RESEARCH ARTICLE

Self-management interventions for adults living with Chronic Obstructive Pulmonary Disease (COPD): The development of a Core Outcome Set for COMPAR-EU project

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Abstract

Background
A large body of evidence suggests that self-management interventions (SMIs) may improve outcomes in chronic obstructive pulmonary disease (COPD). However, accurate comparisons of the relative effectiveness of SMIs are challenging, partly due to heterogeneity of outcomes across trials and uncertainty about the importance of these outcomes for patients. We aimed to develop a core set of patient-relevant outcomes (COS) for SMIs trials to enhance comparability of interventions and ensure person-centred care.

Methods
We undertook an innovative approach consisting of four interlinked stages: i) Development of an initial catalogue of outcomes from previous EU-funded projects and/or published studies, ii) Scoping review of reviews on patients and caregivers’ perspectives to identify outcomes of interest, iii) Two-round Delphi online survey with patients and patient representatives to rate the importance of outcomes, and iv) Face-to-face consensus workshop with patients, patient representatives, health professionals and researchers to develop the COS.

Results
From an initial list of 79 potential outcomes, 16 were included in the COS plus one supplementary outcome relevant to all participants. These were related to patient and caregiver...
knowledge/competence, self-efficacy, patient activation, self-monitoring, adherence, smoking cessation, COPD symptoms, physical activity, sleep quality, caregiver quality of life, activities of daily living, coping with the disease, participation and decision-making, emergency room visits/admissions and cost effectiveness.

Conclusion

The development of the COPD COS for the evaluation of SMIs will increase consistency in the measurement and reporting of outcomes across trials. It will also contribute to more personalized health care and more informed health decisions in clinical practice as patients' preferences regarding COPD outcomes are more systematically included.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is one of the major causes of morbidity and mortality worldwide [1,2]. The economic and social burden related to COPD are expected to increase over the coming decades due to the continued exposure to COPD risk factors and the increasing aging of the world’s population [3]. COPD prevalence varies across countries and across different groups within countries (i.e., being male, older and former or current smoker) [4]. It is directly related to the prevalence of tobacco smoking, although in many countries outdoor and indoor air pollution constitute major risk factors [5,6].

The literature suggests that self-management interventions (SMIs) may improve clinical outcomes, quality of life and reduce costs of chronic conditions, including COPD [7,8]. A Cochrane systematic review showed that SMIs along with support from health professionals improve health-related quality of life while decreasing hospitalizations and emergency department visits of COPD patients [9].

Two recent studies, the COMET [10] and the PIC-COPD [11] showed the potential of SMIs for reducing exacerbations and mortality in integrated case management, as well as for increasing physical activity. However, synthesizing the evidence on the relative effectiveness of SMIs for COPD is challenging due to heterogeneity of interventions, lack of clear definitions of self-management components, and variability in the outcomes reported. Moreover, systematic reviews on SMI effectiveness have found insufficient data for some outcomes, which may be suggestive of selective reporting [9,12,13].

SMIs can only be compared across studies when they share some common outcomes. In addition, it is important to create consensus about what outcomes are especially relevant to assess the effects of SMI and how they should be measured. By reaching consensus of a standardized set of outcomes that should be minimally measured and reported in future COPD clinical trials, we will ensure the comparativeness of results and synthesis of the evidence across studies [14]. This outcome set should be relevant for all stakeholders, but especially for patients, as they are the ones primarily responsible for the daily management of their disease.

In this study we propose a systematic approach to develop a Core Outcome Set [COS] for measuring the effectiveness of SMIs interventions in COPD from the perspective of both patients and health care professionals. This study is part of COMPAR-EU, an EU-funded project designed to bridge the gap between current knowledge and practice on SMIs in four chronic conditions including COPD.
Material and methods

The COS for SMIs in COPD patients was developed in accordance with the Core Outcome Measures for Effectiveness Trials (COMET) Handbook [14] and the Core Outcome Set-STAndards for Development (COS-STAD) guidelines [15]. This study was conducted according to a protocol previously published [16]. The COMPAR-EU COS approach involved four inter-linked stages that are described below and summarized in Fig 1.

Stage 1. Development of an initial catalogue of outcomes

Data sources and searches. We developed an initial catalogue of outcomes from a literature review of two overviews of systematic reviews evaluating the effectiveness of SMIs for
chronic diseases: i) PRO-STEP (Promoting Self-Management for Chronic Diseases in the EU) [17] and ii) EMPATHiE (Empowering Patients in the Management of Chronic Diseases) [18]. Both reviews [17,18] were performed by the research team and were considered as the starting data source to build the initial list of outcomes. We additionally searched for COPD COS in relevant organizations databases such as COMET [10] and ICHOM [International Consortium for Outcomes Health Measurement] [19], to discard the existence of COS on this area and avoid work duplication as recommended by the COMET handbook [20]. The syntax used for the additional literature review in PubMed was the following: (pulmonary disease, chronic obstructive ”[MeSH Terms] AND ”patient preference”[MeSH Terms]) AND ”outcome assessment (health care)”[MeSH Terms]; ”pulmonary disease, chronic obstructive”[MeSH Terms] AND ”core outcome set”[All Fields].

**Study selection.** We included systematic reviews and individual studies that reported outcomes on SMIs for patients with COPD. We excluded systematic reviews that did not report a final list of outcomes or individual studies where the final list of outcomes was not developed considering patients’ input, experiences or values and preferences.

We screened title and abstracts and assessed eligible full-text articles independently. In case of disagreement, reviewers reached consensus or consulted with a third reviewer from the review team. Reviewers checked references from included studies to identify other potentially eligible studies.

**Data extraction.** Pairs of authors independently extracted the following data from eligible studies: i) study database, ii) type of publication (i.e., published COS, literature review or systematic review), iii) age groups, and iv) list of outcomes.

**Data synthesis.** We tabulated and classified the identified outcomes into the following seven categories following the process for the development of the COMPAR-EU taxonomy [21]: i) empowerment components, ii) adherence to expected self-management behaviours, iii) clinical outcomes, iv) patient and informal caregivers’ quality of life, v) perceptions and/or satisfaction with care, vi) healthcare use and vii) costs. The research team reviewed and discussed outcomes and merged them when possible.

Through an iterative process, an external clinician and researcher reviewed and discussed the resulting list of outcomes with multidisciplinary experts from the COMPAR-EU consortium. We prepared a definition of each outcome with the participation of all COMPAR-EU team members. Experts in health literacy and patient representatives adapted the resulting list of outcomes and presented it in plain language. This list of outcomes was to be used in the first round of the Delphi process (Stage 3).

**Stage 2. Scoping review of reviews on perspectives of patients and their caregivers regarding self-management**

We conducted a scoping review of reviews [22] to identify and describe key concepts related to outcomes by exploring patients’ and caregivers’ preferences and experiences when coping with COPD and its self-management.

**Data sources and searches.** We searched MEDLINE, CINAHL and PsycINFO from inception until February 2018. We applied a content search strategy for values and preferences [23] in combination with terms specific for COPD. We used review filters available in each database. We included the following terms for identifying patients’ perspectives: patient perception, experience, perspective, understanding, preferences and health utilities.

**Study selection.** We included reviews of quantitative, qualitative or mixed-methods studies that explored the perspectives, experiences, values and preferences of patients and caregivers on SMIs for COPD.
Data extraction. In a previously pilot-tested data extraction form, we collected the general characteristics and main findings of each review.

Data synthesis. We conducted a descriptive thematic synthesis including the identification of codes, descriptive themes and main themes relevant to outcomes of SMI for COPD. We paired main emerging themes with the subdomains of the COMPAR-EU taxonomy [21] and mapped the correspondence between themes and the initial catalogue of outcomes. We developed infographics illustrating themes to be used as aid materials during the consensus workshop.

Stage 3. Delphi survey (Round I and II)
To prioritize the outcomes identified, we administered two-round modified Delphi online surveys to a convenience sample. Our sample included patients and patient representatives to ensure that we address outcomes that matter to patients as well as to other stakeholders.

Study population and eligibility criteria. We included adults diagnosed with COPD and patient representatives who were able to understand and speak English and provided informed consent to participate through the web platform hosting the Delphi rounds. We made efforts to recruit patients considering age, gender, geographical location and education. However, the patients who participated in this study may have been more knowledgeable, motivated and aware of treatment options and legislation than other COPD patients. In the other hand, they may have been more motivated to engage in research and advocacy activities. They may have also been more aware of the needs of other COPD patients and during the discussion it was evident that they wanted to represent the views of COPD patients as a whole and not just their own. As an example, they mentioned that while they were aware of strategies to avoid exacerbations, other patients may be less knowledgeable.

Recruitment strategy. Participants were identified within the European Patients’ Forum’s EU wide membership network of more than 70 patient organizations [24] and other patient groups (e.g., those involved in ICHOM) [19]. Recruitment started and concluded in February 2018 and ended in May 2018.

Delphi survey. The first and second Delphi rounds took place between May 2018 and June 2018. All participants received an online survey with the outcomes and definitions. They also received weekly reminders and were able to return to the questionnaire within a 3-week period. Some of the participants were supported by their local organizations when completing it. Participants were asked “How important do you think the following outcomes are to measure the success of self-management in people with COPD?”. COPD outcomes for SMIs were prioritized during the two-round Delphi process using a 1 to 9 Likert scale (1 being the least and 9 being the most important for the self-management of COPD).

During the second round, participants were able to see ratings (average score) from the first round and thus, adjust, confirm or rethink their answers. They were also allowed to deliberate. This process enabled participants to rate the most relevant SMIs outcomes for COPD according to their perspective.

Data synthesis and analysis. All outcomes were categorized into three groups based on the level of agreement of ratings from the two-round Delphi online surveys as follows (Table 1): i) Group 1 or “high consensus and high importance outcomes”, ii) Group 2 or “low consensus and mixed importance outcomes” and iii) Group 3 or “high consensus of moderate and low importance outcomes”. We used 70% as a cut off for high agreements based on GRADE recommendations, COMET guidelines and previous papers reporting patient-centred core outcome sets that also used these thresholds [20,25,26].
Stage 4. Consensus workshop and final COPD COS

The final stage of the COPD COS development was a two and a half-day, in-person consensus workshop held in July 2018 in Berlin (Germany). The aim of the workshop was achieving consensus on the most important outcomes to include in the final COPD COS for the COMPAR-EU project. COPD patients and patient representatives who participated in the two Delphi rounds, health professionals and researchers were invited to participate. Researchers and health professionals were selected from a purposive sample of a heterogeneous group of health professionals representing relevant specialties on the care of patients with COPD (general practitioners, specialists, nurses...) and researchers that came from seven collaborating partner-teams, who knew the process well and could participate on the ultimate objective of facilitating dialogue between patients, patient representatives and health professionals during the consensus workshop.

Participants received the results of the two-round Delphi survey (stage 3), and infographics illustrating themes, by outcome, from the scoping review (stage 2) one week before the consensus workshop which were used as additional material for free consultation. We organised outcomes according to a preliminary version of the outcome COMPAR-EU taxonomy [21]. We sorted them by level of agreement as described previously. The COMPAR-EU research team led step-by-step the flow of the discussion to address potential discrepancies across stakeholders (Fig 2). The group worked on prioritizing and selecting a maximum of 15 outcomes and up to five supplementary outcomes from those that had remained from the Delphi survey results. Participants selected outcomes through an iterative voting (secret vote) and discussion process. Outcomes that were closely related were merged. Once a preliminary list was agreed upon after voting and discussing, participants further reviewed the included outcomes and reached an agreement on the final version of the COPD COS.

Ethics statement. Ethical approval was obtained by the Clinical Research Ethics Committee of University Institute for Primary Care Research–IDIAP Jordi Gol in March 2018. All patients and other stakeholders provided written informed consent prior to participation.

Results

Stage 1. Development of an initial catalogue of outcomes

Study selection. The literature review of previous EU funded projects (PRO-STEP [17] and EMPATHiE [18]) identified records focusing on SMIs in chronic diseases in general. We included 22 systematic reviews specific to COPD [27–48] from PRO-STEP. The additional search in COMET [10], ICHOM [19] and snowballing, which included i) looking at suggestions of similar studies in the search databases, ii) looking at the references of eligible studies, and iii) re-running searches using terms from eligible studies, yielded 23 articles. After full-text

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Table 1. Categories of outcomes by level of agreement.

| Group | Votes | Interpretation |
|-------|-------|----------------|
| Group 1a | ≥ 70% voted 8–9 | ≤ 15% voted 1–3 | High agreement on high importance. Suggestion to include on Core Outcome Set |
| Group 1b | ≥ 70% voted 7 | ≤ 15% voted 1–3 | High agreement on high importance. Suggestion to include on Core Outcome Set |
| Group 2 | Intermediate results | | Inclusion or exclusion on Core Outcome Set to be decided in consensus workshop |
| Group 3 | ≤ 15% voted 8–9 | ≥ 70% voted 1–3 | High agreement on moderate or low importance. Suggestion to exclude from Core Outcome Set |

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appraisal, we included five studies [49–53]; one study was excluded because it did not report the list of outcomes [54].

**Study characteristics.** The five included studies reported: i) a summary of outcomes for COPD pharmacological trials from lung function to biomarkers created by the American Thoracic Society/European Respiratory Society Task Force [49], ii) a review of instruments used to measure symptom response in pharmacological trials [50], iii) a review of articles determining themes identified as most important by COPD patients for any aspect of care of COPD [51], iv) a review assessing clinical outcomes in COPD mainly used on current published data [53], and v) a study addressing patient preferences regarding the expectations related to treatment of COPD.

**List of outcomes and outcomes classification.** We identified 79 outcomes for the initial list of outcomes. We classified outcomes into seven predefined subdomains based on a taxonomy for SMIs [21]. Table 2 presents the outcomes classification.

**Stage 2. Scoping review of reviews on perspectives of patients and their caregivers regarding self-management**

**Study selection.** Among the 1,031 unique screened references, 27 reviews were included comprising more than 800 studies.
| Subdomain | Outcome |
|-----------|---------|
| Basic empowerment components | 1 Patient activation  
2 Self-efficacy  
3 Knowledge  
4 Health literacy  
5 Caregiver knowledge  
6 Caregiver self-efficacy |
| Level of adherence to expected self-management behaviors | 7 Taking medication or other treatment as advised (adherence)  
8 Self-monitoring  
9 Diet habits  
10 Diet habits (adherence to diet)  
11 Physical activity  
12 Smoking cessation  
13 Smoking |
| Clinical outcomes | 14 Body weight  
15 Malnutrition  
16 Tiredness (fatigue)  
17 Interrupted  
18 Sleep problems sleep (disturbed sleep)  
19 Sleep quality  
20 Sleepiness  
21 Chest tightness or discomfort  
22 COPD symptoms (short term)  
23 COPD symptoms (long term)  
24 Breathlessness (Dyspnea)  
25 Exacerbation  
26 Lung function (FEV1, FVC)  
27 Lung function  
28 Lung function (LTOT)  
29 Lung function/CPAP  
30 Muscle strength  
31 Effort test/Exercise capacity  
32 Complications  
33 Treatment side effects (adverse effects)  
34 Mortality |
| Patient and informal caregivers’ quality of life | 35 Usual activities  
36 Mobility  
37 Work  
38 Physical activities  
39 Sex life  
40 Normality  
41 Pain or discomfort  
42 Treatment burden  
43 Medication burden  
44 Positive attitude  
45 Depression  
46 Anxiety  
47 Stress  
48 Coping  
49 Hostility  
50 Happiness |

(Continued)
Study characteristics. Of the 27 reviews for COPD, 16 (59%) were qualitative evidence synthesis [55–70], six (22%) quantitative systematic reviews [51,71–75], four (15%) were mixed methods research synthesis [76–79], and one (4%) was a literature review [80].

The number of included studies ranged from five [73] to 213 [75]. The majority of the reviews (n = 22, 82%) included only the patients’ perspective. The phenomena of interest addressed among reviews were preferences on health states of COPD (n = 5, 18%), experiences with the process of self-management (n = 14, 52%) and experiences with self-management interventions (n = 8, 30%).

Main themes related to SMI outcomes for COPD. We identified 21 main themes, which are presented in Table 3. These themes were classified under i) empowerment components, ii) adherence to the expected self-management behaviours, iii) clinical-related outcomes, iv) quality of life of patients and caregivers, v) perceptions and/or satisfaction with care, vi) health care use, vii) costs. Table 3 presents the subdomains of the COMPAR-EU taxonomy and the related identified themes for COPD.

| Subdomain                          | Outcome                                                                                           |
|-----------------------------------|---------------------------------------------------------------------------------------------------|
| Perception of and/or satisfaction with care | 59 Satisfaction with/perception of care  
60 Participation and decision-making  
61 Patient-health care provider relation  
62 Communication with health care professionals  
63 Extent to which the health care professional gives enough time to listen to the patient  
64 The patient feels s/he has enough information |
| Healthcare use                     | 65 Number of primary care or outpatient (ambulatory) visits  
66 Number of nurse visits  
67 Number of virtual visits or contacts with healthcare providers  
68 Number of visits to specialist doctors  
69 Number of home care visits  
70 Number of visits with other healthcare professionals  
71 (Number of) emergency department visits (hospital)  
72 Number of hospital admissions  
73 The length of time spent in hospital (length of hospital stays)  
74 Number of re-hospitalizations unexpected return to hospital |
| Cost                              | 75 Impact of healthcare costs for the healthcare system  
76 Cost of hospitalizations for the healthcare system  
77 Cost savings for the healthcare system  
78 Direct medical costs for patient  
79 Value for money of the self-management intervention |

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Table 3. Main themes related to COPD outcomes according to the subdomains from COMPAR-EU taxonomy.

| Subdomains from the COMPAR-EU taxonomy | Main themes for COPD | References |
|----------------------------------------|---------------------|------------|
| Empowerment components                 | Health knowledge [52,56,57,60,63,64] | [55,58,59,65,66,69] |
|                                       | Help/health-seeking behavior | [55,59,60,69,81] |
|                                       | Technological (digital) literacy | [67] |
| Adherence to expected self-management behaviors | Adherence to treatment | [60] |
|                                       | Self-care ability | [63,77,81,82] |
|                                       | Smoking behavior | [59,60,62,65,74] |
|                                       | Perceived benefit (importance) of the intervention | [57,62,64–67,76,78,79] |
| Clinical-related outcomes              | Adverse events | [75] |
|                                       | Mortality | [65] |
|                                       | Progression of the disease | [58–60,71–73,75,81,83] |
| Quality of life of patients and caregivers | Informal caregiver’s’ burden | [59,60,80] |
|                                       | Physical functioning | [57–59,65,69,78,79] |
|                                       | Psychological distress | [58,60,65,67,70,74,77,78,82] |
|                                       | Social support | [55,57,58,62,64–66,70,76,78,79,81,82] |
| Perceptions and/or satisfaction with care | Individualized care | [60] |
|                                       | Patient-provider interaction | [55,58–60,81] |
|                                       | Perceived quality of care | [67,82] |
|                                       | Usability | [62,67] |
| Healthcare use                         | Access to healthcare | [55,59,69] |
|                                       | Visits or contacts with healthcare professionals | [62,67,82] |
| Costs                                  | Cost for patients (out of pocket) | [75] |

COPD = Chronic Obstructive Pulmonary Disease.

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Mapping of themes
Of the 79 outcomes from the initial catalogue of outcomes, 45 were covered in the thematic synthesis (57%). All outcomes of the subdomain “empowerment components” were informed by the scoping review findings (n = 4, 100%), while the subdomain “costs” was the least informed subdomain (n = 1, 20%). Fig 3 reports the number of outcomes informed by the thematic synthesis of the scoping review.

COPD infographic
An infographic was developed for the final consensus workshop including the main findings and topic related images (Stage 4). The infographic included the outcomes of the initial catalogue informed by the scoping review, classified according to the preliminary version of the outcome taxonomy (S1 File). This material and results from the Delphi rounds were sent to the consensus workshop participants (stage 4) one week in advance.

Stage 3. Two-round modified Delphi survey
Participants were invited via email. Nine participants accepted the invitation to participate and completed round I and round II of the Delphi online survey. Of these, five (56%) were patients and four (44%) were patient advocates or patients’ representatives. Six (67%) were men, five (56%) were over 65 years old and seven (78%) had higher education (master or doctoral equivalent) (S2 File).
After the two-round Delphi survey, 23 (29%) of the 79 included outcomes were voted as high agreement on high importance (Group A: \( \geq 70\% \) of participants voted 7 to 9 on the Likert scale), eight (10%) as high agreement on non-importance (Group C: \( \geq 70\% \) of participants voted 1 to 3 on the Likert scale) and 48 (61%) voted intermediate agreement on importance (Group B) (Table 1).

**Stage 4. Consensus workshop and final COPD core outcome set**

Five of the nine patients or patients’ representatives that participated in the Delphi online survey and five health professionals and researchers participated in the face-to-face consensus meeting. Five members of the COMPAR-EU research team participated as facilitators (S3 and S4 Files).

The consensus workshop resulted in 16 outcomes for COPD plus 1 supplementary outcome (Table 4). Within these 16 outcomes, Delphi participants rated eight (50%) as high agreement on high importance, seven (44%) as low agreement and mixed importance rating, and one (6%) as high consensus of moderate and low support. Knowledge was part of the high consensus and high importance outcomes and was rendered as a supplementary outcome.

**Discussion**

**Main findings**

The final COS for COPD included 16 outcomes plus 1 supplementary outcome. It represents the first COS developed based on patient preferences for evaluating SMIs in adults living with COPD. The COS incorporated results from a literature review complemented by a participatory process involving patients and patient representatives along with health professionals and researchers in all stages of the process.
Our results in the context of previous research

To the best of our knowledge, this is the first COS where a significant part of the work was led by patient representatives’ organizations (EPF). Although various approaches have been described to develop COS [84,85], it is still uncertain which are the most appropriate. We chose to follow an iterative mixed-method approach involving different methodologies used in previous studies [86]. The COS we present is novel since it focuses specifically on SMIs for COPD. Previous studies have focused on COPD management or other conditions [87–89]. Spargo et al. [87] developed a COS for trials investigating the long-term management of bronchiectasis combining an overview of systematic reviews and qualitative studies and a Delphi panel that included mostly health professionals who rated the importance of each outcome initially selected. Verburg et al. [88] developed a standard set of outcome domains and proposed

Table 4. COMPAR-EU COS for COPD.

| Outcome (COS)                          | Definition                                                                                                                                 |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Knowledge (supplementary)             | Relates to knowledge about COPD in general and COPD self-management, or the way care for COPD is organized and this both for patients and their social network. |
| Caregiver knowledge and competence    | That the caregiver has competences and knowledge of the disease and its management.                                                       |
| Self-efficacy                         | A person’s belief that s/he is capable of doing something, often related to a specific goal s/he wants to achieve; feeling of confidence and of being in control. |
| Patient activation                    | The knowledge, skills and confidence a person has on managing their own health and healthcare, including a feeling of being responsible for taking care of their own health. |
| Self-monitoring                       | The extent to which a patient (regularly) monitors themselves as agreed with her/his healthcare professionals, for example her/his symptoms or weight. |
| Taking medication or other treatment as advised (adherence) and adherence to regular visits | The extent to which a patient follows the prescribed treatment, such as taking medication as advised and following life-style advice, and extent of attending scheduled visits. |
| Smoking cessation                     | Stopping smoking (and/or smoking less).                                                                                                    |
| COPD symptoms (short term)            | Extent of Symptoms relief (in the short-term, including cough; breathlessness, among others).                                              |
| Physical activity—muscle strength     | Referral/participation in a Pulmonary Rehabilitation program: Physical activity, Physical activities, Muscle strength linked with exercise capacity plus an overall support. |
| Sleep quality                         | Sleep quality contains interrupted sleep, sleep problems, sleep quality (as overall) and sleepiness.                                         |
| Exacerbation                          | Increased breathlessness, mucus/phlegm/sputum production, and change in color of sputum and Feeling out of breath.                              |
| Caregiver quality of life (including burden) | Caregiver quality of life and the burden that he/she feels from the caregiver’s tasks.                                                   |
| Activities of daily living: including sex life, social activities and work (usual activities) | Being able to do usual activities, such as personal hygiene, housework, sex, managing finances, social activities and work.                   |
| Coping with the disease, including depression and anxiety | How well a person feels able to cope/manage with stress or other difficulties caused by the disease, including depression and anxiety. |
| Participation and decision making      | Feeling able to participate actively in her/his own care (as much as s/he wishes).                                                         |
| Number of emergency room visits and admissions | Number of visits to emergency department visits and hospital admissions.                                                                  |
| Cost effectiveness and resources use  | It includes value for money of the self-management intervention and the use of resources.                                                  |

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measures for patients with COPD for Dutch primary care physical therapy using a consensus-driven modified RAND-UCLA appropriateness method with relevant stakeholders. Jones et al. [89] created a priority list of measures for a combined COPD and heart failure exercise rehabilitation program through a stakeholders consensus event.

**Strengths and limitations**

The first list of COS was mainly based on the results from a literature review on three comprehensive overviews of systematic reviews performed in a previous project (PRO-STEP). As such, it incorporates a robust body of evidence vested in previous projects. The COS development aligns with current methodological guidelines for COS development, as it included a participatory process of patients, patient representatives and other key stakeholders in all stages of the process [14]. Therefore, the resulting COS is strongly based on patient preferences while also incorporating the viewpoints of health professionals, researchers and patients' representatives.

Outcome definitions were adapted to patient accessible language by EPF, which has extensive experience working with and presenting research material to patients in an intelligible manner. This ensured the comprehensibility of the process and the applicability of the results.

Our work is subject to some limitations. The number of participants during the Delphi process was small but the minimum number of patients that had to complete the two Delphi rounds was achieved. We are confident that this shortcoming was overcome via the further deliberations that took place during the workshop. For the workshop, since only five of nine patients from Delphi participated in the consensus, we cannot rule out potential of attrition bias. Lastly, our sample in the Delphi and the consensus workshop may not be entirely representative of the population of patients with COPD. They could represent very motivated individuals or well-informed patients with high education or digital skills. However, and given the resources available, it would not have been feasible to adopt methodology different from electronic surveys (e.g., in-person interviews or surveys) to reach out to participants that are more diverse.

**Implications for practice and research**

The identified COS will inform a series of systematic reviews and network meta-analysis (NMA) about the effectiveness of SMIs as part of the COMPAR-EU project. We are confident that the COPD COS reflects the preferences of all key stakeholders and that it might be applicable with context adaptation to wide range of settings across Europe and the world. Future research evaluating SMIs for COPD should, as a minimum, include the outcomes in the proposed COS. Further work is needed to identify and provide guidance on the most appropriate measures for each outcome, on the right instruments or approaches to measure these outcomes, and on the length of follow up. Moreover, it will be important to identify strategies for fostering the collection of this information, the role of the different providers, and the settings where these outcomes can be assessed.

**Conclusions**

We have developed the first COS for SMIs in COPD. This COS will increase consistency in the reporting of results that are relevant to patients across trials evaluating SMIs for COPD. This COS will enhance evidence synthesis of COPD patient-relevant outcomes and will decisively support research and overall field development. It will improve informed health-decision making in clinical practice and will increase the certainty of evidence to guide policy-making and clinical practice regarding SMI in COPD patients.
Supporting information

S1 File. Infographic COPD.
(PDF)

S2 File. Delphi online survey participant characteristics.
(PDF)

S3 File. Consensus workshop participants characteristics–patients/patient representatives.
(PDF)

S4 File. Consensus workshop participants characteristics–health professionals and researchers.
(PDF)

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Patients and public involvement

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References

1. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012 Dec; 380(9859):2095–128. https://doi.org/10.1016/S0140-6736(12)61728-0 PMID: 23245604

2. Vos T, Flaxman AD, Naghavi M, Lozano R, Michaud C, Ezzati M, et al. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012 Dec; 380(9859):2163–96. https://doi.org/10.1016/S0140-6736(12)61729-2 PMID: 23245607

3. Mathers CD, Loncar D. Projections of Global Mortality and Burden of Disease from 2002 to 2030. Samet J, editor. PLoS Med. 2006 Nov 28; 3(11):e442. https://doi.org/10.1371/journal.pmed.0030442 PMID: 17132052

4. Whitmore G, Aaron S, Gershon A, Gao Y, Yang J. Influence of country-level differences on COPD prevalence. Int J Chron Obstruct Pulmon Dis. 2016 Sep; Volume 11:2305–13. https://doi.org/10.2147/COPD.S113868 PMID: 27698561

5. Eisner MD, Anthonisen N, Coutts D, Kuerzli N, Perez-Padilla R, Postma D, et al. An Official American Thoracic Society Public Policy Statement: Novel Risk Factors and the Global Burden of Chronic Obstructive Pulmonary Disease. Am J Respir Crit Care Med. 2010 Sep; 182(5):693–718. https://doi.org/10.1164/rccm.200811-1757ST PMID: 20802169
6. Salvi SS, Barnes PJ. Chronic obstructive pulmonary disease in non-smokers. Lancet. 2009 Aug; 374 (9691):733–43. https://doi.org/10.1016/S0140-6736(09)61303-9 PMID: 19716966

7. Newham J, Presseau J, Heslop-Marshall K, Russell S, Ogunbayo O, Netts P, et al. Features of self-management interventions for people with COPD associated with improved health-related quality of life and reduced emergency department visits: a systematic review and meta-analysis. Int J Chron Obstruct Pulmon Dis. 2017 Jun; Volume 12:1705–20. https://doi.org/10.2147/COPD.S133317 PMID: 28652723

8. Murphy LA, Harrington P, Taylor SJ, Teljear C, Smith SM, Pinnock H, et al. Clinical-effectiveness of self-management interventions in chronic obstructive pulmonary disease: An overview of reviews. Chron Respir Dis. 2017 Aug 24; 14(3):276–88. https://doi.org/10.1177/1479972316687206 PMID: 28774200

9. Lenferink A, Brusse-Keizer M, van der Valk PD, Frith PA, Zwerink M, Monninkhof EM, et al. Self-management interventions including action plans for exacerbations versus usual care in patients with chronic obstructive pulmonary disease. Cochrane Database Syst Rev. 2017 Aug 4. https://doi.org/10.1002/14651858.CD011682.pub2 PMID: 28774550

10. Kessler R, Casan-Clara P, Koehler D, Tognella S, Viejo JL, Dal Negro RW, et al. COMET: a multicomponent home-based disease-management programme versus routine care in severe COPD. Eur Respir J. 2018 Jan 11; 51(1):1701612. https://doi.org/10.1183/13993003.01612-2017 PMID: 29326333

11. Rose L, Istanboulian L, Carriere L, Thomas A, Lee H-B, Rezaie S, et al. Program of Integrated Care for Patients with Chronic Obstructive Pulmonary Disease and Multiple Comorbidities (PIC COPD +): a randomised controlled trial. Eur Respir J. 2018 Jan 11; 51(1):1701567. https://doi.org/10.1183/13993003.01567-2017 PMID: 29326330

12. Shaw G, Whelan ME, Armitage LC, Roberts N, Farmer AJ. Are COPD self-management mobile applications effective? A systematic review and meta-analysis. npj Prim Care Respir Med. 2020 Dec 1; 30(1):11. https://doi.org/10.1038/s41533-020-0167-1 PMID: 32238810

13. Kaptein A, Fischer M, Scharloo M. Self-management in patients with COPD: theoretical context, content, outcomes, and integration into clinical care. Int J Chron Obstruct Pulmon Dis. 2014 Sep; 907.

14. Williamson PR, Altman DG, Bagley H, Barnes KL, Blazeby JM, Brookes ST, et al. The COMET Handbook: version 1.0. Trials. 2017 Jun 20; 18(Suppl 3):1–50. https://doi.org/10.1186/s13063-017-1978-4 PMID: 28681707

15. Kirkham JJ, Davis K, Altman DG, Blazeby JM, Clarke M, Tunis S, et al. Core Outcome Set-STAndards for Development: The COS-STAD recommendations. PLOS Med. 2017 Nov 16; 14(11):e1002447. https://doi.org/10.1371/journal.pmed.1002447 PMID: 2914504

16. Ballester M, Orrego C, Heijmans M, Alonso-Cóllio P, Versteegh MM, Mavridis D, et al. Comparing the effectiveness and cost-effectiveness of self-management interventions in four high-priority chronic conditions in Europe (COMPAR-EU): a research protocol. BMJ Open. 2020 Jan 19; 10(1):e034680. https://doi.org/10.1136/bmjopen-2019-034680 PMID: 31958612

17. PRO-STEP Consortium. Promoting self-management for chronic diseases in the EU-PROSTEP project. 2018.

18. EMPATHIE Consortium. EMPATHIE, empowering patients in the management of chronic diseases. Final Summary Report. 2014.

19. ICHOM. International Consortium for Health Outcomes Measurement [Internet]. https://www.ichom.org/why-measure-outcomes/.

20. Williamson PR, Altman DG, Bagley H, Barnes KL, Blazeby JM, Brookes ST, et al. The COMET Handbook: Version 1.0. Trials. 2017; 18(Suppl 3):1–50. https://doi.org/10.1186/s13063-017-1978-4 PMID: 28681707

21. Orrego C, Ballester M, Pacheco-Barrios K, Camus E, Heymans M, Groene O, et al. Development and external validation of a comprehensive Taxonomy of Self-Management Interventions in chronic conditions: the COMPAR-EU taxonomy. In 2019.

22. Niño de Guzmán E, Martínez-García L, González AI, Heymans M, Huaringa J, Immonen K, et al. The perspectives of patients and their caregivers on self-management interventions for chronic conditions: a protocol for a mixed-methods overview. F1000Research. 2020 Feb 18; 9:120.

23. Selva A, Solá I, Zhang Y, Pardo-Hernandez H, Haynes RB, Martinez Garcia L, et al. Development and use of a content search strategy for retrieving studies on patients' views and preferences. Health Qual Life Outcomes. 2017 Dec 30; 15(1):126. https://doi.org/10.1186/s12955-017-0698-5 PMID: 28851437

24. European Patients Forum [Internet]. 2020. https://www.eu-patient.eu.

25. Webbe J, Brunton G, Ali S, Duffy JM, Modi N, Gale C. Developing, implementing and disseminating a core outcome set for neonatal medicine. BMJ Paediatr Open. 2017 Jul; 1(1):e000048. https://doi.org/10.1136/bmjpo-2017-000048 PMID: 29637104
26. Potter S, Holcombe C, Ward JA, Blazeby JM. Development of a core outcome set for research and audit studies in reconstructive breast surgery. Br J Surg. 2015 Oct; 102(11):1360–71. https://doi.org/10.1002/bjs.9883 PMID: 26179938

27. McLean S, Nurmataov U, Liu JL, Pagliari C, Car J, Sheikh A. Telehealthcare for chronic obstructive pulmonary disease. Cochrane Database Syst Rev. 2011 Jul 6. https://doi.org/10.1002/14651858.CD007718.pub2 PMID: 21735417

28. Vieira DSR, Maltais F, Bourbeau J. Home-based pulmonary rehabilitation in chronic obstructive pulmonary disease patients. Curr Opin Pulm Med. 2010 Mar; 16(2):134–43. https://doi.org/10.1097/MCP.0b013e32833642f2 PMID: 20104176

29. McCarthy B, Casey D, Devane D, Murphy K, Murphy E, Lacasse Y. Pulmonary rehabilitation for chronic obstructive pulmonary disease. Cochrane database Syst Rev. 2015 Feb 23;(2):CD003793. https://doi.org/10.1002/14651858.CD003793.pub3 PMID: 25705944

30. Majothi S, Jolly K, Heneghan NR, Price MJ, Riley RD, Turner AM, et al. Supported self-management for patients with COPD who have recently been discharged from hospital: a systematic review and meta-analysis. Int J Chron Obstruct Pulmon Dis. 2015; 10:853–67. https://doi.org/10.2147/COPD.S74162 PMID: 25995625

31. Polisena J, Tran K, Citron K, Hutton B, McGill S, Palmer K, et al. Home telehealth for chronic obstructive pulmonary disease: a systematic review and meta-analysis. J Telemed Telecare. 2010; 16(3):120–7. https://doi.org/10.1258/jtt.2009.090812 PMID: 20197355

32. Flodgren G, Rachas A, Farmer AJ, Inzitari M, Shepperd S. Interactive telemedicine: effects on professional practice and health care outcomes. Cochrane database Syst Rev. 2015 Sep 7;(9):CD002098. https://doi.org/10.1002/14651858.CD002098.pub2 PMID: 26343551

33. Jolly K, Majothi S, Sitch AJ, Heneghan NR, Riley RD, Moore DJ, et al. Self-management of health care behaviors for COPD: a systematic review and meta-analysis. Int J Chron Obstruct Pulmon Dis. 2016; 11:305–26. https://doi.org/10.2147/COPD.S90812 PMID: 26937183

34. Walters JA, Turnock AC, Walters EH, Wood-Baker R. Action plans with limited patient education only for exacerbations of chronic obstructive pulmonary disease. Cochrane database Syst Rev. 2010 May 12;(5):CD005074. https://doi.org/10.1002/14651858.CD005074.pub3 PMID: 20464737

35. Gosselink R, De Vos J, van den Heuvel SP, Segers J, Decramer M, Kwakkel G. Impact of inspiratory muscle training in patients with COPD: what is the evidence? Eur Respir J. 2011 Feb; 37(2):416–25. https://doi.org/10.1183/09031936.00031810 PMID: 21282809

36. Bryant J, Bonevski B, Paul C, McEllduff P, Attia J. A systematic review and meta-analysis of the effectiveness of smoking cessation interventions in selected disadvantaged groups. Addiction. 2011 Sep; 106(9):1568–85. https://doi.org/10.1111/j.1360-0443.2011.03467.x PMID: 21288209

37. Cindy Ng LW, Mackney J, Jenkins S, Hill K. Does exercise training change physical activity in people with COPD? A systematic review and meta-analysis. Chron Respir Dis. 2012 Feb; 9(1):17–26. https://doi.org/10.1177/1479972311430335 PMID: 22194629

38. Hamilton FL, Greaves F, Majeed A, Millett C. Effectiveness of providing financial incentives to healthcare professionals for smoking cessation activities: systematic review. Tob Control. 2013 Jan; 22(1):3–8. https://doi.org/10.1136/tobaccocontrol-2011-050048 PMID: 22123941

39. Kruis AL, Smidt N, Assendelft WJJ, Gussekloo J, Boland MRS, Rutten-van Mölken M, et al. Integrated disease management interventions for patients with chronic obstructive pulmonary disease. Cochrane database Syst Rev. 2013 Oct 10;(10):CD009437. https://doi.org/10.1002/14651858.CD009437.pub2 PMID: 24108523

40. Collins PF, Stratton RJ, Elia M. Nutritional support in chronic obstructive pulmonary disease: a systematic review and meta-analysis. Am J Clin Nutr. 2012 Jun; 95(6):1385–95. https://doi.org/10.3945/ajcn.111.029499 PMID: 22513295

41. Tan J-Y, Chen J-X, Liu X-L, Zhang Q, Zhang M, Mei L-J, et al. A Meta-Analysis on the Impact of Disease-Specific Education Programs on Health Outcomes for Patients with Chronic Obstructive Pulmonary Disease. Geriatr Nurs (Minneap). 2012 Jul; 33(4):280–96. https://doi.org/10.1016/j.gerinurse.2012.03.001 PMID: 22595334

42. Bryant J, McDonald VM, Boyes A, Sanson-Fisher R, Paul C, Melville J. Improving medication adherence in chronic obstructive pulmonary disease: a systematic review. Respir Res. 2013 Oct 20; 14:109. https://doi.org/10.1186/1465-9921-14-109 PMID: 24136097

43. Health Quality Ontario. In-home care for optimizing chronic disease management in the community: an evidence-based analysis. Ont Health Technol Assess Ser. 2013; 13(5):1–65. PMID: 24167539

44. Quiñones AR, Richardson J, Freeman M, Fu R, O’Neil ME, Motu’apuaka M, et al. Educational group visits for the management of chronic health conditions: a systematic review. Patient Educ Couns. 2014 Apr; 95(1):3–29. https://doi.org/10.1016/j.pec.2013.12.021 PMID: 24468199
45. Prieto-Centurion V, Markos MA, Ramey NI, Gussin HA, Nyenhuis SM, Joo MJ, et al. Interventions to reduce rehospitalizations after chronic obstructive pulmonary disease exacerbations. A systematic review. Ann Am Thorac Soc. 2014 Mar; 11(3):417–24. https://doi.org/10.1513/AnnalsATS.201308-254OC PMID: 24423379

46. Li G, Yuan H, Zhang W. Effects of Tai Chi on health related quality of life in patients with chronic conditions: a systematic review of randomized controlled trials. Complement Ther Med. 2014 Aug; 22(4):53–65. https://doi.org/10.1016/j.ctim.2014.06.003 PMID: 25140608

47. Zwerink M, Brusse-Keizer M, van der Valk PDLM, Zielhuis GA, Monnikhof EM, van der Palen J, et al. Self management for patients with chronic obstructive pulmonary disease. Cochrane database Syst Rev. 2014 Mar 19;(3):CD002990. https://doi.org/10.1002/14651858.CD002990.pub3 PMID: 24665053

48. Harrison SL, Janaudis-Ferreira T, Brooks D, Desveaux L, Goldstein RS. Self-management following an acute exacerbation of COPD: a systematic review. Chest. 2015 Mar; 147(3):646–61. https://doi.org/10.1378/chest.14-1658 PMID: 25340578

49. Cazzola M, MacNee W, Martinez FJ, Rabec KF, Franciosi LG, Barnes PJ, et al. Outcomes for COPD pharmacological trials: from lung function to biomarkers. Eur Respir J. 2008 Feb 1; 31(2):416–69. https://doi.org/10.1183/09031936.00099306 PMID: 18238951

50. Jadad A, Rizo C, Cubillos P, St50. Harrison C, Britt H, Miller G, Henderson J. Examining different measures of multimorbidity, using a large prospective cross-sectional study in Australian general practice. BMJ Open. 2014; 4(7):e004694. https://doi.org/10.1136/bmjopen-2013-004694 PMID: 25015479

51. Disler RT, Green A, Luckett T, Newton PJ, Inglis S, Currow DC, et al. Experience of Advanced Chronic Obstructive Pulmonary Disease (COPD): A Qualitative Meta-Synthesis. Soyer HP, editor. PLoS One. 2015 Oct 25; 10(10):e0139561. https://doi.org/10.1371/journal.pone.0139561 PMID: 26465333

52. de Sousa Pinto JM, Martin-Nogueiras AM, Morano MTAP, Macëdo TEPM, Arenillas JIC, Troosters T. Chronic obstructive pulmonary disease patients’ experience with pulmonary rehabilitation: A systematic review of qualitative research. Chron Respir Dis. 2013 Aug 29; 10(3):141–57. https://doi.org/10.1177/14799731313493796 PMID: 23897930

53. Glaab T, Vogelmeier C, Buhl R. Outcome measures in chronic obstructive pulmonary disease (COPD): strengths and limitations. Respir Res. 2010 Dec 17; 11(1):79. https://doi.org/10.1186/1465-9921-11-79 PMID: 20657728

54. Bjørner L. The Importance of Continuity in Inhaler Device Choice for Asthma and Chronic Obstructive Pulmonary Disease. Respiration. 2014; 88(4):346–52. https://doi.org/10.1159/000363771 PMID: 25195762

55. Disler RT, Green A, Luckett T, Newton PJ, Inglis S, Currow DC, et al. Experience of Advanced Chronic Obstructive Pulmonary Disease (M mieszta): A Systematic Review of Qualitative Research. J Pain Symptom Manage. 2014 Dec; 48(6):1182–99. https://doi.org/10.1016/j.jpainsymman.2014.03.009 PMID: 24780181

56. Li G, Yuan H, Zhang W. Effects of Tai Chi on health related quality of life in patients with chronic conditions: a systematic review of randomized controlled trials. Complement Ther Med. 2014 Aug; 22(4):53–65. https://doi.org/10.1016/j.ctim.2014.06.003 PMID: 25140608

57. Zwerink M, Brusse-Keizer M, van der Valk PDLM, Zielhuis GA, Monnikhof EM, van der Palen J, et al. Self management for patients with chronic obstructive pulmonary disease. Cochrane database Syst Rev. 2014 Mar 19;(3):CD002990. https://doi.org/10.1002/14651858.CD002990.pub3 PMID: 24665053

58. Harrison SL, Janaudis-Ferreira T, Brooks D, Desveaux L, Goldstein RS. Self-management following an acute exacerbation of COPD: a systematic review. Chest. 2015 Mar; 147(3):646–61. https://doi.org/10.1378/chest.14-1658 PMID: 25340578

59. Cazzola M, MacNee W, Martinez FJ, Rabec KF, Franciosi LG, Barnes PJ, et al. Outcomes for COPD pharmacological trials: from lung function to biomarkers. Eur Respir J. 2008 Feb 1; 31(2):416–69. https://doi.org/10.1183/09031936.00099306 PMID: 18238951

60. Jadad A, Rizo C, Cubillos P, St50. Harrison C, Britt H, Miller G, Henderson J. Examining different measures of multimorbidity, using a large prospective cross-sectional study in Australian general practice. BMJ Open. 2014; 4(7):e004694. https://doi.org/10.1136/bmjopen-2013-004694 PMID: 25015479

61. Disler RT, Green A, Luckett T, Newton PJ, Inglis S, Currow DC, et al. Experience of Advanced Chronic Obstructive Pulmonary Disease (M mischiefta): A Systematic Review of Qualitative Research. J Pain Symptom Manage. 2014 Dec; 48(6):1182–99. https://doi.org/10.1016/j.jpainsymman.2014.03.009 PMID: 24780181
64. Mathar H, Fastholm P, Hansen IR, Larsen NS. Why Do Patients with COPD Decline Rehabilitation. Scand J Caring Sci. 2016 Sep; 30(3):432–41. https://doi.org/10.1111/scs.12268 PMID: 26426088

65. Russell S, Ogunbayo OJ, Newham JJ, Heslop-Marshall K, Netts P, Hanratty B, et al. Qualitative systematic review of barriers and facilitators to self-management of chronic obstructive pulmonary disease: views of patients and healthcare professionals. npj Prim Care Respir Med. 2018 Dec 17; 28(1):2. https://doi.org/10.1038/s41533-017-0069-z PMID: 29343739

66. Sohanpal R, Steed L, Mars T, Taylor SJC. Understanding patient participation behaviour in studies of COPD support programmes such as pulmonary rehabilitation and self-management: a qualitative synthesis with application of theory. npj Prim Care Respir Med. 2015 Dec 17; 25(1):15054. https://doi.org/10.1038/npjpcrm.2015.54 PMID: 26379121

67. Gorst SL, Armitage CJ, Brownsell S, Hawley MS. Home Telehealth Uptake and Continued Use Among Heart Failure and Chronic Obstructive Pulmonary Disease Patients: a Systematic Review. Ann Behav Med. 2014 Dec 25; 48(3):323–36. https://doi.org/10.1007/s12160-014-9607-x PMID: 24763972

68. Habraken JM, Willems DL, de Kort SJ, Bindels PJF. Health care needs in end-stage COPD: A structured literature review. Patient Educ Couns. 2007 Oct; 68(2):121–30. https://doi.org/10.1016/j.pec.2007.05.011 PMID: 17601696

69. Ciari M, Izziku D, Casciaro R, Matarese M. The Unmet Needs of People with Chronic Obstructive Pulmonary Disease: A Systematic Review of Qualitative Findings. COPD J Chronic Obstr Pulm Dis. 2018 Jan 2; 15(1):79–88. https://doi.org/10.1080/15412555.2017.1417373 PMID: 29308932

70. Ciari M, Matarese M, Izziku D, De Marinis MG. Self-Care of People with Chronic Obstructive Pulmonary Disease: A Meta-Synthesis. Patient—Patient-Centered Outcomes Res. 2017 Aug 14; 10(4):407–27. https://doi.org/10.1007/s40271-017-0218-z PMID: 28177788

71. Dretzke J, Blissedt D, Dave C, Mukherjee R, Price M, Bayliess S, et al. The cost-effectiveness of domiciliary non-invasive ventilation in patients with end-stage chronic obstructive pulmonary disease: a systematic review and economic evaluation. Health Technol Assess (Rockv). 2015 Oct; 19(1):1–246. https://doi.org/10.3310/hta19810 PMID: 26470875

72. Jordan RE, Majothi S, Heneghan NR, Blissett DB, Riley RD, Sitch AJ, et al. Supported self-management for patients with moderate to severe chronic obstructive pulmonary disease (COPD): an evidence synthesis and economic analysis. Health Technol Assess (Rockv). 2015 May; 19(36):1–516. https://doi.org/10.3310/hta19360 PMID: 25990984

73. Moayeri F, Hsueh Y-S (Arthur), Clarke P, Dunt D. Do Model-Based Studies in Chronic Obstructive Pulmonary Disease Measure Correct Values of Utility? A Meta-Analysis. Value Heal. 2016 Jun; 19(4):363–73. https://doi.org/10.1016/j.jval.2016.01.012 PMID: 27325328

74. Rose S, Paul C, Boyes A, Kelly B, Roach D. Stigma-related experiences in non-communicable respiratory diseases: a systematic review. Chron Respir Dis. 2017 Aug 23; 14(3):199–216. https://doi.org/10.1080/15412555.2017.1417373 PMID: 28111991

75. Zhang Y, Morgan RL, Alonso-Coello P, Wiercioch W, Bala MM, Jaeschke RR, et al. A systematic review of how patients value COPD outcomes. Eur Respir J. 2018 Jul; 52(1):180022. https://doi.org/10.1183/13993003.00222-2018 PMID: 30002103

76. Cox NS, Oliveira CC, Lahham A, Holland AE. Pulmonary rehabilitation referral and participation are commonly influenced by environment, knowledge, and beliefs about consequences: a systematic review using the Theoretical Domains Framework. J Physiother. 2017 Apr; 63(2):84–93. https://doi.org/10.1016/j.jphys.2017.02.002 PMID: 28433238

77. Kapteijn AA, Scharloo M, Fischer MJ, Snoei L, Cameron LD, Sont JK, et al. Illness Perceptions and COPD: An Emerging Field for COPD Patient Management. J Asthma. 2008 Jan 2; 45(8):625–9. https://doi.org/10.1080/0277090002127048 PMID: 17601696

78. Habraken JM, Willems DL, de Kort SJ, Bindels PJF. Health care needs in end-stage COPD: A structured literature review. Patient Educ Couns. 2007 Oct; 68(2):121–30. https://doi.org/10.1016/j.pec.2007.05.011 PMID: 17601696

79. Cox NS, Oliveira CC, Lahham A, Holland AE. Pulmonary rehabilitation referral and participation are commonly influenced by environment, knowledge, and beliefs about consequences: a systematic review using the Theoretical Domains Framework. J Physiother. 2017 Apr; 63(2):84–93. https://doi.org/10.1016/j.jphys.2017.02.002 PMID: 28433238

80. Rosa F, Bagnasco A, Aleo G, Kendall S, Sasso L. Resilience as a concept for understanding family caregiving of adults with Chronic Obstructive Pulmonary Disease (COPD): an integrative review. Nurs Open. 2017 Apr; 4(2):61–75. https://doi.org/10.1002/nop2.63 PMID: 28286662

81. Harrison SL, Apps L, Singh SJ, Steiner MC, Morgan MD, Robertson N. ‘Consumed by breathing’–a critical interpretive meta-synthesis of the qualitative literature. Chronic Illn. 2014 Mar 13; 10(1):31–49. https://doi.org/10.1177/1742395313493122 PMID: 24227018
82. Brunton L, Bower P, Sanders C. The Contradictions of Telehealth User Experience in Chronic Obstructive Pulmonary Disease (COPD): A Qualitative Meta-Synthesis. Soyer HP, editor. PLoS One. 2015 Oct 14; 10(10):e0139561. https://doi.org/10.1371/journal.pone.0139561 PMID: 26465333

83. Einarson TR, Bereza BG, Nielsen TA, Hemels MEH. Utilities for asthma and COPD according to category of severity: a comprehensive literature review. J Med Econ. 2015 Jul 3; 18(7):550–63. https://doi.org/10.3111/13696998.2015.1025793 PMID: 25735652

84. Kirkham JJ, Gorst S, Altman DG, Blazeby JM, Clarke M, Devane D, et al. Core Outcome Set–STAndards for Reporting: The COS-STAR Statement. PLOS Med. 2016 Oct 18; 13(10):e1002148. https://doi.org/10.1371/journal.pmed.1002148 PMID: 27755541

85. Williamson PR, Altman DG, Blazeby JM, Clarke M, Devane D, Gargon E, et al. Developing core outcome sets for clinical trials: issues to consider. Trials. 2012 Dec 6; 13(1):132. https://doi.org/10.1186/1745-6215-13-132 PMID: 22867278

86. Jones JE, Jones LL, Keeley TJH, Calvert MJ, Mathers J. A review of patient and carer participation and the use of qualitative research in the development of core outcome sets. Young B, editor. PLoS One. 2017 Mar 16; 12(3):e0172937. https://doi.org/10.1371/journal.pone.0172937 PMID: 28301485

87. Spargo M, Ryan C, Downey D, Hughes C. Development of a core outcome set for trials investigating the long-term management of bronchiectasis. Chron Respir Dis. 2019 Jan 3; 16:147997231880416. https://doi.org/10.1177/147997231880416 PMID: 30278785

88. Verburg AC, van Dulmen SA, Kiers H, Ypinga JH, Nijhuis-van der Sanden MW, van der Wees PJ. Development of a Standard Set of Outcome Domains and Proposed Measures for Chronic Obstructive Pulmonary Disease in Primary Care Physical Therapy Practice in the Netherlands: a Modified RAND/UCLA Appropriateness Method. Int J Chron Obstruct Pulmon Dis. 2019 Nov; Volume 14:2649–61. https://doi.org/10.2147/COPD.S219851 PMID: 31819398

89. Jones AV, Evans RA, Man WD-C, Bolton CE, Breen S, Doherty PJ, et al. Outcome measures in a combined exercise rehabilitation programme for adults with COPD and chronic heart failure: A preliminary stakeholder consensus event. Chron Respir Dis. 2019 Jan 1; 16:147997311986795.