Community (EPIC): study protocol for a randomised controlled trial
Methods	***Aim of study:*** does expanding paramedic scope of practice to include chronic disease management, characterised by home visits to facilitate the assessment and treatment of patients under the medical delegation of the primary care physician, reduce the rate of acute care hospitalisation? ***Study design*** **:** pragmatic, stratified RCT ***Geographic location:*** Canada ***Study setting:*** primary health teams/community ***Number of study sites:*** ***Number of arms/groups:*** 2 ***Unit of allocation:*** patient
Participants	Patients who are residents of the York Region, aged 18 years or older, diagnosed with and currently receiving treatment for either HF, COPD or DM, and are identified by the Family Health Care Team as being at high-risk for hospital admission Proposed total sample: 695 patients
Interventions	***Arm 1:*** community paramedic intervention (trained paramedics conducting regular home visits, including health assessments and evidence-based treatments, in partnership with primary care physicians and other community-based resources)

Drennan 2014 *(Continued)*

	Arm 2: standard of care (usual care from family health care team, including physician assessment and treatment, and periodic augmentation of care in the community at the discretion of the treating physician)
Outcomes	***Primary outcome:*** number of hospitalisations per patient after 1 year of study enrolment. Secondary outcomes at 1 year (reported as all-cause and disease-specific): calls to 911; visits to the participating family health team clinics and any after-hours clinics; length of stay in hospital if admitted; mortality; overall health status assessment using the EQ-5D measured at baseline and 1 year after study enrolment; measures of intervention compliance and safety; cost-effectiveness of intervention
Starting date	Pilot started March 2013
Contact information	Principal investigator: Laurie Morrison
Notes	Protocol published. Results of qualitative interviews published (Dainty 2018). No final results published as yet.

Godycki-Cwirko 2014

Study name	Evaluation of a tailored implementation strategy to improve the management of patients with chronic obstructive pulmonary disease in primary care: a study protocol of a cluster randomised trial
Methods	***Aim of study:*** to evaluate the effects of this tailored implementation intervention on general practitioners' adherence to guidelines ***Study design:*** pragmatic, 2-arm cRCT ***Geographic location:*** Poland ***Study setting :*** general practice ***Number of study sites:*** 18 ***Number of arms/groups:*** 2 ***Unit of allocation:*** cluster
Participants	General practices within the Lodz region of Poland, with 80 or more registered COPD patients
Interventions	***Arm 1:*** a tailored implementation program for enhancing physicians' adherence to 4 recommendations for the management of COPD patients. a) Smoker identification and brief intervention - physicians receive training in smoking status identification and smoking cessation counselling, and recording information about actions taken in medical records b) Dyspnoea evaluation - GPs asked to determine patients' status on the mMRC c) COPD checklist - checklist for practitioners with information about what should be done while consulting on a patient with COPD (e.g. patient should be given basic COPD information, treatment, expected effects of drug treatment, making patient an active, aware participant in their long-term treatment) d) Demonstration inhaler devices - practices provided training inhaler device sets for health care staff and training for GPs on how to instruct patients to use devices properly. GPs instructed to teach patients in correct use of each device.

Godycki-Cwirko 2014 *(Continued)*

	Arm 2: control group - GPs provide usual care for COPD patients. GPs receive no intervention during the study.
Outcomes	***Primary outcome:*** GPs' adherence to recommendations (COPD patients' medical records reviewed to ensure all recommendations were performed by GP) ***Secondary outcome:*** patient-reported health status, e.g. change in smoking status, quantity of COPD medications prescribed, dyspnoea perception and number of exacerbations in the past and over the study period
Starting date	September 2013
Contact information	Maciek Godycki-Cwirko, maciej.godycki-cwirko@umed.lodz.pl
Notes	Protocol published and study completed; preliminary analyses performed but no results published as yet

Kowalczyk 2021

Study name	Improvement in COPD Elderly Patients Health
Methods	***Aim of study:*** 1. To determine the effect of intervention aimed at decreasing the hospitalisation of elderly patients with J-44 as the main reason for hospital admission, compared to those receiving usual care 2. To optimise the management of elderly COPD patients 3. To examine whether intervention 1 and intervention 2 are effective, pragmatic and feasible within the primary care setting ***Study design:*** cluster-RCT ***Geographic location:*** Poland ***Study setting:*** general practice clinics ***Number of study sites:*** 84 ***Number of arms/groups:*** 3 ***Unit of allocation:*** clinic (cluster) ***Study start date:*** March 2020 ***Study end date:*** March 2021
Participants	***Type of participants:*** GPs, patients ***Recruitment method:*** 84 GP clinics in the Lodz voivodship in Poland will be identified at baseline using data from the National Health Fund's (Narodowy Fundusz Zdrowia, NFZ) electronic medical records (EHR) ***Inclusion criteria:*** Clinic criteria: clinics with at least 30 patients per clinic, aged 65 years and older with COPD. Patients with COPD will be identified by the ICD-10 code J-44 in NFZ electronic medical records; exacerbations will be defined as cases hospitalised with the J-44 code as the main reason for admission. ***Exclusion criteria*:** nil

Kowalczyk 2021 *(Continued)*

	Number of participants: 84 clusters, 2520 patients (planned)
Interventions	***Arm 1:*** educational intervention with GP and COPD checklist management skills sent once at the beginning of the study ***Arm 2:*** educational intervention with GP and COPD checklist management skills sent twice at the beginning of the study and after 6 months ***Control:*** standard care and not received COPD management skills
Outcomes	Hospitalisation (with J-44 code as main reason for admission) Deaths of elderly COPD patients, registered within practices after 12 months Specific short- and long-acting respiratory drugs prescribed after 12 months
Starting date	March 2020
Contact information	Izabela Zakowska (email: izabela.zakowska@umed.lodz.pl)
Notes	***Trial registry:*** NCT04301505 ***Funding source:*** research project no.2016/21/B/NZ7/02052 funded by Narodowe Centrum Nauki (National Science Centre Poland)

Leiva-Fernandez 2016

Study name	Efficacy of an educational intervention in primary health care in inhalation techniques: study protocol for a pragmatic cluster-randomised controlled trial
Methods	***Aim of study:*** to evaluate the efficacy of an educational intervention to train general practitioners (GPs) in the right inhalation technique for the most commonly used inhalers ***Study design*** **:** pragmatic cRCT ***Geographic location:*** Spain ***Study setting:*** general practice ***Number of study sites:*** 20 ***Number of arms/groups:*** 2 ***Unit of allocation:*** cluster (practice)
Participants	***First level:*** patients with a COPD diagnosis, being treated at participating primary care centres and being prescribed inhalation therapy ***Second level:*** GPs from general practices in primary care centres in Malaga and Almeria (Spain), who care for patients included in the COPD PAI and who are being prescribed inhalation therapy
Interventions	***First level:*** patients receive an educational intervention from their GPs to train them in correct device use (performance of inhalation technique to detect mistakes, demonstration of proper technique, opportunities to ask health professionals about proper technique, reinforcement visits at 3 and 6 months). Control group will follow standard clinical practice. ***Second level:*** demonstration of correct inhalation technique by research team and the rationale for it to a group of 2 to 4 GPs. GP participants asked to identify their mistakes and ask questions un-

Leiva-Fernandez 2016 *(Continued)*

	til full understanding of technique is achieved. Reinforcement with written information (step-by-step instructions for each device).
Outcomes	***First level variables:*** Primary outcome: performance of correct inhalation technique by patients (evaluated through a specific step-by-step test for each inhaler) Secondary outcomes: functional status (force spirometry), dyspnoea index (Basal Dyspnea Index, mMRC dyspnoea scale), health-related quality of life (SGRQ) ***Second level variables:*** Outcomes: correct performance of inhalation techniques by GPs (evaluated through a specific step-by-step test for each inhaler), knowledge about COPD and its treatment (using questionnaire specifically designed for study and based on COPD PAI, Spanish COPD guidelines and GOLD guidelines)
Starting date	January 2014
Contact information	Maria Pilar Barnestein-Fonseca, mariapbarnestein@gmail.com
Notes	Protocol published. Results of the study not yet published.

Littenberg 2016

Study name	Integrating behavioural health and primary care for comorbid behavioural and medical problems (BHPC)
Methods	***Aim of study:*** to deploy the toolkit in a broad array of primary care practices and test its impact on patient functional status as well as the practices' level of integration ***Study design:*** parallel-group, single-blinded cRCT ***Geographic location:*** USA ***Study setting:*** primary care practices ***Number of study sites:*** 4 ***Number of arms/groups:*** 2 ***Unit of allocation:*** cluster (practice)
Participants	**Primary care practices** are eligible to participate if they: have at least one PCP and at least one BHP onsite (co-located), have at least 0.5 full-time equivalent BHPs licensed to practice independently, commit to maintaining onsite BHP for the duration of the study, provide the research team with access to electronic medical records (EMRs) to identify patients with specific medical and behavioural health conditions for recruitment, are willing to complete survey instruments periodically throughout the study, and are willing to be randomised to either the active or control arm. **Patients** eligible if: are at least 18 years old, are an active patient of a participating study practice as evidenced by at least 2 visits in a period of 24 months for any purpose, including at least one in the most recent 6 months, are willing to complete 3 surveys over 2 years, and have both an eligible chronic medical condition and an eligible chronic behavioural health condition, or at least 3 eligible chronic medical conditions. Eligible chronic medical conditions include arthritis; obstructive lung disease including emphysema, chronic bronchitis, or asthma; non-gestational diabetes; and heart disease manifested as heart failure or hypertension. Eligible behavioural health conditions include mood disorder (anxiety or depression), chronic pain (including headache, migraine, neural-

Littenberg 2016 *(Continued)*

	gia, fibromyalgia, or chronic musculoskeletal pain), insomnia, irritable bowel syndrome and substance misuse (substance use disorder, tobacco use, or problem drinking).
Interventions	***Arm 1 (Integration arm):*** training for practice leaders, BHCs, PCPs and office staff, a Protocolised Redesign Process support for practice redesign, and a toolkit of suggested tactics for implementing Tasks A to D (A: Identification, B: Assessment, C: Treatment, D: Surveillance) ***Arm 2 (Co-location arm):*** a BHC such as a psychologist or counsellor in house in or near the primary care practice
Outcomes	At 24 months: Change in general health (PROMIS-29 v2), quality of provider communication (CAHPS(R) 12-month PCMH Adult Questionnaire 2.0), quality of provider empathy (Consultation and Relational Empathy measure), self management (Patient Activation Measure-13), medication adherence (Modified Self-reported Medication-taking Scale), health care utilisation (patient report of utilisation), time lost due to disability (restricted activity days), physical function (Duke Activity Status Index), glycaemic control (HbA1c), substance use disorder and problem drinking (30 days use and Global Appraisal of Individual Needs - Short Screener), hypertension (systolic blood pressure), asthma symptoms (Asthma Symptom Utility Index)
Starting date	April 2016
Contact information	Patient-Centered Outcomes Research Institute (PCORI), info@pcori.org
Notes	NCT02868983 Study in progress; estimated completion April 2021

Martinez 2018

Study name	The CAPTURE Study: Validating a Unique COPD Case Finding Tool in Primary Care
Methods	***Aim of study:*** to explore the impact of the CAPTURE tool on clinical care and patient outcomes ***Study design:*** cRCT ***Geographic location:*** USA ***Study setting:*** primary care clinics ***Number of study sites:*** 100 ***Number of arms/groups:*** 2 ***Unit of allocation:*** cluster (practices)
Participants	***Participants:*** practice clinicians and patients ***Inclusion criteria:*** provision of signed and dated informed consent form, stated willingness to comply with all study procedures and availability for the duration of the study, male or female, aged 45 to 80 years ***Exclusion criteria:*** previous clinician provided diagnosis of COPD, treated respiratory infection (with antibiotics and/or systemic steroids) in the past 30 days, participants unable to perform spirometry due to any of the following conditions within the past 30 days (chest surgery, abdominal surgery, eye surgery, heart attack, stroke)

Martinez 2018 *(Continued)*

Interventions	***Arm 1:*** practice clinicians will receive basic COPD education, and patient-level CAPTURE information with CAPTURE interpretation education (CAPTURE+ COPD education) ***Arm 2:*** practice clinicians will receive basic COPD education only (COPD education)
Outcomes	***Outcomes at 12 months:*** Proportion of CAPTURE+ participants who meet a composite endpoint for diagnosis and management of COPD Proportion of CAPTURE+ participants who are referred for or completion of clinical spirometry testing Proportion of CAPTURE+ participants who are newly diagnosed with COPD Proportion of CAPTURE+ participants with newly prescribed respiratory medication Proportion of CAPTURE+ participants referred to a specialist for respiratory evaluation/treatment Incidence of physician referral to a formal smoking cessation programme in participants with clinically significant COPD and are current smokers Incidence of physician referral to pulmonary rehabilitation programme in participants with clinically significant COPD and are current smokers Incidence of physician prescribed smoking cessation medication in participants with clinically significant COPD and are current smokers Incidence of physician prescribed smoking cessation medication in participants with clinically significant COPD and are current smokers Incidence of physician referral to pulmonary rehabilitation programme in participants with spirometrically defined COPD and are current smokers Change in COPD Assessment Test (CAT) score in participants with clinically significant COPD Change in COPD Assessment Test (CAT) score in participants with spirometrically defined COPD Proportion of participants with clinically significant COPD who experience exacerbations, hospitalisations or mortality Proportion of participants with spirometrically defined COPD who experience exacerbations, hospitalisations or mortality Proportion of participants with spirometrically defined COPD who meet a composite endpoint for diagnosis and management of COPD
Starting date	July 2018
Contact information	Fernando Martinez, fjm2003@med.cornell.edu
Notes	Estimated completion July 2021

Parker 2013

Study name	The study design and rationale of the randomised controlled trial: translating COPD guidelines into primary care practice
Methods	***Aim of study:*** to examine whether a multi-modal intervention tailored to primary care practices will improve the care of patients with COPD

Parker 2013 *(Continued)*	***Study design:*** cRCT ***Geographic location:*** USA ***Study setting:*** primary care practices ***Number of study sites:*** 30 ***Number of arms/groups:*** 2 ***Unit of allocation:*** cluster (practice)
Participants	Primary care providers and at-risk or COPD patients at primary care practices throughout the state of Rhode Island and south-eastern Massachusetts (USA) ***Inclusion criteria:*** patients 40 years or older, seen at least once in past 2 years by their primary care provider and/or patients who smoke ***Exclusion criteria:*** < 40 years
Interventions	Multi-modal intervention tailored to primary care practices of 1 year duration. Phase I of the study involved a needs assessment evaluating barriers and facilitators to implementation of COPD guidelines into clinical practice through focus groups of primary care patients and providers. Tools were developed as a result of these focus groups. ***Arm 1 (Intervention):*** receive portable spirometer with printer, spirometry training of medical staff, provision of 3 tools to clinicians (web-based COPD guideline tool, patient activation tool (iPad - MyLungAge), COPD patient education toolkit), training of clinicians (tools, integration into workflow), academic detailing visits ***Arm 2 (Usual care):*** receive portable spirometer with printer, spirometry training of medical staff, nonacademic detailing visits on same schedule, a website link to GOLD guidelines
Outcomes	***Outcomes measured at 12 months:*** Adherence to COPD guidelines Patient activation Medical record audit at pre- and post-intervention
Starting date	Provider and patient recruitment commenced 2010
Contact information	Donna Parker, Memorial Hospital of Rhode Island
Notes	Protocol published; trial due to be completed 2013 NCT01237561

(Banda) cRCT: cluster-randomised controlled trial; TB: tuberculosis
(Drennan) COPD: chronic obstructive pulmonary disease; DM: diabetes mellitus; EQ-5D: EuroQoL-5D; HF: heart failure; RCT: randomised controlled trial
(Godycki-Cwirko) COPD: chronic obstructive pulmonary disease; cRCT: cluster-randomised controlled trial; GP: general practitioner; mMRC: modified Medical Research Council
(Leiva-Fernandez) COPD: chronic obstructive pulmonary disease; COPD: COPD Process of Andalusian Health Service; cRCT: cluster-randomised controlled trial; GOLD: Global Initiative for Chronic Obstructive Lung Disease; GP: general practitioner; mMRC: modified Medical Research Council; SGRQ: St George's Respiratory Questionnaire
(Littenberg) BHC: behavioural health clinician; CAHPS(R): Consumer Assessment of Healthcare Providers and Systems; COPD: chronic obstructive pulmonary disease; cRCT: cluster-randomised controlled trial; HbA1c: haemoglobin A1c; PCMH: Patient-Centred Medical Homes; PCP: primary care physician; PROMIS-29: Patient-Reported Outcomes Measurement Information System
(Parker) COPD: chronic obstructive pulmonary disease; cRCT: cluster-randomised controlled trial; GOLD: Global Initiative for Chronic Obstructive Lung Disease; USA: United States of America

ADDITIONAL TABLES

Table 1. Study design, study arms, setting and health professional targeted

Study ID	Study design	Number of study arms	Country	Unit of allocation	Health professional targeted
Bachmann 2019	cRCT	2	Brazil	Clinic	Doctors and nurses
Boulet 2013	RCT	4 (2*)	Canada	Physician	Primary care providers
Bunker 2009	RCT	2	Australia	Patient	GPs and practice nurses
Coultas 2005	RCT	3	USA	Patient	Nurses
Cvetkovski 2020	RCT (parallel cross-over)	2	Australia	Physician	GPs
Due 2014	RCT (stepped-wedge)	2	Denmark	Practice	GPs
Fairall 2005	cRCT	2	South Africa	Practice	Nurse practitioners
Fairall 2016	cRCT	2	South Africa	Clinic	Nurses
Freund 2016	cRCT	2	Germany	Practice	Medical assistants
Gruffydd-Jones 2013	RCT	2	Europe (Austria, France, Germany, Ireland, UK)	Physician	Primary care physicians
Hilberink 2011	RCT	3	Netherlands	Practice	GPs
Hurlimann 2015	cRCT	2	Switzerland	Physician	Primary care physicians
Khan 2019	cRCT	2	Pakistan	Facility	Doctors and allied staff
Kruis 2014	cRCT	2	Netherlands	Practice	GPs, practice nurses, specialised physios
Latzke-Davis 2011	RCT	2	USA	Practice	Physicians, medical assistants, registered nurses
Liang 2019	cRCT	2	Australia	Practice	Physicians
Lou 2015	RCT	2	China	Centre	GPs
Lusuardi 2006	RCT	2	Italy	Patient	GPs
Markun 2018	cRCT	2	Switzerland	GP	GPs and practice assistants
Martens 2006	RCT	2	Netherlands	Physician	GPs
Morganroth 2016	RCT	2	USA	Clinic	Physicians
Naidoo 2014	cRCT	2	South Africa	Clinic	Nurses

Table 1. Study design, study arms, setting and health professional targeted *(Continued)*

Poels 2008	cRCT	2	Netherlands	GP	GPs
Salisbury 2018	cRCT	2	UK	Practice	Clinicians and receptionists
Sandelowsky 2018	cRCT	3 (2*)	Sweden	Centre	GPs
Shelesky 2012	RCT	2	USA	Intern	Interns
Shrestha 2006	cRCT	2	Nepal	Facility	Health workers
Smidth 2013	cRCT	2	Denmark	Practice	GPs
Soler 2010	RCT	3	Spain	GP	GPs
Terry 1981	cRCT	5	USA	Geographic clusters	GPs
Thoonsen 2015	cRCT	2	Netherlands	GP	GPs
Tinelli 2003	cRCT	2	Italy	GP	GPs
Torres-Robles 2021	cRCT	2	Spain	Pharmacy	Pharmacists
Uzzaman 2020	RCT	2	Bangladesh	GP	GPs
Walters 2008	cRCT	2	Australia	Practice	GPs
Walters 2013	cRCT	2	Australia	Practice	Nurses
Weinberger 2002	RCT	3	USA	Pharmacy	Pharmacists
Zwar 2016	cRCT	2	Australia	Practice	GPs and practice nurses

* indicates number of arms with data eligible for this review
cRCT: cluster-randomised controlled trial, GP: general practitioner, RCT: randomised controlled trial

Table 2. Elements of intervention delivered to health professionals

Study ID	Education	Tools, toolkit or algorithm	Guidelines	Spirometry training	Feed-back/mentor-ship/ongoing support
Bachmann 2019		#			
Boulet 2013	#	#	#		#
Bunker 2009	#	#			
Coultas 2005	#		#		
Cvetkovski 2020	#				
Due 2014	#	#			

Table 2. Elements of intervention delivered to health professionals *(Continued)*

Fairall 2005	#				
Fairall 2016	#				
Freund 2016	#				
Gruffydd-Jones 2013	#				
Hilberink 2011	#				#
Hurlimann 2015			#		#
Khan 2019	#	#	#		
Kruis 2014	#				
Latzke-Davis 2011				#	
Liang 2019			#	#	
Lou 2015	#				
Lusuardi 2006				#	
Markun 2018	#	#			
Martens 2006			#		
Morganroth 2016	#				#
Naidoo 2014	#	#			
Poels 2008					#
Salisbury 2018	#	#			#
Sandelowsky 2018	#				
Shelesky 2012	#				#
Shrestha 2006	#		#		
Smidth 2013	#				
Soler 2010	#		#	#	
Terry 1981	#				
Thoonsen 2015	#	#			
Tinelli 2003	#	#			
Torres-Robles 2021	#				
Uzzaman 2020	#				

Table 2. Elements of intervention delivered to health professionals *(Continued)*

Walters 2008	#		#	#	
Walters 2013	#				#
Weinberger 2002	#				#
Zwar 2016	#	*		*	

Table 3. Studies reporting proportion of patients with COPD prescribed respiratory medication consistent with recommended guidelines (Primary Outcome #3)

Study ID	Definition(s) of outcome measure	Result(s) (intervention vs control unless specified)
Bachmann 2019	Four definitions used: 1. For participants with COPD, the composite score comprised points awarded for (a) a first prescription of SABA, ICS or ICS + LABA; or a change in prescription, stepping up from SABA to LABA or from LABA to ICS + LABA, or stepping down from LABA + ICS to LABA, or from LABA to SABA (scoring one point if at least one of these occurred) over 12 months 2. First prescription of an ICS 3. First prescription of SABA 4. First prescription of LABA + ICS	Participants (%) 1. 147 (10.7%) vs 120 (10.2%), P = 0.699, ICC 0.013 2. 65 (4.7%) vs 61 (5.2%), P = 0.513, ICC = 0.006 3. 62 (4.5%) vs 51 (4.3%), P = 0.880, ICC = 0.005 4. 83 (6.1%) vs 63 (5.3%), P = 0.456, ICC = 0.018
Fairall 2005	Two definitions used: 1. Prescriptions filled out for ICS after 3 months (higher = better) 2. Prescription for antibiotics after 3 months	Participants (%) 1. 137/1000 (13.7%) vs 77/999 (7.7%), P = 0.006 2. 397/1000 (39.7%) vs 394/999 (39.4%), P = 0.95
Fairall 2016	Treatment intensification over 14 months: 1) the addition or increase in dose of an ICS and/or 2) addition of a beta-agonist and/or 3) addition of ipratropium bromide and/or 4) addition of theophylline	RR 1.08 (95% CI 0.75 to 1.55), P = 0.674, ICC = 0.011, n = 586 intervention vs n = 571 control
Hurlimann 2015	Two definitions used: 1. Percentage prescriptions of penicillins over total number of patients treated with antibiotics for respiratory tract infections over 2 years 2. Percentage of quinolones over total number of patients treated with antibiotics for COPD exacerbations over 2 years	Participants (%) 1. 12,213 patients (56.7%) vs 10,460 patients (48.5%), P = 0.01, ICC 0.27 2. 522 patients (4.8%) vs 450 (4.7%), P = 0.96, ICC 0.50
Lou 2015	Four definitions used: 1. Frequency of LABA use after 4 years 2. Frequency of ICS use after 4 years 3. Frequency of OCS use after 4 years	Percentage of total participants (3418 vs 2803) 1. 16.4% vs 2.3% 2. 32.5% vs 10.6% 3. 40.7% vs 20.7%

Table 3. Studies reporting proportion of patients with COPD prescribed respiratory medication consistent with recommended guidelines (Primary Outcome #3) *(Continued)*

	4. Frequency of theophylline use after 4 years	4. 45.0% vs 34.8%
Markun 2018	Appropriate pharmacological treatment of COPD at 1 year	Non-significant difference between groups (OR visually presented), 69 intervention and 92 control patients analysed
Martens 2006	Two definitions used: 1. Change in prescriptions for SABA for COPD per GP per year standardised per 1000 enlisted patients at 12 months and 24 months 2. Change in prescriptions for ICS for COPD per GP per year standardised per 1000 enlisted patients at 12 months and 24 months (reduction = better)	1. Change at 12 months (CI): -2 (-6 to 3) n = 53 vs 0 (-3 to 4) n = 54; Change at 24 months: -3 (-8 to 2) vs -6 (-10 to -2) 2. Change at 12 months (CI): -5 (-8 to -1) n = 53 vs -3 (-6 to 1) n = 54; Change at 24 months: -15 (-20 to -10) vs -10 (-15 to -6)
Morganroth 2016	Five definitions used: 1. Prescription of bronchodilator at 12 months 2. Prescription of ICS/tiotropium at 12 months 3. Prescription of LABA + ICS at 12 months 4. Prescription of LABA/ICS + TIO at 12 months 5. Prescription of tiotropium at 12 months	Participants (%) 1. 113 (100%) vs 118 (94%) 2. 3 (3%) vs 0 (0%) 3. 43 (37%) vs 28 (22%) 4. 39 (33%) vs 49 (39%) 5. 7 (6%) vs 17 (14%)
Poels 2008	Indicators of GP decision-making process: probability of medication and non-medication changes. Medication change included: stopping or lowering treatment with inhaled corticosteroids or bronchodilators; the commencement of bronchodilator, inhaled or oral corticosteroid treatment; or combination drug treatment. Non-medication included giving smoking cessation advice.	76.2% vs 69.1%, OR (CI) 1.44 (0.80 to 2.59)
Shrestha 2006	Number of prescriptions for COPD post intervention (lower better as indicates more rational prescribing)	15 prescriptions vs 29 prescriptions
Soler 2010	Treatment regimens in patients classified moderate to severe COPD, expressed as percentage of total. Eight definitions used: 1. Anticholinergic + SABA 2. LABA + corticoid 3. SABA 4. LABA 5. Anticholinergic agents 6. Theophylline 7. ICS 8. Antibiotics	G3 vs G2 vs G1 1. 9.4 vs 6.0 vs 6.6 2. 51.2 vs 52.3 vs 50.0 3. 56.0 vs 52.3 vs 50.7 4. 20.2 vs 22.9 vs 27.9 5. 87.8 vs 86.9 vs 82.4 6. 21.8 vs 24.6 vs 28.7 7. 22.8 vs 24.6 vs 25.7 8. 14.2 vs 11.1 vs 19.9
Tinelli 2003	Number of drugs prescribed by the GP for COPD during the 1-year follow-up (lower better as indicates rational prescribing as per guidelines)	Mean (SD) 3.63 (2.96) vs 4.12 (3.10)

CI: confidence interval; COPD: chronic obstructive pulmonary disease; ICC: intra-class correlation coefficient; ICS: inhaled corticosteroid; LABA: long acting beta agonist; OCS: oral corticosteroid; OR: odds ratio; RR: risk ratio; SABA: short-acting beta agonist; SD: standard deviation; TIO: tiotropium

Table 4. Studies reporting health-related quality of life (HRQoL) of patients with COPD

Study ID	HRQoL measure used	Results (intervention vs usual care), mean (SD) unless specified
Coultas 2005	SGRQ, change in total score from baseline SF-36, change in physical functioning and mental health domains	MM Group vs UC Group at 6 months (n = 49 vs 51): SGRQ: 3.4 (14.9) vs 6.3 (15.5), MD -2.9 (95% CI -9.8 to 4.1) SF-36-physical: -2.1 (20.2) vs -1.2 (21.7) SF-36- mental: -2.2 (18.6) vs -0.6 (17.7) CM Group vs UC Group at 6 months (n = 51 vs 51): SGRQ: 3.7 (13.6) vs 6.3 (15.5), MD -2.6 (95% CI -9.5 to 4.3) SF-36-physical: 1.6 (14) vs -1.2 (21.7) SF-36- mental: -1.4 (20) vs -0.6 (17.7)
Fairall 2016	SGRQ, proportion with score ≥ median score (dichotomous)	14 months: 36/256 vs 34/273
Freund 2016	SF-12 EQ-5D, physical component and mental component	12 months: SF-12-physical (n = 801 vs 776): 36.5 (9.7) vs 35.9 (9.7), P = 0.162 SF-12-mental (n = 801 vs 776): 48.8 (10.9) vs 46.9 (11.1), P = 0.019 EQ-5D (n = 918 vs 878): 0.64 (0.22) vs 0.61 (0.23), P = 0.085 24 months: SF-12-physical (n = 553 vs 590): 36.5 (10.6) vs 35.5 (10.2), P = 0.013 SF-12-mental (n = 553 vs 590): 48.9 (10.8) vs 46.9 (11.6), P = 0.002 EQ-5D (n = 779 vs 806): 0.65 (0.22) vs 0.61 (0.23), P = 0.016
Kruis 2014	SGRQ, change in total score SF-36, change in physical component and mental component CCQ, change in total score EQ-5D-3L and VAS change in total score (/100)	12 months (n = 554 vs 532): reported as MD and 95% CI SGRQ: -0.40 (95% CI -1.46 to 0.65) vs 0.33 (95% CI -0.78 to 1.43) SF-36-physical: -1.1 (95% CI-1.82 to -0.38) vs (-0.48 (-1.23 to 0.26) SF-36-mental: -.73 (-0.07 to 1.54) vs 0.09 (-0.74 to 0.92) CCQ: -0.03 (-0.09 to 0.03) vs 0.03 (-0.03 to 0.09) EQ-5D-3L: -0.04 (-0.06 to -0.02) vs -0.01 (-0.03 to 0.01) EQ-5D VAS: -1.71 (-2.95 to 0.46) vs -1.92 (-3.21 to -0.63)
Liang 2019	SGRQ, change in total score from baseline CAT, change in total score from baseline	6 months (n = 118 vs 94): reported as MD and 95% CI SGRQ: 3.07 (0.73 to 5.42) vs 1.54 (-1.06 to 4.14), 2.45 (-0.89 to 5.79) CAT: 2.06 (0.87 to 3.26) vs 1.50 (0.56 to 2.44) 12 months (n = 113 vs 77):

Table 4. Studies reporting health-related quality of life (HRQoL) of patients with COPD *(Continued)*

		SGRQ: 4.69 (1.96 to 7.41) vs 3.35 (0.57 to 6.14), MD 2.21 (-2.86 to 7.28) CAT: 3.05 (1.80 to 4.31) vs 2.62 (1.58 to 3.67)
Markun 2018	CAT, mean change in total score from baseline	12 months (n = 69 vs 92): -1.2 vs 1.1
Salisbury 2018	EQ-5D-5L, total score	15 months (n = 797 vs 749): mean 0.533 (SE 0.012) vs 0.504 (SE 0.012)
Sandelowsky 2018	CCQ (10 items), change in total score from baseline CAT, change in total score from baseline	18 months (n = 209 vs 216): CCQ: mean 1.97 (95% CI 1.81 to 2.14) vs 1.97 (1.81 to 2.13) CAT: mean 16.2 (95% CI 15.1 to 17.4) vs mean 16.3 (95% CI 15.2 to 17.5)
Tinelli 2003	SF-36, physical functioning and mental health domains	12 months (n = 51 vs n = 33): mean total scores SF-36-physical: 57.4 vs 53.6 SF-36-mental: 63.8 vs 57.8
Walters 2013	SGRQ, total score SF-36, total score physical functioning and mental health domains	6 months (n = 74 vs 83): SGRQ: 39.8 (20.5) vs 41.7 (17.8) SF-36-physical: 46.0 (7.5) vs 44.9 (8.7) SF-36-mental: 48.6 (10.9) vs 48.2 (10.9) 12 months (n = 74 vs 80): SGRQ: 41.9 (18.9) vs 40.5 (17.4) SF-36-physical: 44.2 (8.4) vs 45.5 (7.9) SF-36-mental: 50.1 (9.9) vs 49.2 (10.2)
Weinberger 2002	Disease-specific HRQoL using COPD-specific measures (7-point Likert format, score 7 = best)	Pharmaceutical care programme vs PFM control vs usual care control 6 months (n = 146 vs 111 vs 119): 4.5 (1.0) vs 4.3 (1.0) vs 4.1 (1.2) 12 months (n = 149 vs 105 vs 111): 4.4 (1.1) vs 4.3 (1.0) vs 4.2 (1.2)
Zwar 2016	SGRQ CAT	12 months (n = 126 vs 96): SGRQ: 16.85 (15.2) vs 17.06 (14.9), MD -0.21 (95% CI -2.55 to 2.14), P = 0.86 CAT: 9.80 (6.78) vs 9.27 (6.78), P = 0.73

Abbreviations: CAT: COPD Assessment Tool; CI: confidence interval; CCQ: Clinical COPD Questionnaire; HRQoL: health-related quality of life; MD: mean difference; PFM: peak flow meter; SD: standard deviation; SE: standard error; SF-36: short-form health survey, SGRQ: St George's Respiratory Questionnaire; VAS: visual analogue scale.

Table 5. Studies reporting a measure of frequency of COPD exacerbations

Study ID	Outcome measure	Results (intervention vs usual care)
Coultas 2005	Mean (SD) change in self-reported healthcare utilisation for lung disease in past 6 months	n = 49 vs n = 51 Doctor visits: -1 (1.9) vs -0.04 (3.2) ED visits: 0 (0.4) vs -0.02 (0.3)

Table 5. Studies reporting a measure of frequency of COPD exacerbations *(Continued)*

		Hospital visits: -0.04 (0.7) vs 0.04 (0.4)
Freund 2016	Mean (SD) COPD-related hospitalisations, and mean (SD) hospital days at 12 and 24 months	12 months (n = 321 vs 222): Hospitalisations: 0.03 (0.22) vs 0.11 (0.56), P = 0.011 Hospital days: 0.14 (1.62) vs 0.61 (4.20), P = 0.185 24 months (n = 321 vs 222): Hospitalisations: 0.14 (0.61) vs 0.26 (1.09), P = 0.086 Hospital days: 0.73 (3.97) vs 1.55 (8.09), P = 0.30
Kruis 2014	Mean (SD) moderate exacerbation rate at 12 months Mean (SD) severe exacerbation rate at 3 months Mean (SD) hospital admission days at 3 months	n = 554 vs 532 Moderate: 0.4 (0.8) vs 0.3 (0.8) Severe: 0.02 (0.2) vs 0.02 (0.2) Admissions: 6 (2.1) vs 8.6 (4.7)
Markun 2018	Assessment of exacerbation frequency at 12 months	Non-significant, reported visually, n = 161
Sandelowsky 2018	Percentage of patients with one or more exacerbations in past 6 months, measured at 18 months	34.7% (n = 209) vs 34.1% (n = 216), P = 0.93
Thoonsen 2015	Odds ratio (95% CI) for patients who utilised out-of-hours GP services in last 3 months Odds ratio (95% CI) for patients who were hospitalised in last 3 months	Out-of-hours service: 0.4828 (-0.733 to 1.698), P = 0.4307 Hospitalised: 0.797 (0.464 to 1.372), P = 0.4078
Tinelli 2003	Number of episodes of exacerbations in 12 months, categorised as none, low (1 to 2) and high (3+) Number of admissions to hospital because of COPD in 12 months, categorised as none, low (1 to 2) and high (3+)	n = 72 vs n = 51 Exacerbations: none: 30.6% vs 39.2%; low: 48.6% vs 43.1%; high: 20.8% vs 17.6% Admissions: none: 70.8% vs 66.7%; low: 19.4% vs 23.5%; high: 9.7% vs 9.8%
Walters 2013	Number of patients with hospital admissions for COPD in 12 months	12.2% (n = 90) vs 5.4% (n = 92)
Weinberger 2002	Percentage of patients with breathing-related ED or hospital visits in 12 months	22.9% (n = 149) vs 23.2% (n = 111)
Zwar 2016	Proportion of patients reporting use of health services for lung condition in past 12 months	17/126 vs 11/96, P = 0.67

ED: emergency department

Table 6. Studies reporting adherence to medications (including correct inhaler technique)

Study ID	Outcome measure	Results (intervention vs usual care)
Markun 2018	Morisky Medication Adherence Scale - 8-item	Mean (95% CI) at 15 months:

Table 6. Studies reporting adherence to medications (including correct inhaler technique) *(Continued)*

		11.0 (8.0 to 15.0) vs 11.0 (8.0 to 15.0), P = 0.46
Torres-Robles 2021	Morisky-GreenLevine Medication Adherence Questionnaire, reported as mean percentage/100	Mean percentage (95% CI) at 6 months for COPD patients only (n = 145 vs 154): 92.9% (87.0 to 962) vs 72.5 (62.3 to 80.7), P = 0.0001
Walters 2013	Adherence to treatment as part of a larger questionnaire of self-management capacity, scored 0 to 8 (8 = better adherence)	Mean (SD) at 12 months: 7.7 (0.8) vs 7.6 (1.3)
Weinberger 2002	Compliance with breathing medications, percentage of patients not compliant (includes both asthma and COPD patients)	12 months: 22.5% vs 23.3%
Zwar 2016	Correct inhaler technique, number of patients	12 months: 45/126 vs 42/96, P = 0.25

CI: confidence interval; COPD: chronic obstructive pulmonary disease; SD: standard deviation

WHAT'S NEW

Date	Event	Description
10 May 2022	Amended	Author order corrected.

HISTORY

Protocol first published: Issue 5, 2017
Review first published: Issue 5, 2022

CONTRIBUTIONS OF AUTHORS

Screening of titles and abstracts: AC, JL, EZ, DT, JG

Assessment of studies for inclusion: AC, JL, EZ, DT, MA, JG

Quality assessment: AC, JL, EZ, DT, JG

Data extraction: AC, JL, EZ, DT, JG

Data entry into RevMan: AC, JL

Data analysis and interpretation: AC in consultation with JL, EZ, DT, MA, JG

Writing of review: AC, JL, MA, JG

Contributions of editorial team

Emma Dennett (Deputy Co-ordinating Editor): co-ordinated the editorial process; advised on interpretation and content; edited the review, signed off the review for publication.

Anne Holland (Contact Editor): edited the review; advised on methodology, interpretation and content, assisted with sign-off.

Rebecca Fortescue (Co-ordinating Editor) checked the data in the review.

Emma Jackson (Managing Editor): conducted peer review and edited the references and other sections of the protocol and the review.

Elizabeth Stovold (Information Specialist): designed the search strategy; ran the searches; edited the search methods section.

DECLARATIONS OF INTEREST

AJC: none known.

JL: declares funding from Boehringer Ingelheim via investigator-initiated research grants.

DT: none known.

EZ: none known.

MJA: declares funding from Pfizer, Sanofi, GSK and Boehringer Ingelheim via investigator-initiated research grants, and Sanofi for consultancies and travel, all for unrelated research.

JG: declares funding from Pfizer and Boehringer Ingelheim via an investigator-initiated research grant and GSK via investigator-sponsored grant and consultation fee for unrelated research. JG has received in-kind support from Vitalograph®, the manufacturers of COPD-6™, for unrelated research.

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External sources

- National Institute for Health Research, UK

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

In the meta-analysis of health-related quality of life (HRQoL), we chose to present subgroups based on timing of outcome (6 months and 12 months). This was not specified in our protocol, but we believed these subgroups would help to describe and understand the findings and may be of interest to clinicians, policymakers and researchers.

We could not conduct other subgroup analyses as planned, due to an insufficient number of studies identified within each comparison and each outcome.

We could not conduct sensitivity analyses as planned, due to an insufficient number of studies identified with low risk of bias within each comparison and each outcome.

We could not conduct sensitivity analyses to explore the impact of including studies with missing data due to insufficient numbers of studies identified within each comparison and each outcome.

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