

# Self-Management Following an Acute Exacerbation of COPD

## A Systematic Review

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**BACKGROUND:** Self-management (SM) reduces hospital admissions in patients with stable COPD. However, its role immediately post-acute exacerbation (AE) is unclear. The objectives of this review were to describe SM interventions delivered immediately following an AE of COPD (AECOPD) and to conduct a systematic review with meta-analysis of its impact on health-care utilization and health outcomes.

**METHODS:** Randomized controlled trials reporting on SM interventions delivered during hospitalization for an AECOPD or within 1 month of hospital discharge were included. Seven articles were identified. Data were extracted and assessed for quality by two researchers.

**RESULTS:** By definition, all interventions included action plans, education, and at least two SM skills. Nurses were responsible for providing all SM interventions. The delivery and follow-up periods varied widely. At 12 months, there were no significant differences between those who completed the SM intervention and control subjects in the number of patients readmitted to hospital ( $P = .38$ ), or in health-related quality of life ( $P = .27$ ). No effects were found on rate of mortality, depressive symptoms, primary care usage, or exercise capacity. Minimal effects were found on self-efficacy, anxiety symptoms, and health promoting behavior. SM was associated with positive effects on knowledge and management of an AECOPD.

**CONCLUSIONS:** SM interventions delivered immediately post-AE vary widely and outcome measures are inconsistent, making it difficult to draw strong recommendations regarding its effectiveness. The evaluation of SM interventions, delivered by trained health-care professionals to selected patients and which offer structured follow-up, appears necessary.

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**ABBREVIATIONS:** AE = acute exacerbation; AECOPD = acute exacerbation of COPD; HCP = health-care professional; HRQOL = health-related quality of life; MD = mean difference; RCT = randomized controlled trial; SF-36 = Short Form-36; SGRQ = St. George's Respiratory Questionnaire; SM = self-management

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Self-management (SM) describes formalized patient education programs aimed at teaching skills and providing support for health-promoting behavior.<sup>1</sup> It has been cited as a strategy for reducing hospital admissions in patients with stable COPD<sup>2,3</sup> by assisting with the prompt recognition and management of acute exacerbations (AEs).<sup>4,5</sup> A recently updated Cochrane review found that SM in the absence of supervised exercise was effective in reducing respiratory-related and all-cause hospital admissions and improving health-related quality of life (HRQOL) in patients with COPD.<sup>3</sup> In this review, SM was delivered to patients with stable disease or those up to 12 months post-AE. Only one study delivered SM to all patients immediately following an AE of COPD (AECOPD).<sup>6</sup>

The role of SM alone delivered immediately post-AE is not clear.<sup>7</sup> At the time of hospital admission, patients may be more receptive to interventions that improve their health, especially if they believe that such interventions may reduce subsequent hospital admissions. Behavioral interventions, such as smoking cessation, initiated during hospitalization have been proven to be effective.<sup>8</sup> However, breath-

lessness, anxiety, and vigilance of symptoms may inhibit patients from attending to the information being provided,<sup>9,10</sup> especially in the presence of hypoxemia shown to compromise attention and cognitive function.<sup>11</sup>

The aim of this systematic review was to examine the effects of SM alone delivered during hospitalization for an AECOPD or within 1 month of hospital discharge. A definition adopted from Wagg<sup>12</sup> was modified to include interventions which have delivered an action plan, education, and at least two of seven SM skills: self-efficacy, problem solving, resource utilization, collaboration, emotional management, role management, and goal setting. Interventions that included supervised exercise programs were not considered to be SM.<sup>12</sup> The specific study objectives were (1) to describe SM interventions delivered immediately following an AECOPD and (2) to conduct a systematic review with meta-analysis of their impact on health-care utilization and health outcomes. Such information may help to guide health-care professionals (HCPs) in the delivery of SM advice to patients following hospitalization with an AECOPD.

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## Materials and Methods

### Search Strategy

The set of terms included: "chronic obstructive" OR COPD OR emphysema OR bronchitis AND exacerbat\* OR hospital\* AND education OR self-manag\* OR "self manag" OR self-care\* OR "self car\*" OR "management plan" OR "management prog\*" OR "action plan" OR "integrated care". An extensive search was conducted in August 2013, and updated in March 2014, of electronic databases including PubMed, AMED, CINAHL, British Nursing Index (BNI), PsychINFO, EMBASE, and MEDLINE from inception to present. The reference lists of key papers were searched to identify any further relevant studies.

### Selection of Articles

The review was restricted to randomized controlled trials (RCTs) consisting of SM intervention vs usual care, published in English in peer-reviewed journals. To be included, papers had to report on SM interventions delivered during hospitalization for an AECOPD or within 1 month of hospital discharge. To be accepted as SM, interventions had to include an action plan involving symptom monitoring and medical management as well as education providing knowledge and information on decision-making.<sup>12</sup> The definition of SM provided by Wagg<sup>12</sup> is slightly adjusted to include interventions that have delivered at least two of seven SM skills: self-efficacy, problem solving, resource utilization, collaboration, emotional management, role management, and goal setting. In instances where it was unclear whether either disease education or action plans were included, the authors were contacted. Interventions describing solely action plans or action plans with education were excluded, as were disease management programs including supervised exercise training or programs that could be classified as pulmonary rehabilitation. Studies that enrolled clinically stable patients or those in which the time between hospital discharge and initiation

of the intervention could not be determined for all study participants were excluded.

**Screening:** One reviewer (S. L. H.) screened the titles and abstracts. In instances where the first reviewer was unsure, the abstracts were discussed with a second reviewer (T. J.-F.) and a consensus reached.

Two reviewers (S. L. H. and T. J.-F.) assessed the appropriateness of the full text papers against the inclusion and exclusion criteria. Papers categorized as unsure were discussed between reviewers and also at a meeting with the senior authors (D. B. and R. S. G.).

### Determination of Study Quality

Full text papers were assessed for quality using the Cochrane Collaboration Tool.<sup>13</sup> Each study was assessed independently by two reviewers (S. L. H. and T. J.-F.), and any discrepancies were discussed to reach consensus.

### Data Extraction

Data extraction was performed and verified by two reviewers (S. L. H. and T. J.-F.). There were two objectives as follows: (1) All information describing the SM intervention was extracted. (2) The results of the studies were summarized according to the effect of the SM intervention on all included health outcomes.

### Meta-analysis

A meta-analysis exploring the impact of SM interventions was conducted for those outcomes which were assessed in three or more studies, these included health-care utilization and HRQOL. Heterogeneity was investigated according to the guidelines in the Cochrane Handbook for Systematic Reviews, and involved examining the overlap in CIs, interpreting the  $\chi^2$  test, and the  $I^2$  statistic.<sup>14</sup> Due to the heterogeneity of the SM interventions, random models were applied in both cases.

## Results

### Identification of Papers

All papers were identified during the first search in August 2013. An updated search using the same search terms and databases did not identify any new papers. The initial database produced 2,683 titles and abstracts; after duplicates were removed, 1,106 remained: of these, 1,088 articles were excluded during the initial screening. Full text was obtained for 18 papers, of which 11 studies were excluded following appraisal with reasons for exclusion documented in Figure 1.<sup>15-25</sup> Seven articles were included in total. The SM skills identified for the included studies are documented in Table 1. Two studies applied the same intervention but the outcomes assessed differed, therefore, both papers were included in the review.<sup>6,26</sup>

### Description of SM Interventions

A full description of the delivery and structure of each SM intervention is displayed in Table 2. Six inter-

ventions are described in the seven studies.<sup>6,26</sup> The setting for delivering SM interventions varied with two interventions being delivered in-hospital<sup>6,26,27</sup> and the remainder within 1 month of hospital discharge. Five interventions included at least one face-to-face follow-up visit with other consultations conducted over the phone while one intervention included telephone consultations only. The length of continued support ranged from 2 to 3 weeks to 12 months. All programs were delivered by nurses, although one intervention included a home visit consisting of a specialized nurse and the primary care team (physician, nurse, and social worker).<sup>26</sup> In four programs, nurses were specialized or had received specific training.<sup>6,26,28-30</sup> Education topics commonly included COPD education, smoking cessation, medical management, stress management/relaxation, and the promotion of physical activity as well as exercise. The most commonly applied SM skills were problem solving, role management,

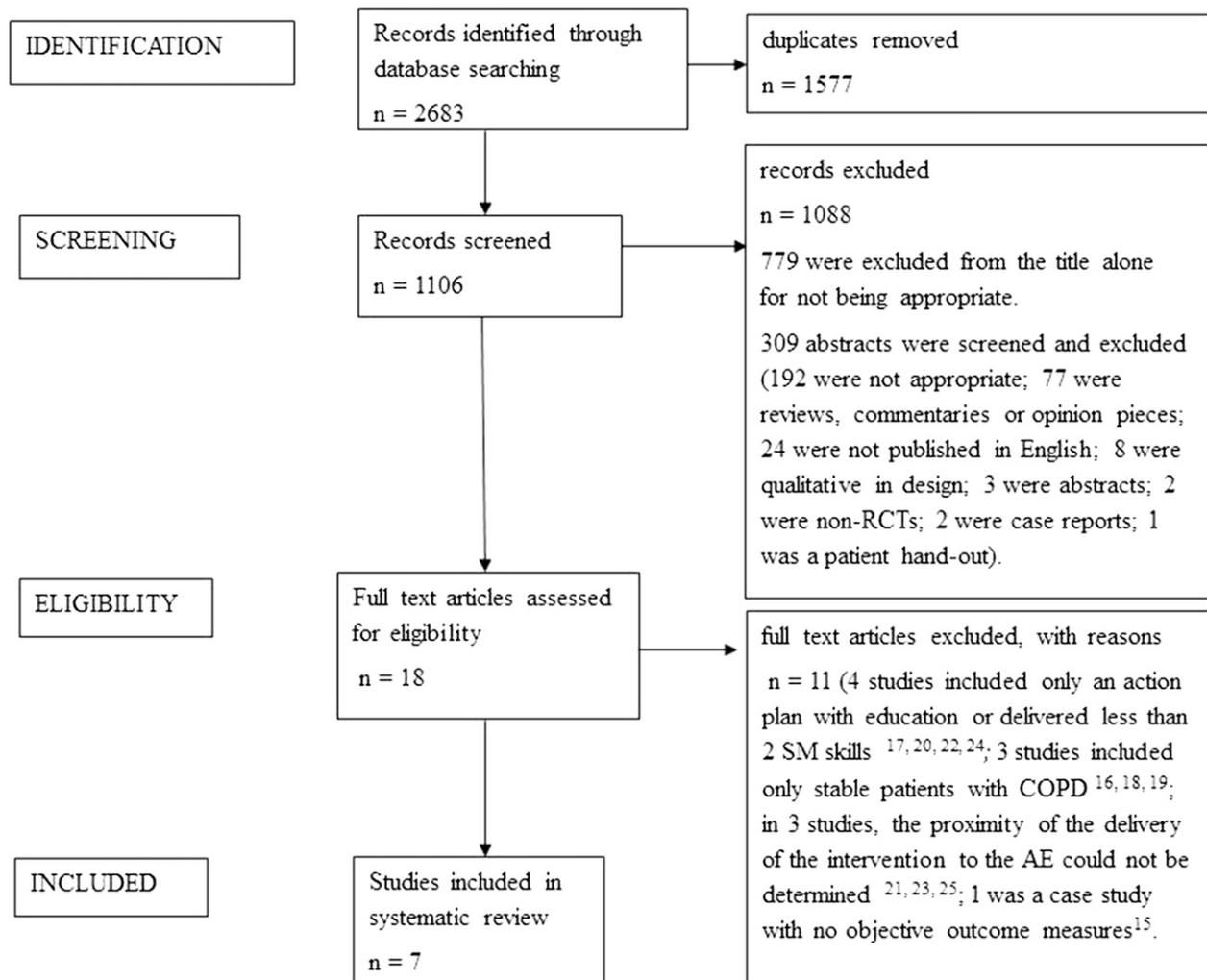


Figure 1 - PRISMA flowchart. AE = acute exacerbation; RCT = randomized controlled trial; SM = self-management.

**TABLE 1 ] Evidence of SM for the Included Studies and Those Studies Excluded for Not Meeting the Criteria for SM**

Study/Year	Education and Action Plan	Wagg et al <sup>12</sup> /2012 SM Skills
Hermiz et al <sup>31</sup> /2002	"Education on the disease" – education	"Management of activities of daily living" – problem solving
	"Early recognition of signs that require medical intervention" – action plan	"Health maintenance" – role management
Casas et al <sup>6</sup> /2006 and Garcia-Aymerich et al <sup>26</sup> /2007	Delivery: verbal and written	"Understanding and use of drugs" – resource utilization
	"A comprehensive educational program including knowledge of the disease" – education	"Empowerment for SM of the disease" – self-efficacy
Wood-Baker et al <sup>30</sup> /2012	"Strategies to adopt during future AE" – action plan	"Instructions on nonpharmacological treatment" – role management and resource utilization
	Delivery: verbal and written	
Song et al <sup>27</sup> /2014	"Daily diary that recorded breathlessness, cough, sputum, wellness, physical activity, and use of medications" – action plan	"Nurses role was one of partnership with patients" – collaboration
	Authors' response: COPD-specific education was provided to the mentors who offered informal/unstructured education to patients – education	"Discussed the main social or clinical problem" – problem solving
Bucknall et al <sup>28</sup> /2012	Delivery: verbal	"Set a medium-term goal and developed an action plan to move towards achieving the goal" – goal setting
	"Educate patients on how to manage medication, cope with dyspnea and maintain functional level" – education	"Defining problems" – problem solving
Wong et al <sup>29</sup> /2005	"Management of symptoms and medication and prevention of an exacerbation" – action plan	"Generating self-care strategies" – role management
	Delivery: verbal, written, and visual	"Expand exercise according to their own goals" – goal setting
Bucknall et al <sup>28</sup> /2012	"Increase understanding of the disease" – education	"Supported SM" – collaboration
	"Monitoring symptoms and developing confidence to carry out appropriate actions, ie, altering treatment early in the evolution of an AE or initiating contact with their usual medical attendant" – action plan	"Empower patients to manage their COPD independently" "Developing their confidence to carry out appropriate actions" – self-efficacy and role management
Wong et al <sup>29</sup> /2005	Delivery: verbal and written	Living well – collaboration, goal setting, resource utilization (oxygen therapy and medications) and emotional management (stress management)
	"Educational program" – education	"Goals were set on discharge" – goal setting
Wong et al <sup>29</sup> /2005	Authors' response: the intervention included symptom monitoring and disease management – action plan	"Increase self-efficacy" – self-efficacy
	Delivery: verbal	"Emotional arousal" – emotional management

AE = acute exacerbation; SM = self-management.

resource utilization, collaboration, and goal setting. Strategies to teach SM skills for coping with future AECOPD were only specifically described in one intervention.<sup>6,26</sup>

#### *Systematic Review With Meta-analysis*

**Study Quality and Outcomes:** Overall, the risk of bias for the majority of RCTs was low; however, frequent issues included no blinding of participants and

**TABLE 2 ] The Delivery and Structure of SM Delivered Immediately Following Hospitalization With an AECOPD**

Study/Year	Population (n, Sex): Age (Mean Years)	Program	Control Group	Outcomes and Method of Assessment (FU)	Significant Findings, $P < .05$
Hermiz et al <sup>31</sup> /2002	177 (84 male): intervention = 84 (67.1 y), control = 93 (66.7 y)	<p><b>Delivery</b>                      Commencement: 1 wk post-hospital DC.                      Duration: 2 home visits at 1 wk and 1 mo post-hospital DC.                      Supervised: community nurse.</p> <p><b>Structure</b>                      Information: verbal and written.                      Components: disease education; stopping smoking; management of daily activities; energy conservation; exercise; drug education; health maintenance and early recognition of signs.                      Continued support                      1 mo.                      Patient progress was reviewed.                      Patients were encouraged to continue to refer to the education booklet and keep in contact with their GP.</p>	<p>Usual care: DC to GP care with or without specialist FU.                      No routine nurse or other community FU.</p>	<p>Hospital admissions:                      Self-reported admissions to hospital.                      HRQOL: SGRQ.                      Knowledge: nonstandardized tool.                      Primary care usage: GP visits reported by GPs and patients.                      Positive health-behavior change: patient interviews.                      Length of FU: 3 mo.</p>	<p>Differences in knowledge favor the intervention.</p>

(Continued)

**TABLE 2 ] (continued)**

Study/Year	Population (n, Sex): Age (Mean Years)	Program	Control Group	Outcomes and Method of Assessment (FU)	Significant Findings, $P < .05$
Casas et al/2006	155 (129 male): intervention = 65 (70 y), control = 90 (72 y)	<p><b>Delivery</b>            Commencement: at hospital DC.            Duration: 2-h education session, weekly phone calls for 1-mo post-hospital DC, 1 home visit, phone call at 3 mo and 9 mo.            Access to a specialized nurse guaranteed throughout the study period.            Supervised: specialized nurse.  <b>Structure</b>            Information: verbal and written.            Components: disease education; smoking cessation; promotion of physical activity; nutrition recommendations; instructions on nonpharmacologic treatment; assessment of administering pharmacologic therapy; teaching SM strategies to cope with future AE; education on skills to identify clinical deterioration; individually tailored care plan.            Continued support            1 mo.            Weekly phone calls were undertaken to reinforce self-management strategies. Nonscheduled visits could be triggered by the patient or their carer.</p>	<p>Usual care: DC from the hospital by the attending physician following the standard protocols of the center.</p>	<p><b>Hospital admissions:</b>            examined clinical records to report admissions to hospital.  <b>Mortality:</b> examined clinical records to report all-cause mortality.  <b>Primary care usage:</b> GP visits reported by patients and validated using clinical records.            Length of FU: 12 mo.</p>	<p>Differences in the number of patients admitted to hospital favor the intervention.</p>

(Continued)

**TABLE 2 ] (continued)**

Study/Year	Population (n, Sex): Age (Mean Years)	Program	Control Group	Outcomes and Method of Assessment (FU)	Significant Findings, $P < .05$
Garcia-Aymerich et al <sup>26</sup> /2007	113 (97 male): intervention = 44 (72 Y), control = 69 (73 Y)	See Casas et al <sup>6</sup> /2006		HRQOL: SGRQ and EQOL-5D. Knowledge: nonstandardized questionnaire. Self-management of an AE: standardized questionnaire. Positive health-behavior change: standardized questionnaire, MAS, and IAS. Length of FU: 12 mo.	Differences in knowledge and management of an AE favor the intervention.
Wood-Baker et al <sup>30</sup> /2012	106 (49 male, 69.1 Y): intervention = 55, control = 51	<p>Delivery</p> <p>Commencement: at a "subsequent visit" following an assessment 1 wk post-hospital DC.</p> <p>Duration: 2 home visits and regular phone calls.</p> <p>Supervised: community health nurses provided disease-specific knowledge and trained by a health psychologist on the transtheoretical model of change and motivational interviewing.</p> <p>Structure</p> <p>Information: verbal.</p> <p>Components: problems; goals setting and action plans; reformulation plans.</p> <p>Continued support</p> <p>12 mo.</p> <p>Patients were regularly contacted by telephone to discuss progress and reformulate goals.</p>	Usual care: no description of "usual care in COPD" is supplied.	<p>Hospital admissions: self-reported admissions to hospital.</p> <p>HRQOL: SF-36.</p> <p>Self-efficacy: SSEQ.</p> <p>Psychologic morbidity: HADS.</p> <p>Length of FU: 12 mo.</p>	No significant improvements.

(Continued)

TABLE 2 ] (continued)

Study/Year	Population (n, Sex): Age (Mean Years)	Program	Control Group	Outcomes and Method of Assessment (FU)	Significant Findings, $P < .05$
Song et al <sup>27</sup> /2014	40 (26 male): intervention = 20 (66.6 y), control = 20 (68.1 y)	<p>Delivery</p> <p>Commencement: during inpatient stay.</p> <p>Duration: 2 inpatient and 1 outpatient session.</p> <p>Supervised: nurses.</p> <p>Structure</p> <p>Information: verbal, written, and visual.</p> <p>Components: medication management; coping with dyspnea; maintaining functional levels by defining problems; generating self-care strategies; education; pursed lipped breathing; arms and legs stretching; walking.</p> <p>Continued support</p> <p>1 mo.</p> <p>2 booster phone calls within a 2-wk interval during which patients were encouraged to progress exercise.</p>	<p>Control Group</p> <p>Usual care: education on COPD management; proven benefits of exercise; maintaining daily activities.</p>	<p>Exercise capacity: 6MWD.</p> <p>Positive health-behavior change: structured questionnaire.</p> <p>Length of FU: 2 mo.</p>	<p>Differences in health-promoting behavior.</p>

(Continued)

**TABLE 2 ] (continued)**

Study/Year	Population (n, Sex): Age (Mean Years)	Program	Control Group	Outcomes and Method of Assessment (FU)	Significant Findings, <i>P</i> < .05
Bucknall et al <sup>28</sup> /2012	464 (170 male, 69.1 y): intervention = 232, control = 232	<p>Delivery</p> <p>Commencement: 29 d (mean) post-hospital DC.</p> <p>Duration: 4 × 40 min training sessions every 2 wk for 2 mo and home visits every 6 wk for 12 mo.</p> <p>Supervised: nurses trained in the self-regulatory theory.</p> <p>Structure</p> <p>Information: verbal and written.</p> <p>Components: disease education; events leading to admission; nature of COPD and AE; recognizing early symptoms; managing AEs; drugs.</p> <p>Continued support</p> <p>12 mo.</p> <p>Home visits at least every 6 wk (more frequently on request).</p> <p>The FU visits were patient centered, based on individual needs as well as reviewing and reinforcing basic self-management messages on the basis of diary cards.</p>	Usual care: managed by the GP and/or hospital-based specialists.	Hospital admission to hospital reported by HCP. HRQOL: SGRQ and EQOL-5D. Mortality: reported by HCP. Self-efficacy: COPD-SEQ. Psychologic morbidity: HADS. Length of FU: 12 mo.	Differences in the number of patients admitted to hospital in those identified as successful self-managers and differences in anxiety.

(Continued)

**TABLE 2 ] (continued)**

Study/Year	Population (n, Sex): Age (Mean Years)	Program	Control Group	Outcomes and Method of Assessment (FU)	Significant Findings, $P < .05$
Wong et al <sup>29</sup> /2005	60 (47 male): intervention = 30 (72.8 y), control = 30 (74.4 y)	<p><b>Delivery</b>                      Commencement: 3-7 d post-hospital DC.                      Duration: 2 telephone contacts (10-20 min) on days 3-7 and days 14-20 post-hospital DC.                      Supervised: experienced (&gt; 5 y) respiratory nurse.                      Structure                      Information: verbal.                      Components: use of medications; goal setting and education; verbal persuasion; stress management and relaxation; evaluation with appropriate referral.                      Continued support                      2-3 wk.                      Telephone FU consisting of: assessment, management options, and evaluation.</p>	Usual care: routine care without telephone FU.	<p>Self-efficacy: modified CSES.                      Hospital admissions: self-reported admissions to hospital.                      Primary care usage: GP visits and visits to outpatient clinics were reported by patients.                      Length of FU: 3 mo.</p>	Difference in self-efficacy and ED visits at 3-mo FU.

6MWD = 6-min walk test; AECOPD = acute exacerbation of COPD; COPD-SEQ = COPD-self-efficacy questionnaire; CSES = Chinese self-efficacy scale; DC = discharge; EQOL-5D = EuroQol-5D; FU = follow-up; GP = general practitioner; HADS = Hospital Anxiety and Depression Scale; HCP = health-care professional; HRQOL = health-related quality of life; IAS = inhaler adherence scale; MAS = medication adherence scale; SF-36 = Short Form 36; SGRQ = St. George's Respiratory Questionnaire; SSEQ = Stanford self-efficacy questionnaire. See Table 1 legend for expansion of other abbreviations.

underreporting of reasons for withdrawal. An overview of the quality assessment is displayed in Table 3. Study outcomes are summarized in Table 4.

**Hospital Admissions:** Admission to hospital was assessed in five studies. Self-reported admissions to hospital were reported in two,<sup>29,31</sup> while three studies examined clinical records to verify hospital admission.<sup>6,28,30</sup>

Only one study found significant differences in favor of those receiving the SM intervention ( $P = .03$ ),<sup>6</sup> while three identified no differences ( $P > .05$ ).<sup>29-31</sup> Additionally, one study compared those classified as a successful self-manager (prompt responders) to those who were deemed unsuccessful (a two-point deterioration for 2 consecutive days before commencing treatment).<sup>28</sup> A significant within-group reduction was noted in the number of patients admitted to hospital for those classified as successful self-managers ( $P < .001$ ), although overall no between-group differences emerged ( $P = .73$ ).

Results of the meta-analysis revealed that, at 12 months, there were no significant differences in the number of patients readmitted to hospital following an AECOPD (mean difference [MD] = 1.32; 95% CI, 0.71-2.46;  $P = .38$ )<sup>6,28,30</sup> (Fig 2).

**Health-Related Quality of Life:** Four studies examined differences in HRQOL following completion of SM intervention compared with those receiving usual care using either the St. George's Respiratory Questionnaire (SGRQ)<sup>26,28,31</sup> or the Short Form-36 (SF-36).<sup>30</sup> No between-group differences were noted in overall HRQOL. There were between-group differences in the SF-36 subscales for physical functioning ( $P = .01$ ) and general health ( $P = .05$ )<sup>30</sup> and for the SGRQ impact subscale ( $P < .015$ )<sup>28</sup> in favor of SM intervention.

The meta-analysis showed that there were no significant differences in total scores of HRQOL across the four studies (standardized mean difference = 0.11; 95% CI, -0.08-0.36;  $P = .27$ ) (Fig 3). Analysis of individual domains of the SGRQ did not reveal significant differences (symptoms [MD = 1.10; 95% CI, -3.83 to 6.02;  $P = .66$ ]; activities [MD = -1.46; 95% CI, -4.43 to 1.51;  $P = .33$ ]; impacts [MD = 3.48; 95% CI, -1.24 to 8.20,  $P = .15$ ]).

**Mortality:** Two studies reported the percentage of patients who died during the study period.<sup>6,28</sup> No differences were detected between the intervention and control group for all-cause mortality ( $P = .67$ ),<sup>6</sup> ( $P = .30$ ),<sup>28</sup> or COPD-specific deaths ( $P = .35$ ).<sup>29</sup>

**Knowledge:** Two studies assessed the impact of SM intervention on patient knowledge using nonstandardized tools.<sup>26,31</sup> Those who completed SM intervention had greater knowledge compared with those receiving only usual care ( $P < .05$ ).<sup>26,31</sup>

**Self-Efficacy:** Three studies examined the effectiveness of SM intervention on self-efficacy.<sup>28-30</sup> One study identified a significant difference in self-efficacy between the intervention and control groups ( $P = .03$ )<sup>29</sup>, while the other two studies identified no differences ( $P = .54$ ,<sup>28</sup>  $P = .68$ )<sup>30</sup>.

**Psychologic Morbidity:** Anxiety and depression were explored in two of the six studies.<sup>28,30</sup> One study found less anxiety scores following SM intervention compared with a control group ( $P < .044$ ) although there was no difference in depression scores ( $P > .538$ ).<sup>28</sup> The other study identified no differences in anxiety or depression.<sup>30</sup>

**Primary Care Visits:** Three studies examined the effect of SM intervention on the use of primary care services compared with a control group and found no differences ( $P = 1.00$ ),<sup>29</sup> ( $P = .44$  and  $P = .45$  for Barcelona and Leuven sites, respectively),<sup>6</sup> ( $P = .30$  for patient reported and  $P = .90$  for general practitioner reported).<sup>31</sup>

**SM of an AECOPD:** One study identified significant differences in the identification ( $P < .001$ ) and early treatment of an exacerbation ( $P = .04$ ). Results favored the SM intervention group.<sup>26</sup>

**Positive Health Behavior Change:** Health-promoting behavior included any of the following: smoking habits, alcohol habits, medication adherence, exercise behavior, and physical activity. Three studies assessed aspects of health-promoting behavior<sup>26,27,31</sup> with two reporting no significant differences.<sup>26,27,31</sup> Increased exercise behavior and medication adherence were observed in one study in patients who completed SM intervention compared with usual care ( $P < .001$  and  $P = .05$ , respectively).<sup>27</sup>

**Exercise Capacity:** Only one study assessed exercise capacity. No between-group differences were identified ( $P = .42$ ).<sup>27</sup>

## Discussion

This is the first systematic review examining the effect of SM interventions, in the absence of supervised exercise, delivered immediately post-AECOPD. The SM interventions included in the studies were delivered in-hospital and in patients' homes by nurses. All studies included action plans for the early recognition of AE, as well as disease-specific education, but strategies to teach

TABLE 3 ] Cochrane Collaboration Tool for Assessing Risk of Bias

Study/Year	Random Sequence Bias	Allocation Concealment	Blinding, Participant	Blinding, Outcome Assessor	Incomplete Outcome Data	Selective Reporting	Other
Hermiz et al <sup>31</sup> /2002	Low: randomized permuted blocks with a block size of 4 at Liverpool Health Service and a simple randomized procedure at Macarthur.	Unclear	High: no blinding.	High: no blinding.	High: underreporting as more withdrew in the intervention group. Did not report reasons for withdrawal. Reasons for exclusion are not reported.	Low: all outcomes are discussed.	None
Casas et al/ <sup>9</sup> Garcia-Aymerich et al <sup>26</sup> /2007	Low: blindly assigned using a 1:2 ratio using computer-generated random numbers.	Low: blindly assigned.	High: no blinding.	Low: blind administration of a questionnaire to assess outcomes.	Low: reported reasons for exclusion and the percentage who completed the trial.	Low: all outcomes are discussed.	None
Song et al <sup>27</sup> /2014	Unclear: randomly allocated.	Unclear	Low: control group were offered education.	High: no blinding.	High: no description of how many patients were approached, how many refused, or why patients withdrew.	Low: all outcomes are discussed.	None
Bucknall et al <sup>28</sup> /2012	Low: minimization technique to stratify randomization by demographic factors. Computer-generated sequence using randomized permuted blocks of length 4, with 2 allocations by random and 2 by minimization.	Low: blindly assigned.	High: no blinding.	Low: telephone calls were by a research assistant who was blinded to allocation to collect information on exacerbation and health-care usage. When classifying patients as successful SM or not, the team was blind to information on hospital admissions.	High: the percentage who withdrew is documented but reasons are not supplied. No reasons for exclusion.	Low: all outcomes are discussed.	None

(Continued)

**TABLE 3 ] (continued)**

Study/Year	Random Sequence Bias	Allocation Concealment	Blinding, Participant	Blinding, Outcome Assessor	Incomplete Outcome Data	Selective Reporting	Other
Wood-Baker et al <sup>30</sup> /2012	Low: allocation was dependent on domicile/depending on catchment area. Groups were matched for rurality and socioeconomic status.	High: assignment was dependent on where they lived.	High: no blinding.	High: no blinding.	High: underreporting as more withdrew in the intervention group. Did not report reasons for withdrawal.	Low: all outcomes are discussed.	None
Wong et al <sup>29</sup> /2005	Low: randomized using the research randomizer.	Low: blindly assigned.	High: no blinding.	Low: the research assistant who collected the Chinese Self-efficacy Scale after the follow-up was blinded.	High: two dropped out from each group. Reasons were not reported and their data were replaced by the group mean.	Unclear: no outpatient data at 3 mo.	None

Review author's judgment assessed as low, unclear, or high risk of bias. High = bias of sufficient magnitude to have a notable effect on the results or conclusions of the trial; Low = no obvious risk of bias; Unclear = insufficient detail is reported of what happened in the trial.

SM skills were limited. The health outcomes assessed varied widely across studies, often in the absence of standardized, objective measures. Findings revealed that SM alone delivered immediately post-AECOPD did not impact on hospital readmissions or HRQOL. No effects were found on rate of mortality, depressive symptoms, primary care usage, or exercise capacity. Minimal effects were found on self-efficacy, anxiety symptoms, and health-promoting behavior. SM was associated with positive effects on knowledge<sup>26,31</sup> and management of an AECOPD.<sup>26</sup>

The absence of effect on hospital readmission of SM delivered immediately following an AECOPD contrasts with evidence from patients with stable disease.<sup>2,3</sup> A recent Cochrane review identified that SM interventions are effective in reducing respiratory-specific and all-cause hospital admissions.<sup>3</sup> It was not possible in this review to divide respiratory and all-cause admissions. Similarly, the absence of effect on HRQOL contrasts with the positive impact observed when SM interventions are provided for stable patients with COPD.<sup>3</sup> Following an AECOPD, patients may be unwilling or unable to comply with SM advice. Patients' engagement in active interventions, such as rehabilitation, post-AE has been shown to be poor.<sup>32,33</sup> Furthermore, patients' ability to attend to new information when they are acutely breathless may be compromised.<sup>11</sup>

Although studies were selected based on their inclusion of two or more SM strategies, shortcomings in the delivery of SM interventions included little emphasis on teaching and empowering patients to use SM skills, with only two studies reporting training nurses in the principles of behavior change theories and interventions.<sup>28,30</sup> Fewer than 50% of patients who received SM intervention post-AE were classified as successfully mastering SM skills,<sup>28</sup> and for these individuals, the likelihood of readmission to hospital was improved. Second, despite heightened levels of distress post-AECOPD,<sup>10</sup> there has been little attention given to patients' psychologic status. This may be important when considering patients' suitability for enrollment in SM interventions as distress and body vigilance increase following SM intervention in patients who post-AE were identified as suffering from panic disorder.<sup>34</sup> Finally, only one intervention included more than two home visits and maintained face-to-face follow-up for 12 months.<sup>28</sup> Interestingly, this study demonstrated the greatest improvements in social and psychologic functioning. It may be necessary to reinforce information at a time when acute breathlessness has resolved and patients' ability to attend to information has improved.

**TABLE 4 ] Outcomes of SM Delivered Following Hospitalization With an AECOPD**

Outcomes	Hermiz et al <sup>21</sup> /2002	Casas et al <sup>6</sup> /2006 and Garcia-Aymerich et al <sup>26</sup> /2007	Wood-Baker et al <sup>29</sup> /2012	Song et al <sup>27</sup> /2014	Bucknall et al <sup>28</sup> /2012	Wong et al <sup>29</sup> /2005
Hospital admissions	NBGD	+	NBGD	...	NBGD	+
HRQOL	NBGD	NBGD	NBGD	...	NBGD	...
Mortality	...	NBGD	...	...	NBGD	...
Knowledge	+	+	...	...	...	...
Self-efficacy	...	...	NBGD	...	NBGD	+
Psychologic morbidity						
Anx	...	...	NBGD	...	+	...
Dep	...	...	NBGD	...	NBGD	...
Primary care usage	NBGD	NBGD	...	...	...	NBGD
SM of an AE	...	+	...	...	...	...
Positive health-behavior change	NBGD	NBGD	...	+	...	...
Exercise capacity	...	...	...	NBGD	...	...

Anx = anxiety; Dep = depression; NBGD = no between-group differences; + = positive result. See Table 1 and 2 legends for expansion of other abbreviations.

Despite the questionable effectiveness of SM interventions post-AE, the safety of such interventions appears to be acceptable, with two studies reporting no differences in mortality between groups. This is a relevant observation since the safety of delivering SM post-AE has been recently questioned with higher mortality rates evident in those who participated in SM intervention post-AE.<sup>35</sup> SM interventions may not be appropriate for all patients and identifying those in whom it might be effective is necessary.

This review presents a number of limitations which ought to be considered. As SM has multiple components, issues of study heterogeneity are not surprising. Information on specific components of the intervention is limited; specifically, in most studies, action plans, which are an important component of SM, are poorly described, information is not provided on the intent vs actual delivery of the intervention and little detail is

offered on the type of behavior the intervention is aiming to change. Alterations in “usual care” over the time period of the studies, from discharge with no support<sup>29,31</sup> to education and management as part of standardized care,<sup>27</sup> may also have affected the observed impact of a SM intervention. Few studies assessed knowledge, although standardized, valid, and reliable disease-specific tools are available.<sup>36</sup> The outcomes assessed were not always matched to the content of the interventions. For example, studies assessed anxiety and depression but SM interventions did not address psychological symptoms. Issues with bias were identified across all seven included studies with SM interventions being delivered only to those without any impairment of cognitive functioning. Given the prevalence of cognitive impairment in patients with COPD (27%), the generalizability of results is limited.<sup>37</sup> A final limitation of the review pertains to the involvement of one reviewer in the initial screening of articles, although two reviewers

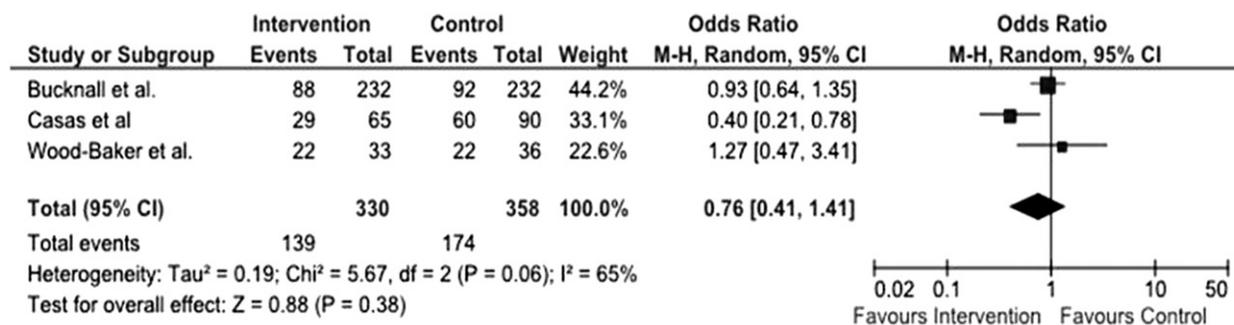


Figure 2 – Results for the meta-analysis on hospital admissions. *df* = degrees of freedom; M-H = Mantel-Haenszel.

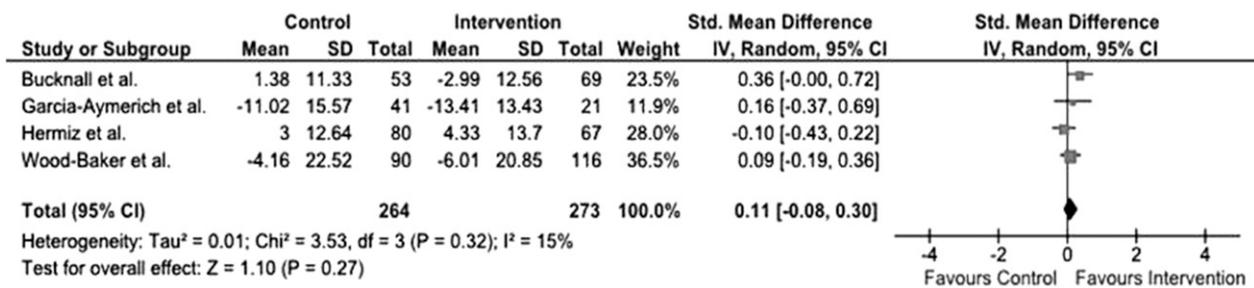


Figure 3 – Results for the meta-analysis on health-related quality of life (total score). Std = standardized. See Table 2 legend for expansion of other abbreviations.

(S. L. H. and T. J.-F.) worked in close collaboration and several meetings were held with the senior authors (D. B. and R. S. G.) throughout the selection process.

Future research is required to establish the potential importance of training HCPs in theories of behavior change and the delivery of SM skills as well as understanding the impact of the level of expertise (general nurse vs specialized nurse). Given the heterogeneity of the studies reviewed, it is difficult to evaluate the effectiveness of SM intervention delivered immediately post-AE. Although, to date, SM delivered immediately

post-AE appears to have limited effectiveness, particularly in addressing readmissions and improving HRQOL, the trials which do demonstrate some success include structured follow-up. This follow-up should be individualized, focused on reinforcing SM skills, and offer face-to-face contact.

In conclusion, the content of SM interventions delivered immediately post-AE and the health outcomes assessed vary widely, as with studies in stable patients with COPD, making it difficult to conclude that there is any evidence for its effectiveness.

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