Physical activity and chronic obstructive pulmonary disease: a scoping review

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Abstract

Background

Reduced physical activity (PA) was the strongest predictor of all-cause mortality in patients with chronic obstructive pulmonary disease (COPD). This scoping review aimed to map the evidence on the current landscape of physical activity, barriers and facilitators, and assessment tools across COPD patients.

Methods

Arksey and O'Malley's scoping review methodology framework guided the conduct of this review. An electronic search was conducted on five English databases (PubMed, Cochrane library, PsycINFO, CINAHL and Web of Science (Medline)) and three Chinese databases (CNKI, CQVIP and WAN-FANG) in November 2021. Two authors independently screened the literature, extracted the studies characteristics.

Results

The initial search yielded 3686 results, of which 1754 were duplicates. Of the remaining 135 articles, 42 studies met the inclusion criteria. Among the reviewed articles, there were 14 (33.3%) cross-sectional study, 9 (21.4%) cohort study, 4 (9.5%) longitudinal study, 3 qualitative study, 12 (28.7%) randomized control trials (RCTs). The main barriers identified were older age, women, lung function, comorbidities, COPD symptoms (fear of breathlessness, severe fatigue, anxiety and depression), GOLD stage, frequency of exacerbation, oxygen use, low motivation and environment-related (season and weather). Twelve studies have evaluated the effects of physical exercise (e.g., walking training), pulmonary rehabilitation, pedometer, self-efficacy enhancing intervention, behavioral modification intervention on physical activity and have had inconsistent results.

Conclusions

Changing physical activity behavior in patients with COPD requires multidisciplinary collaboration. Future studies need to identify the best instruments to measure physical activity in clinical practice. Future studies should focus on the effects of different types, time and intensity of physical activity in COPD patients and conduct randomized, adequately-powered, controlled trials to evaluate the long-term effectiveness of behavioral change interventions in physical activity.

1. Introduction

Chronic obstructive pulmonary disease (COPD) is a common inflammatory lung disease characterized by persistent respiratory symptoms and airflow limitation [1, 2]. According to the World Health Organization, COPD is the third leading cause of mortality in the world [3]. The China Pulmonary Health (CPH) study

showed that the overall prevalence of COPD was 8.6%, accounting for 99.9 million people with COPD in China [4]. For now, COPD has been a worldwide public health challenge to be paid attention to urgently.

Physical activity (PA) is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. Types of physical activity in daily life can be categorized into occupational sports, transportation (cycling and walking), household (such as yard work cleaning and home maintenance) or other activities [5]. Strong evidence demonstrates regular physical activity is beneficial to reducing the risk of many chronic diseases. On the contrary, lack of physical activity contributes to early death in patients harboring chronic diseases [6–8]. The majority of COPD patients are usually forced to reduce physical activity due to exercise-related dyspnea and decreased exercise tolerance [9–11]. Specifically, the duration, intensity and counts of activity in patients with COPD were reduced significantly [12]. In addition, physical activity levels in patients with COPD began to decrease in the early stage of the disease and substantially declined over time [10, 13–15]. As a result, the risk of readmission and mortality increased, and the patients' quality of life fell [7, 16]. Fortunately, physical activity in COPD patients has gradually attracted the attention of scholars in recent years. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) has recommended regular physical activity for all COPD patients [17]. Both the American Thoracic Society (ATS) and the European Respiratory Society (ERS) have stressed that physical activity can significantly improve health outcomes in patients with COPD [18]. For example, a study found that COPD patients with high levels of physical activity had a 34% lower risk of 30-day readmission and a 47% lower risk of death within 12 months of discharge compared to inactive patients [19].

It's true that many factors may affect physical activity in patients with COPD, such as greater airflow obstruction, higher lung hyperinflation, severe dyspnea, worse exercise capacity, fear of breathlessness, frequency of exacerbation, low motivation and prolonged use of oxygen therapy [20–22]. Therefore, accurate assessment of the amount and intensity of physical activity in a patient's daily life is a prerequisite for making a physical activity plan. Two main physical activity assessment tools commonly utilized contain subjective assessment (questionnaire, diary, self-reported) and objective measurement (pedometer, accelerometer, activity monitor) [23–25]. However, the heterogeneity of measurement and reporting methods among different studies makes the results neither comparable nor easily synthesized.

A series of strategies currently implemented to treat low levels of physical activity in patients with COPD, includes pulmonary rehabilitation, various types of exercise training, self-management, and behavior change strategies, reflect the complexity of this issue [26, 27]. A systematic review suggests that exercise training coupled with behavior change interventions (such as goal setting, motivational interviewing, and self-feedback) may be the optimal strategies to increase physical activity in people with COPD [26–29]. Although studies have shown that these methods may improve the physical activity of COPD patients, there is little evidence that meaningful and sustained improvements in physical activity, especially moderate-to-vigorous physical activity (MVPA), are achievable. What's more, the optimal timing, components, duration and models for interventions are still unclear [30]. Confronting this, scope review may be a better choice. It can quickly describe the research progress of a certain field, showing the scope, depth, breadth and deficiency, finally providing more information for the future.

In a word, this study used the method of scope review to summarize the current situation, assessment tools, barriers and facilitators factors of physical activity in COPD patients, which provided a comprehensive understanding of the existing problems in this field and a clear direction of future research. What this study has done is very important for guiding future research and clinical practice.

2. Methods

This scoping review was designed according to the reference framework developed by Arksey and O'Malley [31]. The main five stages were followed: (1) identify the research question, (2) identify relevant studies, (3) study selection, (4) charting the data, (5) summarize and report the results.

2.1 Identify the research question

The main question of this review was: (1) What are the physical activity status of patients at all stages of COPD? (2) How to assess patients' physical activity? (3) What are the barriers to physical activity? (4) How to improve physical activity of patients? (5) How to evaluate the effectiveness of physical activity intervention.

2.2 Identify relevant studies

In this scoping review, we searched relevant publications for five English databases, including: PubMed, Cochrane library, PsycINFO, CINAHL, Web of Science (Medline), and three Chinese databases, including: CNKI, CQVIP and WAN-FANG from their inceptions until November 2021. Boolean logic operators "AND, OR, NOT" were used for comprehensive retrieval. Articles were searched using Boolean combinations of keywords and MeSH terms: ("physical activity*") AND ("chronic obstructive pulmonary disease" OR "pulmonary disease, chronic obstructive" OR "COPD" OR "chronic obstructive lung disease" OR "chronic airway obstruction" OR "chronic obstructive airway disease" OR "airflow obstruction, chronic" OR "airflow obstructions, chronic" OR "chronic airflow obstructions"). The language of literature was limited to English. Then we translated the English keywords into corresponding Chinese words for use in the Chinese databases. The detailed search strategies can be found in additional file 1.

2.3 Study selection

The inclusion criteria were the following: (i) the target population was COPD patients; (ii) physical activity should be the major dependent or independent variables; (iii) articles must be published in the English language. The exclusion criteria were the following: (i) Unpublished papers (including conference abstract, editorials, opinion papers, thesis); (ii) full text conference abstracts that are unavailable; (iii) non-human studies; (iv) studies not written in the English language.

2.4 Data extraction

We used NoteExpressX9 for references management, classification, sorting, retrieval and editing. After the removal of duplicated records, two researchers independently screened the titles and abstracts of studies based on the following inclusion and exclusion criteria. Then, read the full text to determine the final

references to be included in the study. In the case of disagreement, a third researcher participated in the discussion and made judgments. Data was extracted from the included studies according to the following fields: (i) general information: author, country, publication date, (ii) study characteristics: study designs, objectives, sample size (age and gender), findings, (iii) physical activity assessment tools, (iv) barriers and facilitators of physical activity (see additional file 1). Given the nature of scoping review, the risk of bias assessment is also not applicable.

3. Results

3.1 Articles retrieved

All searches were carried out in November 2021. The initial search yielded 3686 articles, with 526 records from Chinese databases and 3,160 records from English databases. After exclusion of duplicates by NoteExpress software (n = 1,732), 1,932 articles were obtained for the screening process of the title and abstract. Finally, 135 full-text articles were analyzed for eligibility, and 42 articles were ultimately included. We described the searching process and outcome in Fig. 1.

3.2 Article characteristics

42 studies included in this review were mainly from 19 countries (Fig. 2). Spain was the most frequently studied country (6 studies, 14.3%), followed by the United States (5 studies, 11.9%), the United Kingdom (5 studies, 11.9%) and Switzerland (5 studies, 11.9%). The remaining 21 studies were conducted in 15 countries (Australia–Germany–Japan–Brazil–Netherlands–Romania–Norway–Sweden–Denmark–China–Sydney–Indonesia–Portugal–Santiago–Netherlands). Among the reviewed articles, study designs ranged from: n = 14 (33.3%) cross-sectional study [15, 22, 32–43]; n = 9 (21.4%) cohort study [44–52]; n = 4 (9.5%) longitudinal study [53–56]; n = 3 (7.1%) qualitative study [21, 57, 58]; n = 12 (28.7%) RCTs [27, 59–69]. Cross-sectional studies make up the majority. The studies publication year ranged from 2006 to 2021, and 27 (64.3%) studies were published in the period from 2017 to 2021 (see Table 1). Concerning the participants, the sample size varied from 18 to 4,83603 participants, with ages ranging from 20 to 91 years and most of them were elderly and male patients. A list of the 42 references, with all study characteristics, is presented in additional file 1.

Table 1 General characteristics of included scoping reviews (n = 42)

Characteristic	Number of studies	Percentage (%)
Publication year		
2006–2010	2	4.8
2011–2016	12	30.9
2017–2021	27	64.3
Total	42	100.0
Study designs		
cross-sectional study	14	33.3
cohort Study	9	21.4
longitudinal Study	4	9.5
qualitative study	3	7.1
RCT	12	28.7
Total	42	100.0
Methodology		
quantitative study	39	92.9
qualitative study	3	7.1
Total	42	100.0

3.3 Barriers of physical activity

Across all the 42 studies, 26 (61.9%) of studies summarized the barriers to physical activity in COPD patients, of which thirteen used a cross-sectional design, four used a longitudinal design, six were cohort studies, and three used a qualitative design. We classified the barriers into five main aspects: (a) sociodemographic characteristics: older age, gender, employment status, race, lower educational levels, smoking history; (b) Physiological factors: lung function, comorbidity, fear of breathlessness, gold stage, frequency of exacerbation, oxygen use, severe fatigue, worse exercise capacity; (c) psychological factors: anxiety and depression symptoms, low motivation; (d) social environmental factors: lack of infrastructure, social support, lack of willpower, season and weather.

Regarding the sociodemographic characteristics, studies focused on the effects of age and gender on physical activity in COPD patients. Low levels of physical activity are particularly important in women and older patients and it is related to worse functional and clinical characteristics [36]. Aging is associated with a decline in skeletal muscle mass and cardiopulmonary fitness, leading to impaired daily physical activity and maintaining independence [70]. In a study, the proportion of inactive COPD patients over 70 years old was significantly higher than other young age groups. Compared with men, women

significantly reduced the intensity of walking and the amount of time they spent doing moderate and vigorous exercise [10]. Women begin to lose bone mass before menopause, and sedentary women as early as the 20s [71]. Moreover, these differences are probably due to the socio-economic and cultural characteristics of the area, where few women are engaged in professional activities. Yet, they are used to staying home caring for the households and the family members.

In terms of the physiological factors, studies examined the effects of dyspnea, fatigue, comorbidity, and pulmonary function status on physical activity. Dyspnea is one of the most characteristic symptoms in patients with COPD. Studies have shown that severe airflow obstruction and dyspnea are significantly associated with reduced levels of physical activity [72]. Patients with severe dyspnea often limit daily physical activity to alleviate dyspnea symptoms, ultimately creating a vicious cycle of decreased physical activity, muscle atrophy, and disease progression [72]. Fatigue is a highly prevalent symptom among patients with COPD (71%) [73]. More patients with low PA had severe fatigue compared to the number of patients with moderate and high PA [34]. In a cross-sectional study, decreased cardiopulmonary function, systemic inflammation, and muscle weakness were strongly associated with physical inactivity in COPD patients [38, 55]. Chronic obstructive pulmonary disease is a systemic disease with multiple comorbidities, including cardiovascular disease, lung cancer, osteoporosis, diabetes, anxiety, and depression, and is associated with an increased risk of hospitalization and death [45, 74]. Inowe et al. showed that in patients with COPD combined with osteoporosis, decreased bone mineral density and bone damage increased the risk of fracture, which would further aggravate the disease, leading to decreased lung function and reduced physical activity level [75].

Of psychosocial factors, anxiety, depression and motivation were consistent positive correlates and determinants of physical activity in COPD patients. The prevalence of depression and anxiety is two to three times higher in people with chronic (long-term) medical conditions [76]. Anxiety and depressive symptoms are associated with poor exercise ability and quality of life. A multi-center study using objective assessment tools measured the relationship between anxiety and depressive symptoms and physical activity in 220 COPD patients at baseline and 6 months and 12 months of follow-up. Results had shown that symptoms of depression are prospectively associated with fewer steps per day and less time after 6 months of follow-up in COPD patients [42]. The lower motivation was a key barrier to PA. Fear of breathlessness may lead to low motivation and thereby reduce engagement in PA as patients are alarmed by a sensation of breathing difficulty that they are unable to manage [35]. In addition, one qualitative study based on grounded theory aimed to examine healthcare professionals' perspectives on the importance and prescription of physical activity in patients with COPD. The study found that although they acknowledged the importance of physical activity for people with COPD, there were few evidence-based strategies to enhance physical activity. The limitations include time constraints, treatment prioritization and perceived lack of expertise [77].

As for social-environmental correlates, weather conditions and seasonal variations may affect physical activity in COPD patients [41, 44, 78]. Physical activity in a clean environment had greater health benefits than in more polluted areas. Alahmari et al. used a pedometer to examine the effects of the weather data

(temperature, rainfall, sunshine) and environmental particulate matter on physical activity in COPD patients. The results found that when air pollution was too hot or too cold, it caused obstacles to exercise and activity adherence, and patients' daily steps were significantly reduced [79]. Stevens et al. investigated the relationship between environment and PA and self-rated health in COPD patients. Logistic and multivariate linear regression models showed a significant negative correlation between physical activity level and ozone pollution [80].

3.4 Interventions for promoting physical activity

Twelve RCTs met the inclusion criteria reported that facilitators of physical activity among COPD patients. The main interventions were related to physical exercise (e.g., walking training), pulmonary rehabilitation, pedometer, self-efficacy enhancing intervention, behavioral modification intervention (including education session, goal setting, motivational interview, identify potential barriers, self-monitoring, feedback, telephone calls). The majority of the reported physical activity programs had a total duration of eight to twelve weeks. The longest intervention lasted about 12-months [68]. This study aimed to assess the 12-month efficacy and effectiveness of the Urban Training intervention on physical activity in COPD patients.

Walking is the most recommended form of aerobic exercises. An RCT study of “Nordic Walking” has shown that it is a simple, feasible and effective physical activity training program for patients with COPD. Nordic walking had a long-term positive impact on physical activity, dyspnea and other daily symptoms in COPD patients [59]. In another study, participants in the walking group received walking training sessions three times per week for 8 weeks, with significant improvements in health-related quality of life and exercise ability compared to usual care [64]. Pulmonary rehabilitation is the preferred non-drug treatment for COPD patients, which can improve the symptoms of dyspnea and exercise ability although the intervention did not maintain physical activity levels in the long term. Wshah et al. embedded a 4-week behavior change program, consisting of a 30-minute personalized face-to-face session and three follow-up visits, which aimed at reducing sedentary time, into pulmonary rehabilitation programs in people with COPD. Pulmonary rehabilitation combined with behavior change intervention can increase daily steps and reduce sedentary time compared to pulmonary rehabilitation alone, while its effect on sedentary behavior needs to be further explored [81]. Several studies have shown that replacing 30 minutes of sleep or sitting times with 30 minutes of moderate to vigorous physical activity is consistently associated with improved lung function [82]. However, given that physical activity of moderate to vigorous intensity leads to an increase in ventilation and dyspnea, which serves as a barrier to engagement in regular physical activity. In contrast, light physical activity is more acceptable for patients that can promote long-term maintenance of physical activity, improve health-related quality of life and functional ability [37, 83]. Moreover, wearable activity monitors such as pedometers or accelerometers can help patients set goals, make plans, and self-monitor daily steps, exercise time and intensity, thus effectively improving patients' exercise compliance. Qi et al. study showed that the use of walking counter significantly increased the daily steps and physical activity level of patients, yet it may not improve the physical activity or exercise ability of patients with moderate and severe COPD, and its long-

term effectiveness has not been examined [4]. Larson et al. conducted a 10-week “Active for Life with COPD” program in 36 COPD patients, including walking, functional circuit training, behavioral intervention and health education. Participants engaged in at least 60 minutes of daily activity (including 20 minutes of walking, 30 minutes of moderate-intensity exercise, and 10–15 minutes of stretching). The results showed that the behavior change program was feasible and acceptable, and patients with COPD increased mean time spent standing/stepping by 36 minutes per day [60].

Among the twelve studies, physical activity (daily step count) was the primary outcome (9/12); The secondary outcome could be classified as Functional exercise capacity (six-minute walking test(6MWD) (10/12), health-related quality of life (36-item short form (SF-36), SGRQ and CAT) (9/12), anxiety and depression (Hospital Anxiety and Depression Scale (HADS)) (4/12). All studies showed the effectiveness of physical activity interventions, including increased daily walking time, improved quality of life, and reduced risk of anxiety and depression. The frequency and intensity of training sessions varied between studies. Only four studies accounted for the time, intensity and frequency of physical activity in COPD patients, which recommends ≥ 30 min moderate physical activity ≥ 5 days per week. Physical activity intensity was generally assessed using a dyspnea Borg scale score, maximum heart rate (HR), metabolic equivalents.

3.5 Measurement of physical Activity

Thirty-nine studies (92.3%) reported the measurements tools for assessing physical activity in patients with COPD. Of these, 11 (26.2%) utilized questionnaires including the International Physical Activity Questionnaire (IPAQ), Yale Physical Activity Survey (YPAS), Physical Activity Scale for Elderly (PASE), the Longitudinal Ageing Study Amsterdam Physical Activity Questionnaire (LAPAQ), Clinical-PRO active Physical Activity (C-PPAC) [27, 85]. Two (4.8%) studies collected data using interview [49, 50]. 27(64.3%) studies utilized physical activity monitors, including pedometers (monitor daily step counts and provide real-time feedback) and accelerometers (measure the intensity of physical activity and provide energy expenditure). The instrument is a small and light device, which can be worn on the arm, waist, wrist, foot or thigh. Five types of accelerometers are most widely used, including the Sense Wear Armband (Body Media, Inc.), ActivPAL3 activity monitor, Actigraphy GT3X, DynaPort accelerometer, Actimarker EW4800 P-K. Compared with accelerometers, pedometers are cheaper and widely used in clinical practice. However, most studies failed to provide information on the validity of the instruments.

4. Discussion

This is the first scoping review to document the existing evidence from studies examining the prevalence of physical activity, barriers, facilitators to physical activity and measurement of physical activity.

Our results show that overall low levels of physical activity in COPD patients are associated with poor patient outcomes (increased hospitalization and mortality) [72]. Compared to healthy, age-matched control subjects, patients with COPD had a significant reduction in the duration, intensity and counts of physical activity [86]. They were more likely to have a common sedentary lifestyle. One cross-sectional

study found that patients with COPD average sedentary time was 643 minutes/day, of which 374 minutes/day were accumulated in prolonged bouts of ≥ 30 min [37]. Furthermore, the mortality risk in subjects with COPD was 4.09 times higher in those subjects who spent > 8.5 h/d in activities requiring 1.5 MET, in which the patients were mainly limited by physical disease-specific factors, such as dyspnea, fatigue and reduced exercise tolerance [87]. Over time, physical activity substantially decreases across all severity stages of COPD, and this decline is paralleled by a worsening of lung function and health status. Therefore, it is recommended that medical staff assess, diagnose and manage the physical activity behavior of COPD patients as soon as possible, and take targeted intervention measures to improve the quality of life of patients.

The aim of the cohort study was to (i) determine how COPD patients' levels of physical activity changed during follow-up and (ii) to evaluate the longitudinal association between physical inactivity and mortality, disease progression, exacerbation symptoms, comorbidities. Physical inactivity was the strongest predictor of all-cause mortality in COPD patients [51]. A study found that over half (53.5%) patients were inactive. Patients with lower levels of physical activity are at higher risk for anxiety and depressive symptoms [45]. Among the COPD population, participants who were fully active had longer life expectancies than those inactive, an additional 2.4–4.0 years in men and 4.4–4.8 years in women [48]. Nonetheless, this study also has several limitations. Firstly, the sample size was small and the sex ratio of the study was uneven. In that case, it could not represent the whole population and may result in selection bias. Secondly, the study has different lengths of follow-up time and mainly focused on 1–3 years. Thirdly, most of the physical activity assessment tools were self-reported questionnaires, which may be affected by recall bias.

Physical activity is a complex behavior, which is affected by comprehensive factors such as individual physiological, psychological, socio-cultural and environmental factors. As the research mainly focuses on cross-sectional investigation, the influencing factors of the research design are relatively single, lacking comprehensive and systematic discussion. The cross-sectional study design is limited to speculating about the relationship between variables and has some limitations in exploring causality. Daily clinical symptoms such as fear of dyspnea, fatigue, anxiety, and depressive are associated with low levels of physical activity in COPD patients. Female patients showed lower energy expenditure in physical activity compared to male. This suggests that medical staff and caregivers of COPD patients should pay more attention to the physical activity of female patients. According to the characteristics of middle-aged and elderly women, specific suggestions were put forward for activities, such as walking and square dancing. In addition, patients were encouraged to carry out activities with others, so as to enhance their sense of exercise self-efficacy and improve their physical activity level.

The results of 12 RCTs studies aiming at increasing physical activity in COPD patients showed that physical activity intervention strategies, including pulmonary rehabilitation, pedometers monitor, self-efficacy enhancement interventions and behavior change interventions, can enhance patients' exercise capacity and improve their quality of life. As anticipated, a previous study showed that pulmonary rehabilitation can lead to changes in dyspnea and motor ability across COPD patients, but did not

increase physical activity levels [88]. Compared with pulmonary rehabilitation alone, pulmonary rehabilitation combined with physical activity counseling and behavior change technology can effectively improve patients' physical activity levels [27]. A simple physical activity enhancement program using pedometers can effectively improve physical activity level in COPD patients [69]. However, patients' wearing compliance is poor. Pedometers cannot quantify patients' physical activity types and exercise-related environmental conditions, and its long-term effectiveness in physical activity needs to be further discussion. Theory-based behavior change interventions have been proved to be the most effective interventions [89]. The present behavioral modification interventions alongside pulmonary rehabilitation were well received by the vast majority of patients showing high compliance. However, such behavioral interventions may require a lot of health care resources as they are more time-consuming compared to PA tele-coaching. In addition, the timing, intensity, and frequency of physical activity remain obscure. Although guidelines recommend that all older adults should do at least 150 minutes of moderate-intensity physical activity a week, the majority of COPD patients fail to meet those guidelines [86, 90]. Light-intensity physical activity has been shown to reduce all-cause and respiratory mortality in patients and is more readily accepted by patients. But it is not clear exactly what needs to be done to improve physical activity in the long term, which is what may be required for health benefits.

The quantification of physical activity level is very complex, and its accurate quantification may be a key step in the research and promotion of the physical activity. Accurate measurement of physical activity will further improve our understanding of the relationship between physical activity and health. The measurement of physical activity mainly included the frequency, duration, intensity and types of physical activity [91]. At present, research shows that physical activity measurement tools can be divided into two main types: subjective assessment and objective measurement. Subjective assessment methods include questionnaire, self-report and interview [24]. The International Physical Activity Questionnaire is a widely recognized measurement method [36]. It mainly investigates the frequency and time of walking intensity physical activity and high-intensity physical activity during leisure time in the past 7 days, and calculates energy expenditure per unit body weight through metabolic equivalent. Although the questionnaire method has recall bias to some extent, it is widely used and more suitable for large epidemiological studies. Objective measurements, including pedometers and accelerometers, are mainly used to measure individual physical activity intensity and energy expenditure within a clinical trial. Generally, to optimize the adherence of patients to wearing the device, the measurement should be worn at least 8 hours during waking hours, except for bathing and swimming activities [92]. Compared with traditional standard assessment tools, activity monitor has the advantages of high measurement accuracy and operability [23]. Moreover, it can improve patients' compliance and quality of life through real-time feedback. It's a pity that the high price limits its application scope. To ensure more scientific and objective research results, future research should combine subjective and objective measurement methods. Subjective methods such as activity log, questionnaire used to understand the characteristics and preferences of physical activity participants and activity monitors were used to monitor physical activity to obtain timely information and feedback, providing instrumental support for clinical staff to develop more scientific and perfect guidance measures.

5. Strengths And Limitations

The scoping review compiles information from studies with a wide range of designs and methodologies and is conducted with the rigor and transparency required. Despite a comprehensive search in this study, we only included relevant literature published in English or Chinese, thus omitting valuable data from relevant articles published in other languages. The quality evaluation of RCTs was not carried out in this review. The sample size was insufficient and could not represent the whole population.

6. Conclusions

This scoping review identified 42 studies on the PA of COPD patients published from 2006 to 2021. Overall, these individuals have low physical activity levels. In particular, older and women had relatively lower levels of PA. Physical activity is a complex behavior, which is difficult to be captured by simple measurement methods due to the influence of social population, physiology, psychology and environmental factors. Therefore, it is necessary to conduct effective intervention strategies. Pulmonary rehabilitation combined with physical activity counseling, self-efficacy enhancement and behavior change interventions were reported to have positive effects in enhancing COPD patients' PA. However, its long-term effectiveness still needs to be further developed and validated in the future study. Sports program must be individualized, starting from low-intensity exercise. In addition, strengthening multidisciplinary cooperation and social support (from families, friends, and work) is utmost important to enhance the motivation of patients to exercise and promote changes in health behavior. More randomized controlled trials are recommended to evaluate the effects of different types, frequencies and intensities of physical activity on health-related quality of life in COPD patients.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

Competing interests

The authors declare no conflicts of interest.

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Authors' contributions

XYX was involved in the data curation, visualization and and writing of the original draft. LHH was involved in the conceptualization, methodology, and writing. YF and SSC independently screened the titles and abstracts of the studies according to the inclusion criteria. XYX and MYZ also independently extracted and analyzed the data from these studies. All authors read and approved the final manuscript.

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Figures

Figure 1

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Fig. 2 Number of studies per country

Figure 2

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