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# Perspectives of Patients and Health-care Professionals on Remote Pulmonary Rehabilitation: A Systematic Review

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**Abstract:** ***Aims:*** ***The purpose of this systematic review is to systematically review and synthesize qualitative studies involving the perceptions of patients and health care professionals about pulmonary telerehabilitation to understand patients' attitudes and determine the obstacles in the use of telemedicine.*** ***Design:*** ***Systematic review of qualitative studies. Data sources: Qualitative studies were extracted from MEDLINE, EMBASE, Web of Science, CINAHL, PsycINFO, PubMed, CBM, CNKI, and WanFang Database from the inception of each database until November 2025. Qualitative research and mixed-method research, including perspectives on remote pulmonary rehabilitation in chronic respiratory patients, were included.*** ***Review methods:*** ***The systematic search method SPIDER (sample, phenomenon of interest, design, evaluation, research type) was used. Thematic synthesis of qualitative data was used.*** ***Results:*** ***870 studies were screened, and finally 12 studies. 12 articles included were published between 2015 and 2025. 265 patients with chronic respiratory disease and Health-care Professionals were included. 3 themes and 12 sub themes were extracted from the views of patients and health professionals on remote pulmonary rehabilitation.*** ***Conclusion:*** ***In general, patients with chronic respiratory diseases have a positive attitude toward telepulmonary rehabilitation. Patients have a lot of perceived benefits in telepulmonary rehabilitation. Many factors affect patients' participation in telepulmonary rehabilitation. It is necessary to address the obstacles that affect patients' participation in telepulmonary rehabilitation, so as to promote the development and improvement of tele pulmonary rehabilitation.***

**Keywords:** Telehealth, Pulmonary rehabilitation, Chronic respiratory diseases, Qualitative research, Systematic review.

## 1. Introduction

Chronic respiratory diseases are diseases of the airways and other structures of the lung and are among the leading causes of morbidity and mortality worldwide [1, 2]. Pulmonary rehabilitation (PR) is an exercise and education program for people with chronic lung conditions [3]. Quantitative research results have confirmed the effectiveness of pulmonary rehabilitation in improving the daily living ability of patients with chronic respiratory diseases, improving their quality of life, and reducing cost-effectiveness [4-7], but the application of pulmonary rehabilitation is still very limited at present. It has been shown that PR improves exercise tolerance, peripheral muscle function, quality of life, and reduces hospitalizations [8, 9]. Many pulmonary rehabilitation programs have transitioned rapidly to remote delivery models [10-12]. Pulmonary telerehabilitation (P-TR) using information communication technology, such as video communication, wearable accessories, trackers, applications, etc., may support alternative approaches to delivering traditional in-person PR [13, 14]. P-TR has shown equivalent effectiveness to face-to-face PR in exercise capacity, respiratory symptoms, anxiety and depression, and quality of life, with greater adherence to conventional PR [15, 16]. However, while the technologies and capacity exist, there are many questions about the necessary features and how to implement them effectively [17]. Furthermore, acceptance of technologies by patients and health care providers (HCPs) is critical to the success of telehealth initiatives.

Qualitative research, which explores the human experience in-depth, may be better suited to elucidate the perceptions of patients and HCPs among chronic respiratory patients. In recent years, more qualitative studies started to explore factors influencing patients' participation in remote pulmonary rehabilitation from the perspectives of patients, caregivers, and dialysis staff members. Some qualitative studies have been performed to understand the perspectives of patients and HCPs' on remote pulmonary rehabilitation, However, there is no systematic review of the perspectives. Therefore, we conducted a systematic review of qualitative studies of patients' and HCPs' perspectives on engaging with telehealth interventions and online health information to comprehensively understand their experiences, attitudes, and beliefs about P-TR. These data may be highly relevant to changes in studies that improve exercise levels and survival outcomes in patients with chronic respiratory disease. Identifying the experiences, attitudes, and beliefs about pulmonary telerehabilitation can provide potential strategies for enhancing interventions, clinical service delivery, and policy frameworks to promote exercise for patients with chronic respiratory disease. To understand the real feelings and inner needs of patients when using ICT equipment for remote rehabilitation, so as to provide a reference for better clinical practice of remote rehabilitation.

## 2. Methods

A systematic review and thematic synthesis of qualitative studies were undertaken. This systematic review was conducted by Enhanced Transparency of Reporting the Synthesis of Qualitative Research framework [18]. The protocol for this systematic review was registered with the International Prospective Register of Systematic Reviews, with the registration number CRD42022322744. As this is a systematic review of qualitative studies, no raw data will be collected from the patients, and there is no need for patients and public involvement.

### 2.1 Selection Criteria

Types of studies were qualitative studies and mixed methods studies which express the perspectives of patients and healthcare professionals on remote pulmonary rehabilitation. Types of participants among adult patients (over 18 years) with any chronic diseases including but not limited to chronic obstructive pulmonary disease, Interstitial lung disease, and bronchiectasia were eligible for inclusion. We included English and Chinese articles, and excluded studies that used structured questionnaires or surveys as the sole data collection method or reported only quantitative data. Studies that did not elicit data directly from patients were also excluded.

### 2.2 Data Sources and Searches

The search strategy will comprise comprehensive keyword combinations for each of the two concepts of interest, that is, pulmonary telerehabilitation, qualitative study design. We will search English databases including MEDLINE (from 1950 to November 2025), EMBASE (from 1974 to November 2025), Web of Science (from 1900 to November 2025), CINAHL (from 1981 to November 2025), (PsycINFO from 2004 to November 2025), and PubMed (from 1950 to November 2025). Chinese databases include CBM (from 1978 to November 2025), CNKI (from 1979 to November 2025), and WangFang (from 1900 to November 2025). In addition to the mentioned search strategy, we will manually search reference lists of included studies to identify any additional studies that fit the inclusion criteria.

### 2.3 Search Outcome

The search results were imported into the Endnote X9 software. Duplicated and unrelated studies were deleted. Two independent evaluators screened the study title and the abstract to determine its substitutability. Eligibility for each study was tested against predefined eligibility criteria and quality assessment guidelines. In all cases, the decision to include or exclude a study was approved by two reviewers. If a decision cannot be made, a third reviewer will make the final decision. Figure 1 shows the preferred reporting items for systematic review and meta-analysis protocols flowchart.

### 2.4 Quality Appraisal

Two researchers independently evaluated the methodology of the included literature according to the qualitative research quality evaluation criteria of JBI Evidence based Health Care Center [19]. There were 10 evaluation items in total, and each item was evaluated with “yes”, “no”, “unclear” and “not applicable”. The included literature was divided into three grades: A, B, and C. In case of disagreement, the third researcher shall be consulted to decide whether to include the literature.

### 2.5 Data Synthesis

The thematic synthesis described by Thomas and Harden was applied to the data synthesis. Thematic synthesis enabled us to stay close to results of the primary studies, synthesizing them in a transparent way, and facilitating the explicit production of new concepts. Thematic synthesis consists of three stages: (1) line-by-line free coding; (2) construction of descriptive themes; and (3) construction of analytical themes. One author coded the text line by line in these hypothetical studies, grouped similar concepts and developed new codes when necessary. The results of data synthesis were checked by another author with experience in thematic synthesis to enhance credibility.

## 3. Results

### 3.1 Characteristics of Included Studies

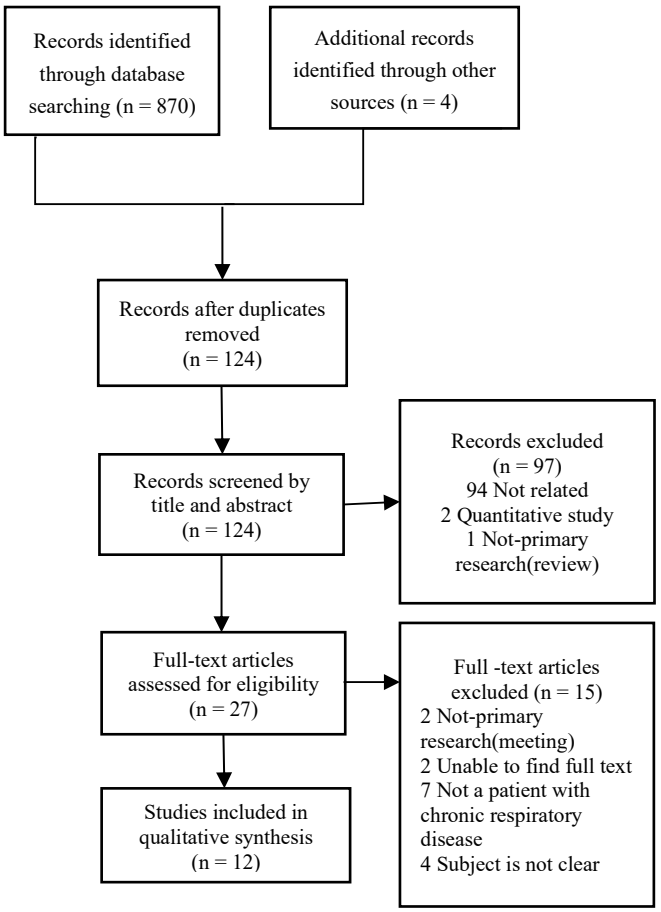


**Figure 1:** Flow chart of study selection

Totally, 870 studies were screened, and finally 12 studies. Ten articles included were published between 2015 and 2025. 265 patients with chronic respiratory disease and HCP were included. All the 12 studies met the criteria of CASP quality appraisal. For quality of the included studies, please see Supporting Information table 2. Among them,11 studies are qualitative and 1 are mixed studies. One study is in Chinese and nine studies are in English. One studies are conducted in the United States, three in China, two in the United Kingdom, two in Australia, one in Norway，one in Denmark，one in Chile，and one in Greenland. Through repeated reading and analysis of 12 articles, 3 themes and 12 sub themes were extracted from the views of patients and health professionals on remote pulmonary rehabilitation.

**Table 1:** Characteristics of included studies (n=12)

| Country Setting | Type of participants (*n*) | Patient population (condition and/or treatment) | Phenomena of interest | Methodological framework | Data collection | Analysis | Main findings |
|---|---|---|---|---|---|---|---|
| Rutherford H,2025, Australia[20] | Patients (25, 13 m-PR/12 CB-PR) | Chronic Obstructive Pulmonary Disease | 8-week home-based PR with mHealth app (m-PR) vs centre-based PR (CB-PR) | Critical realist/constructivist, phenomenological | Individual semi-structured interviews | Inductive thematic analysis (NVivo 14) | 1. Both internal and external motivations drive participation/compliance in pulmonary rehabilitation, while the goal setting and progress tracking features of mobile health applications provide unique incentives; 2. Home mobile lung rehabilitation can flexibly adapt to individual schedules, while central lung rehabilitation requires adjusting personal arrangements for fixed time periods; 3. Coexistence of multiple diseases/acute illnesses are the core compliance barriers of two modes; 4. The sports environment, resources, and social networks affect the enjoyment of the project experience; 5. Medical staff support is crucial for both modes, and home-based mobile lung rehabilitation benefits from weekly clinical doctor phone follow ups |
| Gregersen S,2025, Greenland [21] | Patients (7, 4 completers /3 dropouts) | Chronic Obstructive Pulmonary Disease | 10-week pulmonary telerehabilitation (PTR) via video consultation platform (Puisa) | Mixed-method (quant+qual); Theoretical Framework of Acceptability (TFA) | Quant: Adherence tracking, satisfaction questionnaire, clinical outcome measures (1-min STS, CAT score)Qual: Semi-structured focus group interview (Sharing Circle), physiotherapist field log | Quant: Descriptive statisticsQual: Systematic text condensation | 1. High satisfaction with PTR in completers (83.3% for intervention), with improved clinical outcomes (reduced CAT score, increased 1-min STS repetitions).2. High dropout rate (43%) due to illness, holiday obligations and scheduling misalignment.3. Frequent technical issues and low digital literacy hinder implementation and supervision.4. Participants value PTR's patient education (improving disease understanding and self-efficacy) but prefer in-person peer support.5. Structured post-program support is needed to maintain exercise routines.6. Scheduling flexibility and digital readiness assessment are critical for future PTR implementation. |
| Inskip JA,2018, UK[22] | Patients(26); HCPs(26) | people with chronic diseases | portable devices related to P-TR | Qualitative | Semi-structured interviews and focus group | inductive approach | 1. Maintaining the social aspect of pulmonary rehabilitation virtually<br>2. Communicating with HCPs for education and support<br>3. Using biosensors for monitoring and promoting self-knowledge<br>4. Evolution of support as the patient progresses over time |
| Jiang,2022, China [23] | Patients(29); HCPs(23) | Chronic obstructive pulmonary disease | mobile technology; social media WeChat official account | Qualitative | Semi-structured interviews | inductive thematic analysis | 1. Faced with a vast amount of online health information<br>2.Essential competencies and personality traits ensuring older patients' participation and sustained use<br>3. User experience with the use of technology<br>4. Being in a complex social context |
| Méndez ,2021, Chile [24] | Patients (8); HCPs (13) | Chronic Obstructive Pulmonary Disease | Rehabilitation programme using remote PR, carried out through an App to be installed on mobile devices | Qualitative | semi-structured interview | hermeneutic analysis | 1. Willingness to use telerehabilitation tools<br>2. Perception of the benefit of the proposed App<br>3. Identification of the tools and resources that the App should incorporate to favour its use and the achievement of results |
| Pekmezaris R,2020, United States [25] | 20 CAB members (including patients; nonprofessional caregivers; HCPs) | Chronic Obstructive Pulmonary Disease | PR being via telehealth in either the patients' home or community center; rehabilitation equipment (Exercise video ;a bicycle) | Qualitative | focus groups | Content analysis | 1.Equipment Changes<br>2.Equipment Changes<br>3. Study Logistics<br>4. Self-Efficacy<br>5. Access |
| Burkow TM,2015, Norway [26] | Patients (10) | Chronic Obstructive Pulmonary Disease | Internet-enabled home pulmo-nary rehabilitation programme(online sessions、exercise video and step-counting) | Interpretive descriptive | semi-structured interview | Thematic analysis | 1. General approval<br>2. Attendance of online sessions<br>3. Group education<br>4. Supervised group exercising, exercise video and step-counting<br>5. Individual consultations and the digital health diary<br>6. Comprehensive programme<br>7.Supportive social environment<br>8.Programme organization<br>9. Intrusiveness<br>10. Technology usability |
| Tsai LLY ,2016, Australia [27] | Patients (11) | Chronic Obstructive Pulmonary Disease | Remote exercise rehabilitation program(use videoconferencing software, cycle ergometer) | Qualitative | Semi-structured interview | Thematic and descriptive qualitative analysis | 1.virtual interaction through technology;<br>2. use of equipment;<br>3. convenience;<br>4.health benefits. |
| Claire Bourne,2020, UK [28] | Patients (20) | Chronic Obstructive Pulmonary Disease | a novel web-based pulmonary rehabilitation programme, Progress was monitored and reviewed weekly via email or telephone contact. | Qualitative | Semi-structured interview | Framework analysis | 1. Programme content and reported gains;<br>2. Embedding the programme into daily routines;<br>3. Barriers to participating in the programme;<br>4. Support. |
| Lahham A,2018, Australia[29] | Patients (13) | Chronic Obstructive Pulmonary Disease | at least 30 minutes of whole-body exercise on most days of the week and were provided with an exercise diary and a pedometer,seven weekly phone calls | | Semi-structured interview | Deductive thematic analysis | 1. Improved well-being;<br>2. Flexible programme fits with life;<br>3. Social support encouraged Commitment;<br>4. Programme challenges. |
| Rayce, 2021, Denmark[30] | patients (11); partners (4); HCPs (6) | severe Chronic Obstructive Pulmonary Disease | Physical therapist leads patients to perform lung rehabilitation training remotely through screen and monitoring | ethnographic methodology | informal and formal inter-views | Framework analysis; Postphenomenology; | 1.Telemediated Training Spaces<br>2.Training telemediated: a trade-Off<br>3.Telemediated Social Spaces. |
| HE, 2021, China[31] | patients (13) | elderly patients after lung cancer surgery | 'Internet+" pulmonary rehabilitation after discharge | Interpretive descriptive | Semi-structured interview | Thematic analysis | 1.Pulmonary rehabilitation health education<br>2.Exercise therapy<br>3.Homogeneous rehabilitation medical service resources<br>4.The need for public welfare economic support. |

**Table 2:** Methodological quality evaluation of included literatures(n=12)

| Citation | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | Q10 | Quality grade |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rutherford H,2025, Australia[20] | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | A |
| Gregersen S,2025, Greenland[21] | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | B |
| Inskip JA,2018,UK[22] | Y | Y | Y | Y | Y | UN | UN | Y | Y | Y | B |
| Jiang,2022, China [23] | Y | Y | Y | Y | Y | Y | Y | Y | Y | Y | A |
| Méndez,2021, Chile [24] | Y | Y | Y | Y | Y | UN | N | Y | Y | Y | B |
| Pekmezaris R,2020, United States [25] | Y | Y | Y | Y | Y | UN | UN | N | Y | Y | B |
| Burkow TM,2015, Norway [26] | Y | Y | Y | Y | Y | UN | UN | Y | Y | Y | B |
| Tsai LLY,2016, Australia [27] | Y | Y | Y | Y | Y | Y | N | Y | Y | Y | B |
| Claire Bourne,2020, UK [28] | Y | Y | Y | Y | Y | UN | UN | Y | Y | Y | B |
| Lahham A,2018, Australia[29] | Y | Y | Y | Y | Y | UN | UN | Y | UN | UN | B |
| Rayce, 2021, Denmark[30] | Y | Y | Y | Y | Y | UN | Y | Y | N | Y | B |
| HE, 2021, China[31] | Y | Y | Y | Y | Y | UN | UN | Y | Y | Y | B |

Note: Y, yes; N, no; UN, unclear. Q1 Whether the philosophical viewpoints and research methods are consistent; Q2 Whether the research methods are consistent with the research questions or objectives; Q3 Whether the research methods and data collection methods are consistent; Q4 Whether the research methods are consistent with the data analysis and expression methods; Q5 Whether the research method is consistent with the interpretation of the results; Q6 Whether the potential impact of researchers' concepts and values on the research is clarified; Q7 Whether the influence of the researcher on the research and the influence of the research on the researcher are described; Q8 Whether it fully represents the meaning stated by the participants; Q9 The research conforms to the current ethical standards, and has the research ethics approval certificate recognized by the academic institution; Q10 Whether the conclusions of the study come from the analysis and interpretation of the data.

### 3.2 Attitudes and Experiences of Remote Pulmonary Rehabilitation

#### 3.2.1 Attitudes

Some patients were curious in telepulmonary therapy as a novelty and were eager to try it out with a positive and accepting attitude [23-27]. 'I thought it was all good because it was specifically designed for our kind of problem, so I thought it was good [27]', 'Eight m-PR participants reported enjoyment of the programme, compared with only two CB-PR participants, with boredom and lack of variety cited as key negative experiences in CB-PR. [20]' Patients believed that telepulmonary rehabilitation was highly necessary and that they needed remote supervision since they were unable to assess the efficacy of their own home-based pulmonary rehabilitation, particularly in the case of elderly patients [31]. Furthermore, patients expressed their gratitude to the hospital for providing them with telepulmonary therapy and expressed their want to continue utilizing the program in the future as well as their desire to suggest it to others [23, 26-29]. The willingness of healthcare providers to use e-health tools for telepulmonary rehabilitation is also cheerful, as they see it as a complement to face-to-face pulmonary rehabilitation. 'I find the idea interesting. I think it could benefit a part of the population' [24].

#### 3.2.2 Experience

Telepulmonary rehabilitation technology is generally easy to learn and use for patients [23], though some report that it is difficult at first but becomes more manageable once they begin training [25, 26], 'So at the beginning I felt very afraid that I would not be able to do it, because I'm not very technical. But it was so easy that anybody at all could do it'. [26], 'Eleven m-PR participants reported initial apprehension about using the mHealth app, with limited prior experience of digital health technology being a key concern. Healthcare staff support (e.g., one-on-one guidance, troubleshooting technical issues) was essential for overcoming initial app use barriers and ensuring successful m-PR participation. [20]' The telepulmonary rehabilitation provider prepares the patient for the telepulmonary rehabilitation equipment, such as computers, bicycles, and systems, to be pre-setup. To achieve telepulmonary rehabilitation, the patient only needs to do a few simple things [27]. Patients find it simple to enter data into electronic logs, access logs, watch educational videos, and use video conferencing systems [26-28], with only a few encountering technical difficulties (such as wireless network connectivity) [26]. Many people found it simple to use and full of useful information [28], The overall length of the telepulmonary rehabilitation program, as well as the timing and frequency of educational sessions and individual consultations, were all appropriate. One patient stated that doing the program at home was more comfortable than going to the gym [25]. However, some patients felt that there were some navigational issues, that some sections were incorrectly marked as completed, and that they did not understand the reasons for the automatic prompts, and that these issues contributed to the withdrawal of some participants [28]. Participants did not consider the camera on top of the TV or the computer behind the living room TV to be intrusive in terms of security [26], Still, out of habit or concern, patients turned off the camera when not in use, 'It shouldn't be possible after all [to be monitored]. But Might as well'. [26]

### 3.3 Benefits of Remote Pulmonary Rehabilitation as Perceived

#### 3.3.1 Enhance physical function and promote health management

Some patients felt that telepulmonary rehabilitation improved their physical function in terms of walking distance, activity endurance, and activity level [28, 29], and that it improved many participants' ability to cope with breathing difficulties [29], resulting in a significant improvement in breathing function: 'Well, I can walk a bit further now and I am thinking to myself 'Breathe! Breathe! I am going a bit better with my breathing.' [29], 'PTR completers demonstrated improved clinical outcomes, including a mean reduction in CAT score of 7.3 and a mean increase in 1-minute sit-to-stand test repetitions of 6' [21]. Patients who completed the telepulmonary rehabilitation program stated that they regained control of their health during the program as a result of improved health due to exercise, felt an 80% improvement, their chest became less tight, and they were able to breathe through their nose when performing the breathing exercises learned during the program [25].

#### 3.3.2 Increased happiness, well-being, pride, and self-efficacy

Telepulmonary rehabilitation improved the mood and sense of well-being of the majority of participants. Some older patients felt better than their peers after independently searching for health information online and accessing telehealth services for telepulmonary rehabilitation [23], 'I always keep up with the trends, they wanted to be like me.' [23] Patients gained confidence, self-sufficiency, and motivation as a result of their new telepulmonary rehabilitation information and knowledge [22, 26, 28]. Telepulmonary rehabilitation, on the other hand, has improved their social functioning. Patients report that they can keep up with their friends while walking and talking, that they feel proud when their friends recognize their progress, and that they feel more confident in managing their symptoms, 'we're able to interact and switch between bike and exercises and warm-up, we are able to do pretty much everything' [25].

#### 3.3.3 Improving Self-Management Capabilities

Patients and HCPs can monitor biological parameters such as heart rate and blood oxygen saturation during telepulmonary rehabilitation to determine the appropriate intensity of exercise. According to the HCP, patients gained motivation by understanding and drawing on these biological parameters, which increased responsibility and self-management of their illness [22, 24]. Many patients reported that telepulmonary rehabilitation improved their disease management skills, allowing them to manage their deterioration more effectively and learn to connect the numbers recorded with how they felt [22, 29] 'The step counter that was a very motivating factor. Because, when you had sat there and been lazy one day, you felt ashamed to write the figures [in the diary]. [26]"

#### 3.3.4 Improving pulmonary rehabilitation adherence

Apps, according to the HCP, can help patients adhere to pulmonary rehabilitation exercises and facilitate treatment adherence [24]: 'if it is an application that has everything clear. How to use it and that the Physiotherapist also helped them with education, I think that could favour treatment adherence.' [24]. Remote monitoring can help improve patient compliance. The HCP believes that using an app to monitor exercise and capture complex physiological indicators that patients cannot self-report will help patients adhere to their practices and maintain continuity in pulmonary rehabilitation [24]. Patients report that when they do things on their own, they become tired and sluggish, but there are no shortcuts when a physiotherapist monitors them [27], Remote pulmonary rehabilitation motivates them to make greater efforts and to stop putting off exercise by using remote devices such as exercise videos [24]: 'But now you knew there was an exercise session, and you got ready and did the exercise…'[24].

3.3.5 Cost-effective, secure, and time-saving

Telepulmonary rehabilitation, according to both medical staff and patients, reduces travel costs, promotes resource savings, and has significant economic benefits for both the individual and the country [23, 24, 27, 29]. Patients found it convenient to travel long distances from the hospital, 'fantastic for those of us who live so far away from the hospital…' [26], and the HCP believed that telepulmonary rehabilitation could provide rural patients with access and resources [24] 'solving access problems." [24]. Furthermore, patients and HCPs agreed that telepulmonary rehabilitation reduces the risk of cross-contamination [23], and the 2019 coronavirus disease pandemic has boosted the use of telehealth for older people with COPD [23]. Patients who receive pulmonary rehabilitation at home have more flexibility in their schedules and do not have to change their current work activities due to waiting, saving time and reducing the inconvenience of mobility [24, 27].

3.3.6 Obtaining and maintaining social support and relationships

Some patients claim that exercising close to family members provides them with more support and understanding [28]. Despite the fact that telepulmonary rehabilitation cannot be done face to face, some patients felt that the new social group formed by telepulmonary rehabilitation increased sociability between groups and that the group was cohesive, open, and familiar [26, 27], with patients encouraging each other's company [27]. 'The whole thing became very sociable too' 'Even though you were kind of far away, they were so close to you. In a way, they were here at home with me.' [26]. In addition, the physiotherapists also wanted to expand unestablished social relationships, with physiotherapists leaving the screen at appropriate times to create opportunities for socialization between patients, who also mentioned that they would be more willing to interact if there were people of their age in the group, 'maybe I could have had something social if there had been another woman of my age in the group'.

**3.4 Influencing Factors in Remote Pulmonary Rehabilitation**

3.4.1 Physical aspects

Patients reported pain in areas such as knees, hips, or ankles [28, 29], aggravation of their condition [28], old age [23], reduced vision [31] and forgetfulness [22, 23], all of which affected their ability to carry out their exercise program. 'We taught the older patients to use PeR to participate in chronic disease management for COPD...some of them are slow to learn and quick to forget' [23], 'Multi-morbidity and acute illness were the primary barriers to adherence, interrupting programme participation or leading to complete withdrawal in both m-PR and CB-PR groups. Managing the impact of multi-morbidity was a key implementation challenge for both m-PR and CB-PR, with exercise prescriptions requiring frequent adaptation for chronic pain, acute illness, and other health conditions.'[20] The improved physical condition, on the other hand, facilitated the use of telepulmonary rehabilitation. Patients discovered that telepulmonary rehabilitation improved their walking ability [28], which could aid in achieving personal goals and increasing motivation for telepulmonary rehabilitation [29].

3.4.2 Psychological aspects

Without a strong sense of self-motivation, patients find it difficult to engage in a telepulmonary rehabilitation program [28]. Patients' participation in telepulmonary rehabilitation is also influenced by their conservative mindset, concerns about their ability to use a computer or the Internet, and the work habits of medical staff.[23] 'I'm afraid I can't master it (to use a cell phone)... so I quit.' [23] Some patients stated that they had never experienced telepulmonary rehabilitation before, which caused them to be fearful, anxious, and unable to concentrate during the early stages of rehabilitation [22, 29]. Furthermore, some elderly patients are prejudiced against the Internet and refuse or discontinue telepulmonary care.Rehabilitation, the belief that online access to health information or medical services is vulnerable to fraud or invasion of privacy, and so on, 'I don't go for online rehab exercises... a few clicks might give your privacy away.' [23] Remote interactions, On the other hand, medical staff and patients felt that remote interactions were less psychologically supportive than face-to-face interactions and did not provide the psychological support and comfort that face-to-face rehabilitation could [23].

3.4.3 Telepulmonary rehabilitation equipment and rehabilitation components

3.4.3.1 Technology and equipment issues

The study discovered that navigation issues, sound delays, or annoyance with automated messages were factors in patients dropping out of telepulmonary rehabilitation [28, 30]. Poor hearing in older patients, combined with noise from several home environments in the telepulmonary rehabilitation group, could complicate group conversations [30], which annoyed both the patient and the HCP, as mentioned by the patient's family: 'They all chatter on [without listening to each other]. It's terrible." [30] In addition, participants were frustrated by automated messages prompting them that they had not met their daily walking goal. Even after entering the reason for not completing the plan, they continued to receive prompt

notifications (e.g., physical, weather). These less-than-human automated messages have the potential to be demotivating [28]. Furthermore, HCP mentioned device factors influencing patient use, such as the high tablet computer on the bicycle will interfere with viewing [25].

3.4.3.2 Concerns about safety

The patient's remote pulmonary rehabilitation is hampered by difficulty adjusting the camera angle during rehabilitation training. The physiotherapist is also concerned that the patient is injured and must keep a close eye on the screen to ensure that these parts can be seen when the patient is exercising parts such as the legs or feet, but after the HCP training, the patient's image frequently shows the physiotherapist's full body shape, resulting in a smaller picture of the patient, making it difficult for the HCP to observe the patient and only the patient can adjust the angle. During training, the patient is strained and has difficulty breathing, which can be very stressful if changed frequently [30]. In addition, the physiotherapist must assess the patient's blood oxygen levels in order to determine the intensity of the training. While the physiotherapist can easily observe the patient's skin and lip color in the rehabilitation unit, maintaining the digital close-up view of remote pulmonary rehabilitation is difficult, Physiotherapist: ' … also the image is not good enough for me to see if the colour of their faces has turned totally blue" [30]. The screen would occasionally freeze, leaving the physiotherapist unable to determine the patient's breathing rhythm, making them uneasy. Patients see contacting the team in other locations as an important resource because it allows them to establish lines of communication with professionals if a question or emergency arises, and the HCP speaks to support patients remotely, assisting them in taking appropriate measures to manage critical situations, ensure safety, and give them peace of mind [24, 28].

3.4.3.3 Exercise program flexibility and usability

The flexibility and ease of use of the exercise program influenced patient participation in the intervention. Because telepulmonary rehabilitation cannot be taught face-to-face, rehabilitation therapists have attempted to develop simple exercises that reduce the complexity of the training and have been shown to help patients participate in the activity [30]. The HCP suggests that it should have a user-friendly design for older people or people who have never used technology before. It should also allow instructions to be provided progressively based on the level of compliance with PR, such as activity reminders, achievement visualization, and so on [24]. It should also allow professionals and users to communicate in order to report events or questions. Flexibility in training time is also viewed as a motivator to stick to the exercise program [29], It should provide a more personalized experience by not interfering with daily life and by delivering interventions at times that are convenient for them [28, 29]:'To do walking just in my own time where I can fit it in is much more establishing, something that I can keep on doing. [28]' 'Scheduling inflexibility of PTR sessions (fixed Tuesday/Thursday mornings) was a key implementation barrier, with participants reporting misalignment with work and personal routines. [21]'

3.4.4 Social assistance

3.4.4.1 HCP assistance

Professional guidance from the HCP facilitated patients' telepulmonary rehabilitation [27, 29], and patients in telehealth tended to follow the instructive language of medical staff [23]. Patients felt that a professional at home assisted them in navigating the website, guiding them in goal setting and exercise program completion, discussing progress, and exploring any difficulties [27, 28, 30]. The HCP's authority, competence, and skill in teaching telepulmonary rehabilitation, patient and slow speech, easy-to-understand explanations, a friendly voice, use of rhetorical devices, motivational words, and other factors have been reported to make patients more willing to learn and use telehealth and to increase their confidence in participating in telehealth [22, 23, 29]. Patients were frequently encouraged with amusing remarks such as "it's easier to live, learn, and PeR than to play mahjong" to make them feel at ease [23]. Some HCPs, on the other hand, stated that they did not have enough time or energy to participate in telehealth consultations and medical services and provide timely feedback, resulting in lower satisfaction among older patients [23].

3.4.4.2 Family members' assistance

Older people are less skilled at using electronic devices than younger people and require assistance with telepulmonary rehabilitation. Older patients, their peers, and medical staff, influenced by traditional Chinese culture, believe it is their children's responsibility to ensure their health and act as the patient's preferred supporter and assistant during telemedicine services [23]. 'Searching, consulting doctors... No matter what difficulty I met, my son would teach me.' [23] Furthermore, medical staff has discovered that involving patients' children can improve the efficiency of telepulmonary rehabilitation for elderly COPD patients while avoiding potential liability risks [23]. In contrast, in some countries, older adults are primarily expected to care for their grandchildren, neither of whom has enough time or energy to exercise. The lack of family support is detrimental to telepulmonary rehabilitation [23].

3.4.3.3 Peer assistance

One participant stated that seeing others (particularly patients of similar age, condition, ability, and so on) succeed on the bike encouraged him to believe that he, too, could grow in the program [25]. Participants shared their experiences and discussed issues with one another, learning from one another and becoming information sources for one another [26].' It is very good to meet others with the same illness and hear how they experience it' [26], It gives you a bit more fun to do it with the people [29]. Some patients, however, mentioned a lack of social interaction during telepulmonary rehabilitation, 'Some of it is going to be really hard for you to actually do anything about, because one of the things that I did miss was the social [interactions]' [28].

3.4.4.4 Economic support

Economic factors influence patient participation.

Low-income users require financial assistance [24], 'Is rehabilitation free? If it's free, I'll take part.'[31]. According to the HCP, telehealth services should not be provided for free, and pricing and healthcare payment systems should be adjusted accordingly [23] 'In order to promote telehealth services for health care professionals … People will be motivated if there is a moderate pay rise … or a higher possibility of promotion for the telehealth work they perform. [23]'

## 4. Discussion

### 4.1 Benefits of Tele Pulmonary Rehabilitation

The numerous advantages of telepulmonary rehabilitation and current research Pulmonary rehabilitation is a highly effective treatment for patients suffering from chronic lung disease, but it is underutilized globally. There is mounting evidence that pulmonary rehabilitation benefits chronic respiratory disorders such as COPD, interstitial lung disease, bronchiectasis, and pulmonary hypertension, including increased exercise capacity, decreased dyspnea, improved health-related quality of life, and fewer hospitalizations [32, 33]. Despite the recognized benefits, pulmonary rehabilitation training participation and completion rates have fallen short of expectations. According to the American Thoracic Society and the European Respiratory Society, there are currently many limitations to pulmonary rehabilitation, such as insufficient resources, low rates of health insurance allocation, and a shortage of specialist healthcare providers. Furthermore, other factors (transportation, population mobility, distance, and training location) make it difficult for people with COPD to participate in and adhere to pulmonary rehabilitation training. In recent years, new program models, such as the telepulmonary rehabilitation model, have emerged to improve access and uptake. Telepulmonary rehabilitation, considered a subset of telehealth, was developed as a system to control or monitor telerehabilitation using telecommunications technology in order to increase accessibility and improve continuity of care for a vulnerable, geographically remote disabled population, potentially saving time and resources in healthcare. Telepulmonary rehabilitation not only meets the healthcare needs of people with COPD and reduces costs, but also increases the viability of service delivery programs and expands the reach of pulmonary rehabilitation through new resources such as digital alternative rehabilitation models. Several studies have found that patients with chronic respiratory disease who received primary or maintenance pulmonary rehabilitation via telerehabilitation had similar or even better outcomes than those who received traditional center-based pulmonary rehabilitation, with no safety concerns [34, 35]. Ceravolo et al. performed a systematic assessment of the rehabilitation needs of patients affected by the new coronal epidemic. They emphasized the significance of remote pulmonary rehabilitation in encouraging patients to exercise at home [36].

### 4.2 Emphasis on Telepulmonary Rehabilitation Attitudes and Experiences with Various Cultural Interpretations

Acceptance of telepulmonary rehabilitation devices by patients suffering from chronic respiratory disease is a necessary condition for the successful implementation of telepulmonary rehabilitation. This systematic evaluation includes the United Kingdom, China, the United States, Australia, intellect, Denmark, and Norway, with some geographical representation. Overall, patients are enthusiastic about the use of telepulmonary rehabilitation. However, there are some concerns, particularly among the elderly Bermejo-Gil et al [37] found that 87% of COPD patients found exercise exercises easier to perform and respiratory function improved after using the telepulmonary rehabilitation app for one month.

Lundell [38] conducted qualitative interviews with 13 COPD patients, who expressed initial skepticism about the operating system, but gradually gained confidence over time. Tandon et al [39] used the Heal-Me app to assess the acceptability, effectiveness, and cost of a pulmonary rehabilitation program. They concluded that the app has the potential to be implemented in a variety of chronic disease groups. Peer support also improves the physical and mental health of people with chronic respiratory disease and their caregivers. Telerehabilitation, a relatively new form of rehabilitation, on the other hand, has had a more limited spread. According to the findings of this study, people with chronic respiratory disease who perceived more significant benefits from telerehabilitation were more compliant and felt more comfortable recommending telerehabilitation to their peers, which should improve patients' perceptions.

### 4.3 Comprehensively Explore Influencing Factors to Improve Patient Engagement and Adherence

Telepulmonary rehabilitation will undoubtedly affect how health services work and may become a standard way of working, as previously identified barriers must be quickly overcome [40]. According to research, some patients, particularly the elderly, are less receptive to new technology. To ensure that older people can easily use ICT, appropriate websites must be created to facilitate access to the information they require while also improving technology accessibility. Simultaneously, technical support should be provided prior to the implementation of telerehabilitation. ICT equipment support teams can be formed to train and monitor technology for patients with chronic respiratory diseases and their caregivers, as well as to resolve technical issues online or at home. Furthermore, this study demonstrates that a friendly and personalized device design is more conducive to increasing the interest and compliance of patients with chronic respiratory disease in rehabilitation. Consistent with previous research findings, some patients with chronic respiratory disorders continue to advocate for expanding the content of remote rehabilitation and enriching its development forms in order to meet patients' long-term needs [29]. Patients with chronic respiratory diseases can have personalized equipment functions performed based on the type of dysfunction to increase their willingness to participate in remote rehabilitation. Physiotherapists meeting with patients before training to establish a trusting relationship in the real world can improve patient motivation and compliance [30]. Concerning safety, patients and medical professionals emphasize that remote monitoring or self-monitoring systems should consider relevant legal issues [24], that better regulation of information by government departments is a critical way to change people's prejudices about the internet,

and that "having government regulation is the only way to prevent fraud and information leakage and for people to trust the internet [23]." Social interaction is frequently a deciding factor in whether patients continue to participate in telepulmonary rehabilitation, and apps that include social interaction are more likely to be used consistently [41], which may be a goal for many telepulmonary rehabilitation apps to achieve. Improving social support is also important for increasing patient participation in telepulmonary rehabilitation. A chronic respiratory disease telerehabilitation peer support system can be developed to increase the dissemination of telerehabilitation benefits through peer education from people with chronic respiratory disease and caregivers, as well as to ensure that telerehabilitation runs more smoothly through peer-to-peer sharing [42]. They can also set up discussion forums to receive comments and suggestions from patients with chronic respiratory diseases, understand the needs of participants, and promptly answer their questions online. It is difficult to ensure the sustainability of rehabilitation solely through patient management. The role of the family should be emphasized, and family members' participation is beneficial to improving exercise compliance and rehabilitation effect in chronic respiratory disease patients [12, 43]. Simultaneously, the telerehabilitation system should include optional alarm reminder functions, manual service functions, and activity monitoring and feedback functions based on family needs and home environment to meet patients' long-term rehabilitation needs to the greatest extent possible. To support the development of telemedicine, supporting software information systems should be developed..... Create and improve laws and regulations to address issues of medical liability. The promotion of telepulmonary rehabilitation cannot be achieved without the efforts of HCPs. While benefiting patients, HCPs' interests should also be protected; such telemedicine services should not be free, and the corresponding pricing system and medical payment system should be updated.[23]" Healthcare administrators also need to focus on the HCP practice environment, arrange and train professional staff to take charge of the work and provide compensation and incentives to strengthen HCPs' awareness of telepulmonary rehabilitation and promote its development.

### 4.4 Restrictions

The majority of the findings in this systematic review came from the perspectives of patients and HCPs; very few came from the perspectives of patients' families on telepulmonary rehabilitation, which play an important role in the development of telepulmonary rehabilitation and promoting patient compliance with its use. As a result, this will be an area of future research that must be investigated. This study's participants were mostly elderly patients. There may be differences in perceptions and factors influencing telepulmonary rehabilitation use among younger participants, with some underrepresenting the study population. The literature search for the included studies in this review was systematic and rigorous. However, because we did not include grey literature, we may have overlooked some relevant studies that influenced the findings. Because 9 of the ten included studies were of moderate quality, the data analysis and conclusions may have suffered as a result. To ensure representativeness, future systematic text evaluations on this topic should include more high-quality articles and consider a broader population.

## 5. Summary

Through the meta-integration of qualitative studies, this study provides insight into the attitudes and experiences of patients with chronic respiratory disease toward telerehabilitation, systematically interpreting the perceived benefits of telerehabilitation and the factors influencing its use by patients with chronic respiratory disease. Despite the fact that the patients in this study had some variation in general demographic characteristics and the researchers came from a variety of cultural backgrounds to some extent, it can truly reflect the experience and expectations of patients with chronic respiratory diseases in remote pulmonary rehabilitation. Patients with chronic respiratory illness had generally positive attitudes toward telepulmonary rehabilitation, though some patients, particularly older patients, may be concerned about using new equipment and technology. Telepulmonary rehabilitation provides many benefits to patients, including improved physical function, promotion of health control, improved mood, increased well-being, pride and self-efficacy, improved self-management, improved adherence to pulmonary rehabilitation, economic, safety, and time benefits, and assistance in gaining social support for themselves and building more social relationships. Patients' participation in telepulmonary rehabilitation is influenced by physiological factors, psychological factors, telepulmonary rehabilitation equipment, rehabilitation content factors, and social support. In future research and clinical practice, we should address the barriers that prevent patients from participating in telepulmonary rehabilitation, improve telepulmonary rehabilitation equipment and technical support, and enrich the content and form of telepulmonary rehabilitation for patients with chronic respiratory diseases.

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