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Patient-centered Outcomes Research in Interstitial Lung Disease
An Official American Thoracic Society Research Statement

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Background: In the past two decades, many advances have been made to our understanding of interstitial lung disease (ILD) and the way we approach its treatment. Despite this, many questions remain unanswered, particularly those related to how the disease and its therapies impact outcomes that are most important to patients. There is currently a lack of guidance on how to best define and incorporate these patient-centered outcomes in ILD research.

Objectives: To summarize the current state of patient-centered outcomes research in ILD, identify gaps in knowledge and research, and highlight opportunities and methods for future patient-centered research agendas in ILD.

Methods: An international interdisciplinary group of experts was assembled. The group identified top patient-centered outcomes in ILD, reviewed available literature for each outcome, highlighted important discoveries and knowledge gaps, and formulated research recommendations.

Results: The committee identified seven themes around patient-centered outcomes as the focus of the statement. After a review of the literature and expert committee discussion, we developed 28 research recommendations.

Conclusions: Patient-centered outcomes are key to ascertaining whether and how ILD and interventions used to treat it affect the way patients feel and function in their daily lives. Ample opportunities exist to conduct additional work dedicated to elevating and incorporating patient-centered outcomes in ILD research.

Keywords: interstitial lung disease; patient-centered outcomes; health-related quality of life

Contents

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This statement is dedicated to the memory of Mrs. Glenda Rouland.

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Overview

Interstitial lung disease (ILD) is often a life-altering diagnosis associated with chronic symptoms, disruption of patients' daily lives, and the prospect of shortened survival. Many ILDs have an unpredictable trajectory, making prognostication challenging and reinforcing the need for care plans that align with patients' goals, values, and preferences. Traditionally, upper-tier endpoints in ILD therapeutic trials have been measures of lung function, which correlate weakly with outcomes that patients value most, such as symptom burden, day-to-day physical functioning, and quality of life (QOL). In the past two decades, major advances in understanding the pathophysiology of ILD have supported the identification of promising therapies; however, none have demonstrated improvement in patient-centered outcomes. There remains much to learn about how ILD itself and the interventions prescribed to treat it affect the outcomes that are valued most by patients. The need for an improved understanding provides the impetus for developing an agenda around patient-centered outcomes research (PCOR) in ILD. This statement describes the work of a multistakeholder committee whose mission was to assess the current state of PCOR in ILD, to identify important gaps in our understanding of patient-centered outcomes in the field, and to provide recommendations for conducting PCOR in patients with ILD.

Definition

We defined patient-centered outcomes and PCOR in ILD as a collection of reliable and valid endpoints that represent what matters most to individual patients in their day-to-day lives. These outcomes may represent how patients feel, or function, or how they view their QOL. Patient-centered outcomes are determined from the patient perspective and are ideally designed and chosen with patient engagement to ensure they reflect and encompass patients' priorities, preferences, beliefs, values, hopes, and needs. PCOR is research of any design that seeks to understand or measure patient-centered outcomes.

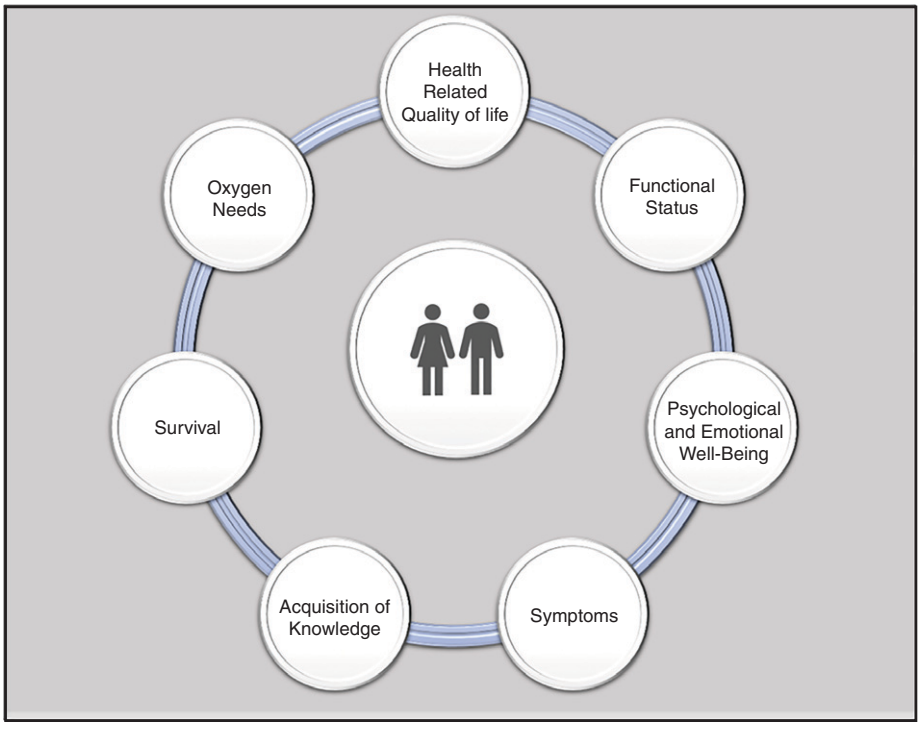

Figure 1. Key patient-centered outcomes of focus in interstitial lung disease.

Specific Patient-centered Outcomes

The committee identified several patient-centered outcomes grouped into the following seven themes that form the framework for this statement: *1*) health-related QOL (HRQOL), *2*) symptoms, *3*) psychological and emotional well-being, *4*) functional status, *5*) oxygen needs, *6*) hospitalizations and survival, and 7) acquisition of knowledge (Figure 1). These themes are meant to guide the discussion of PCOR in ILD and provide a starting point to identify gaps and formulate recommendations for research. The committee acknowledges that these themes are not necessarily mutually exclusive (for example, HRQOL may be influenced by a patient's symptoms or psychological state) but highlighted them distinctly for the purposes of comprehensively evaluating each, highlighting important gaps, and making research recommendations. For each theme, the committee reviewed the current state of research, identified gaps in knowledge, and developed a total of 28 key recommendations as an agenda for future research priorities. These are summarized in Table 1.

Introduction

ILD comprises multiple conditions defined by diffuse inflammation and/or fibrosis of the lung interstitium, typically resulting in physiological restriction and impaired gas exchange. The cause of the ILD may be unknown, be a manifestation of systemic autoimmune disease, or result from an environmental, occupational,

Table 1. Key Research Recommendations for PCOR in ILD

Domain	Key Recommendation
HRQOL	• Investigators, sponsors, regulatory agencies, scientific organizations, publishing bodies, and policy makers should come to a consensus to support use of HRQOL PROs in trials. • Studies should use a combination of generic and disease-specific HRQOL questionnaires. These must be carefully chosen on the basis of the context and population included in the study. • There should be a balance between developing new and better PROs, validating existing newer PROs, and using older, extensively validated ones. • Development of a new HRQOL measure requires careful consideration and input from a diverse multicultural panel of stakeholders from the outset. • Studies should include a limited number of VASs to assess major driving components of HRQOL in order to simplify assessments. • Studies should use composite endpoints including HRQOL, quality-adjusted life-years, or quality-adjusted hospitalization-free survival. • In trials with disease-modifying drugs aimed at slowing down disease progression, assessing time to deterioration in HRQOL should be considered. • In RCTs with interventions primarily aimed at the improvement of HRQOL, consider measuring actual values of HRQOL with PROs and comparing these values between intervention groups. • Studies to determine the clinical utility of the HRQOL PROs for patients with chronic fibrotic ILD are warranted.
Symptoms	• Investigators should define which aspect(s) of which symptom(s) they wish to investigate and how those can be measured appropriately in their study. This will inform the decision of what measurement tool is chosen or whether a new tool needs to be developed. • The choice of which symptom PRO to include in a study should be dependent on the research question and reviewed by multidisciplinary research staff, including patients. One may also consider an HRQOL instrument if the goal is to better understand the impact of the burden of a particular symptom. • Studies should explore fatigue as an endpoint in ILD. More work is needed to characterize patients' fatigue in ILD and to develop and validate outcome measures of fatigue in patients with ILD. • Studies using a mixed-method study design are needed. More work is needed to determine implementation strategies of this study design in the context of a large clinical trial. • Studies should focus on the development of an individualized approach to symptom measurement based on what an individual patient designates as their most distressing or bothersome symptoms.
Functional status	• When including patient-reported functional status as an outcome in their study, investigators should choose a PRO on the basis of the type of information they want to learn (e.g., someone's functional capacity from functional performance). • Studies to assess the feasibility, acceptability, and effectiveness of using accelerometers and GPS tracking devices in different patient populations are needed. • Subjective (questionnaire-based) and objective data are needed if intending to capture a comprehensive understanding of a patient's functional status. • More research is needed to identify the most acceptable test of endurance for patients with ILD.
Psychological and emotional well-being	• Studies that measure aspects of psychological and emotional well-being as distinct outcomes instead of predictor variables in models measuring other outcomes (e.g., symptoms, PFTs, HRQOL) are needed. • Studies to assess the validity of currently available measures of depression and anxiety in ILD are needed, and, when appropriate, stakeholder engagement is recommended to modify existing instruments for use in ILD. • Studies are needed (including summarizing existing and generating new qualitative work) to better understand and determine how to measure other aspects of psychological and emotional well-being (aside from depression and anxiety) that are not currently captured, including coping effects, stress, resilience, satisfaction, interpersonal relationships, and self-esteem. • Studies of medications targeting improvement in primary psychological endpoints are needed.
Hospitalizations and survival	• Studies are needed that include the following outcomes to capture survival: *1*) hospital-free days, *2*) disease-related hospitalization, and *3*) QUALY. • More work to best define and include a hospitalization endpoint in the context of ILD and its therapies is needed.
Supplemental oxygen needs	• There should be continued efforts to produce standardized and data-driven practice guidelines for supplemental oxygen prescription in ILDs. • Studies should include "oxygen need" as a distinct patient endpoint. More work is needed on how to best define and measure this endpoint.
Acquisition of knowledge	• Studies focused on effects of disease-related education should include an assessment of knowledge as an endpoint. • Further investigation is warranted to determine the best way to deliver disease-related information to patients, with consideration of including stakeholders with expertise in dissemination and implementation science methods to achieve this.

Definition of abbreviations: GPS = Global Positioning System; HRQOL = health-related quality of life; ILD = interstitial lung disease; PCOR = patient-centered outcomes research; PFTs = pulmonary function tests; PRO = patient-reported outcome; QUALY = quality-adjusted life-years; RCT = randomized controlled trial; VAS = visual analog scale.

Table 2. Considerations for Best Practices to Facilitate PCOR and Immersion with Clinical Practice in ILD

- Patients should be viewed as important stakeholders in ILD research, and patients should be included in the process of research from conception and design through dissemination of results.
- We recommend studies to determine the feasibility and optimal use of digital platforms for data collection in ILD research studies and clinical practice.
- We recommend studies to determine how the use of digital technology in both research and clinical practice affects patient-centered outcomes

Definition of abbreviations: ILD = interstitial lung disease; PCOR = patient-centered outcomes research.

avocational, or drug exposure. Regardless of etiology, the majority of patients with ILD experience symptoms including exertional breathlessness, cough, and fatigue. Furthermore, the subset of ILDs that are fibrosing are typically incurable, frequently progressive, and often lethal (1–4). As such, for many patients, ILD is a life-altering condition whose intrusive symptoms rob them of their physical and emotional well-being as they confront the prospect of shortened survival (5–7).

Over the past two decades, investigators have advanced our understanding around the pathogenesis of ILD and have conducted ground-breaking research focused on therapeutic interventions. The discovery of effective therapies for various forms of ILD has enhanced awareness of ILD and generated significant optimism among patients and enthusiasm in the research community (8–13).

PCOR includes all forms of research focused on things that matter most to patients, including symptom frequency and severity, day-to-day physical functioning, emotional well-being, and QOL (14). PCOR might include assessing how a condition or symptom affects patients' lives or determining whether a therapy has beneficial (or detrimental) impacts on those things most important to patients. Given the recent scientific discoveries in the field, we believe now is the perfect time to take stock of PCOR in ILD (15). This research statement provides an in-depth assessment of several patient-centered outcomes in ILD, reviews the excellent work in PCOR already accomplished, and sets the agenda for future PCOR in ILD.

Methods

Committee Composition

An international committee comprising patients, patient advocates, and experts from various disciplines, including nurses, scientists, and clinician investigators, was assembled by the two co-chairs (K.I.A. and J.J.S.). Potential conflicts of interest were disclosed and managed in accordance with the policies and procedures of the American Thoracic Society. A steering committee of six experts, including the two co-chairs, was identified and charged with overseeing the work of six subcommittees. Each subcommittee was responsible for reviewing relevant literature, presenting findings to the committee at large, and generating a draft manuscript of their findings.

Definitions and Outcomes of Interest

To formulate an initial framework for the statement, every committee member responded to an e-mail survey (developed by the steering committee) that asked for the following: *1*) their definition of "patient-centered outcomes research in ILD" and *2*) the five patient-centered outcomes they viewed as most important in ILD research. The co-chairs conducted a simple qualitative content analysis to derive a consensus definition of PCOR in ILD (subsequently approved by the committee after review and discussion at the in-person meeting, and upon review of the draft manuscript) and to identify the themes and outcomes the committee would focus on most intensely. Each subcommittee was assigned one or two (of the seven total selected) outcomes.

Literature Search and Preparation for In-Person Committee Meeting

For each of the seven outcome themes, literature searches were conducted with the assistance of a medical librarian. Search results were sent to the subcommittees, who reviewed them, selected relevant publications, and used these to summarize published research on their topic, to identify gaps in understanding, and to make recommendations for advancing PCOR in ILD moving forward. Committee members were encouraged to include additional literature they viewed as relevant to the topic. To promote consistency, each subcommittee used a question guide developed by the co-chairs to review relevant literature (*see* the online supplement).

In-Person Meeting and Research Recommendations

Each subcommittee presented their findings to the entire committee at an in-person meeting at the American Thoracic Society 2019 International Conference in Dallas. Recommendations for future research were formulated via consensus. Additional topics covered in the discussion, addressed in this statement, and accompanied by research recommendations include general approaches to PCOR and innovative ways of engaging patients with ILD in PCOR research. In accordance with its mission, the committee developed research recommendations, not recommendations for patient care; thus, guideline methodology was not employed to formulate or grade recommendations.

Document Development

Each subcommittee was responsible for writing on their assigned topic and submitting drafts to the co-chairs (K.I.A. and J.J.S.) who reviewed, edited, and collated sections to develop the draft document. The draft was circulated among the committee for comment, review, and approval. Two cycles of review and revision occurred before the final document was submitted for peer review.

Definitions

The committee's consensus definition for patient-centered outcome research in ILD is "a collection of reliable and valid endpoints for ILD research that represent what matters most to individual patients in their day-to-day lives. These outcomes may represent how patients feel, function, and view their QOL. They are determined from the patient perspective and are ideally designed and chosen with patient engagement to ensure they reflect and encompass patients' priorities, preferences, beliefs, values, hopes, and needs."

It is important to recognize the distinction between a patient-centered outcome and a patient-reported outcome (PRO). A patient-centered outcome may or may not be a PRO. For example, patients with ILD value performing various physical activities (e.g., exercising, taking a leisurely

walk, or walking to the mailbox to pick up their mail), so a laboratory-based test to measure physical functioning (such as a wearable activity tracker), although not a PRO, is clearly patient centered. The Food and Drug Administration defined a PRO as "any report of the status of a patient's health that comes directly from the patient, without interpretation of the patient's response by a clinician or anyone else" (16).

Considerations and Best Practices for Engaging Patients and Other Key Stakeholders in PCOR in ILD

There are several things to consider when designing a patient-centered research study. The committee unanimously agreed on the utility and importance of engaging patients in all aspects of research, from planning to disseminating results. Patient advisors, integrated at the clinic and organization level, are increasingly viewed as essential members of the research community (17–19). Engaging patients early in the research process helps to determine key patient-centered study outcomes, to identify drivers of and barriers to research participation, and to enable patients to take on central roles in overseeing the conduct of PCOR. Researchers have documented their real-world experiences and recommendations for best practices for engaging patients in research. This includes suggested approaches for patient recruitment, ensuring a diverse patient group of representatives, and providing training materials for patient advisors (20, 21). The PCOR Institute has developed a rubric for investigators who are interested in collaborating with patients in research (22). Other groups, including the Agency for Healthcare Research and Quality, Outcome Measures in Rheumatology, and the European League Against Rheumatism, have provided their experience and recommended best practices for patient engagement in research (18, 23). More research is needed to evaluate the impact of these practices and to identify ways to facilitate uptake of these practices across other disciplines, including ILD (24, 25) (Table 2).

The committee stressed the importance of identifying and incorporating all other stakeholders, including individuals or groups who represent, support, or otherwise align with the patient's voice and their interests. These may be patients' family members or caregivers, healthcare providers, community members, patient advocacy groups, not-for-profit organizations that support research, and even regulatory agencies such as the Food and Drug Administration and European Medicines Agency (26).

Table 3. Conceptual Framework That Includes the Seven Patient-centered Outcomes and Subcategories of Focus

Patient-centered Outcome	Subcategories
Health-related quality of life	General Disease-specific
Symptoms	Dyspnea Cough Fatigue Medication side effects
Psychological and emotional well-being	Depression Anxiety Grief Stress Emotional freedom Confidence
Functional status	Activities of daily living Capacity to function at home and at work Ability to leave home to participate in enjoyable activities and/or travel
Oxygen needs	Need for supplemental oxygen prescription and amount of oxygen prescribed Type and availability of oxygen delivery device Cost and navigating logistics
Hospitalizations and survival	Hospital-free days
Acquisition of knowledge	Therapies and clinical trials available Risks and benefits of tests and procedures Prognosis and level of certainty for what the future holds Supportive care options

Discussion of Specific Patient-centered Outcomes and Research Recommendations

The seven outcome themes (and associated subthemes) identified by the committee are summarized in Table 3. Below, each theme is addressed in its own subsection of the manuscript, and, for each theme, the following topics are addressed: *1*) the current state of research, *2*) gaps in knowledge, and *3*) recommendations for future research priorities.

HRQOL

QOL is defined as an individual's perception of their position in life, considered in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns (27). Health is one of the important factors affecting QOL, but other factors such as personality traits, beliefs, spiritual and cultural forces/traditions, psychosocial and economic status, social relationships, and living environment also play important roles. HRQOL encompasses all aspects of health or disease (and all associated treatments and evaluations) on overall QOL, but in the literature, HRQOL is often limited to physical and psychological (mental) impacts and social well-being.

Over the last decade, our field has witnessed increasing awareness of the impact of ILD—especially the progressive fibrotic form—on HRQOL (28–32). Patients with ILD have impaired HRQOL in several domains, particularly those that assess physical health. Patients with idiopathic pulmonary fibrosis (IPF; the most common of the progressive fibrosing ILDs) report impaired emotional health and have scores significantly worse than the normative values for the general population

(and equal to or greater than those with other chronic illnesses such as heart failure and sleep disorders) on domains that assess depression, anxiety, fatigue, and sleep disturbance (33). Patients with IPF or fibrotic hypersensitivity pneumonitis have shared their perspectives on how their condition impacts other important aspects of their lives, such as family, independence, sexual relations, employment and finances, self-perception and identity, and knowledge and uncertainty (5, 6). Although breathlessness is a strong driver of HRQOL among patients with IPF, variability in HRQOL is not fully explained by indices of breathlessness or tests of pulmonary function, suggesting that measures of HRQOL yield important patient-centered information not captured by routinely used physiological clinical trial endpoints (34). More research is needed to convince stakeholders (regulatory agencies, in particular) of the validity of HRQOL and that it is one of the most important endpoints to assess in therapeutic trials.

Traditionally, therapeutic trials for ILD have employed a combination of generic and respiratory- or disease-specific questionnaires aimed at assessing HRQOL (35, 36). Table 4 provides an overview of some of the measures used in ILD research. Although there is broad consensus that HRQOL is both an important and relevant outcome in ILD research, several factors have shaped the current landscape of pharmaceutical trials, in which HRQOL has yet to be accepted as a top-tier endpoint. One driving factor may be the misguided belief that there is one "ideal" instrument to be used in every study or trial; however, the choice of which instrument(s) to use in a particular instance depends on several things, including the interests of the investigator/research team, the research questions to be answered, and the mechanism (and potential side effects) of the drug/intervention. A general lack (or poor understanding) of the scientific rigor needed to develop, test, and build validity of HRQOL questionnaires has also detracted from enthusiasm. In addition, until recently, there were no ILD-specific questionnaires available, so many questionnaires used for ILD research contained irrelevant questions, and most did not include items capable of capturing cultural differences among subjects. The heterogeneity of phenotypes of patients with ILD and the variable prognoses within the spectrum of ILDs add to the challenge (37). In addition, HRQOL does not necessarily follow a linear path in many patients with progressive ILDs, so statistical analyses require sophistication (38). Impairments in HRQOL may be slight or decline gradually, but periods of steep decline or rapid deterioration (particularly in the final stages of disease) are not uncommon (38).

Ideally, a HRQOL measure should capture 80% of determinants of HRQOL at the group level, and the minimal clinically important difference for its scores in ILD should be rigorously established. The committee suggests that, rather than measuring HRQOL at any one time, time to decline in HRQOL (as defined by any selected change score displayed by a cumulative distribution function plot) may hold more merit. This is particularly relevant in the progressive fibrotic ILDs, in which combination therapies are being studied and effect size margins are small. In other forms of ILD, in which improvement or reversal of disease is achievable, changes in actual values of HRQOL scores could be more easily assessed and evaluated. The same may hold true for interventions directly aimed at improving HRQOL (e.g., ambulatory oxygen) (39).

We recommend the following:

- To advance the field, investigators, sponsors, regulatory agencies, scientific organizations, publishing bodies, and policymakers should come to a consensus to support use of HRQOL PROs in trials. This includes more established PROs as well as newly developed, simpler PROs when deemed to be appropriate for the target population. Even when used as an exploratory endpoint, these data will likely generate hypotheses and may contribute to the validation and acceptance of these HRQOL PROs in ILD.
- Using a combination of generic and disease-specific HRQOL questionnaires is advocated, and these must be carefully chosen on the basis of the context and population included in the study.
- To optimize development and use of HRQOL PROs, a balance should be sought between developing new and better PROs, validating existing newer PROs, and using older, extensively validated ones.
- Development of a new HRQOL measure requires careful consideration and input from a diverse multicultural panel of stakeholders from the outset.
- One possible strategy for simplifying assessments is to include a limited number of visual analog scales to assess major driving components of HRQOL.
- Composite endpoints, including HRQOL, quality-adjusted life-years, or quality-adjusted hospitalization-free survival, should be explored.
- In trials with disease-modifying drugs aimed at slowing disease progression, assessing time to deterioration in HRQOL should be considered.
- In randomized controlled trials with interventions primarily aimed at the improvement of HRQOL, measuring actual values of HRQOL with PROs and comparing these values between intervention groups may be the best method of endpoint assessment.
- Further studies to determine the utility in clinical practice of an HRQOL PRO for patients with ILD are warranted.

Symptoms

A patient's experience of physical symptoms largely shapes their experience of living with ILD. Not uncommonly, symptoms prompt patients to seek evaluation, as symptoms affect their psychological and emotional well-being and QOL. There are a myriad of symptoms associated with ILD, some related to the disease itself and others related to therapy side effects. Many symptoms go unmeasured or unreported in research studies unless they are systematically captured as adverse events. Here, we focus on dyspnea, cough, and fatigue, which are three of the most common symptoms in ILD.

Dyspnea (also commonly referred to as breathlessness or shortness of breath) is the most common symptom of ILD (40–42) and is a strong driver of QOL (7). The emotional and psychological components of dyspnea (i.e., fear, frustration, and anxiety) may be equally or more detrimental to some patients than the physical constraints imposed by dyspnea. Qualitative and mixed-methods studies have shown that patients with ILD describe their dyspnea as gasping, feeling out of breath, or breathing that is shallow or requires effort (43–45). Several things make the measurement of dyspnea challenging, including its multiple dimensions, its variability and dependence on the amount of exertion, and the likelihood that the use of supplemental oxygen confounds its measurement (46). Dyspnea should be included as an endpoint in ILD research. It is important to consider the distinction between the perception of the intensity of breathlessness, the emotional response to the

Table 4. Patient-reported Outcome Measures Used in ILD

Patient-reported Outcome Measure	Description	Validated Disease and MCID*	Key Features	References
Disease-specific				
SGRQ	50-item questionnaire with three domains assessing HRQOL in chronic respiratory disease	IPF (MCID, 4–8) and CTD-ILD (MCID, 4–13)	It is used in many clinical trials and is well validated. It was originally developed for COPD and asthma and is a lengthy, difficult questionnaire.	72, 164–172
SGRQ-I	IPF-specific version of the original SGRQ; contains 34 items	IPF (MCID, N/A)	Its questions are more relevant for IPF than those of the SGRQ. Its responsiveness and MCID are not known yet. Limited experience.	173, 174
CAT	Composed of eight symptom items on a 0–5 response scale	IPF (MCID, N/A) and CTD-ILD (MCID, 1–4)	It is a simple and quick instrument that was originally developed for COPD. Limited experience in clinical trials.	175–178
K-BILD	15-item health status questionnaire in ILD with three domains	IPF and ILD (MCID, 4–8)	It is brief and was developed in ILD (including patients with IPF). Limited experience in clinical trials, though increasingly used.	35, 179–182
ATAQ-IPF	74-item questionnaire with 13 domains assessing HRQOL; designed for IPF	IPF (MCID, N/A)	It covers the patient-identified domains of interest, and is a lengthy, difficult questionnaire.	183
L-IPF	Modified variant of the ATAQ-IPF, consisting of two modules (symptoms and impacts)	Currently in validation process	It was adapted with feedback from patients and has undergone initial stages of validation testing.	36
IPF-PROM	Concise questionnaire to assess QOL in IPF	Study is ongoing	It was developed with patients and caregivers. Validation studies are ongoing.	184, 185
PESaM	Generic and disease-specific module; evaluates patients' expectations, experiences, and satisfaction with disease-modifying drugs	Currently in validation process	It was developed together with patients with IPF and has undergone initial stages of the validation process.	186, 187
IPF-PREM	Questionnaire to assess experiences with care delivery	Study is ongoing	It measures experiences of patients. Not available yet.	188

(*Continued*)

Table 4. (*Continued*)

Patient-reported Outcome Measure	Description	Validated Disease and MCID*	Key Features	References
Domain-specific				
Dyspnea				
UCSD-SOBQ	Contains 24 items on a 0–5 response scale assessing dyspnea in the last week	IPF (MCID, 8) and CTD-ILD (MCID, N/A)	It is used in different clinical trials and is valid to assess change in dyspnea in IPF but takes more time to complete compared with other dyspnea measures. It was not originally developed in ILD.	189–191
mMRC	Consists of one question with five grades for the level of dyspnea	IPF and ILD (MCID, N/A)	It is a quick, easy tool for use in daily practice that relates to disease progression. Its responsiveness in ILD is unclear. It was not originally developed in ILD.	164, 192, 193
BDI-TDI	BDI (three components of dyspnea on baseline) and TDI (measure changes compared with baseline)	SSc-ILD (TDI MCID, 1.5)	It measures both baseline and change over time. There are few specific instructions included in the instrument. It was not originally developed in ILD.	194, 195
D-12	Consists of 12 items on a 0–3 response scale assessing dyspnea	ILD and CTD-ILD (MCID, N/A)	It is a brief, reliable, and valid instrument that was developed using descriptors of dyspnea relevant to patients with a variety of cardiopulmonary diseases, including ILD. Its responsiveness and MCID are not known yet. Limited experience in clinical trials.	189, 196, 197
Borg scale	Measures level of dyspnea scored on a 0–10 response scale	Not well-validated in ILD	It is useful during 6-min-walk test in daily practice and only measures dyspnea during exertion. It was not originally developed in ILD.	198
PROMIS Dyspnea Item Banks	Two separate item banks available (functional limitations of dyspnea and severity of dyspnea)	Not well-validated in ILD	It was developed and validated in patients with COPD. Computer adaptive testing is available. Additional pool items are available to assess impact of environment, characteristics of dyspnea, and emotional response to dyspnea (these are not scored but aid in having a more complete understanding of individual respondents).	199

(*Continued*)

Table 4. (*Continued*)

Patient-reported Outcome Measure	Description	Validated Disease and MCID*	Key Features	References
Cough				
LCQ	Chronic cough QOL questionnaire with 19 items in three domains	IPF (MCID, 1.3 in chronic cough)	It is reliable, responsive to changes, and easy to complete. Its responsiveness and MCID in ILD are not known yet. It was not originally developed in ILD.	200–204
CQLQ	Consists of 28 cough-specific questionnaires in six domains	IPF (MCID, 5)	It is a comprehensive, responsive outcome measure with good validity for total score in IPF but not for all domains. It was not originally developed in ILD.	205
Fatigue				
FAS	10-item general fatigue questionnaire	IPF (MCID, N/A) and sarcoidosis (MCID, 4)	It is quick and easy to complete. Limited experience in ILD. It was not originally developed in ILD.	206–209
MFI	20-item multidimensional questionnaire with five subscales of fatigue	Sarcoidosis (MCID, N/A)	Limited experience in ILD.	210
PROMIS fatigue	Asks about experience of fatigue and the impact of fatigue on physical, mental, and social activities	Sarcoidosis (MCID, N/A)	It is available in short form for computer adaptive testing. Limited experience in ILD.	211
Anxiety/depression				
HADS	Composed of 14 items assessing anxiety and depression in a general medical population	IPF (MCID, N/A)	It is a reliable screening tool for anxiety and depression and is simple and easy to use. It should not be used as a diagnostic test. It was not originally developed in ILD.	117, 119, 212, 213
GAD-7	Seven-item questionnaire assessing generalized anxiety disorder	Not well-validated in ILD yet	It is a valid and efficient tool for screening for generalized anxiety disorder and assessing its severity in clinical practice and research. It is not specific to ILD and was not originally developed in ILD.	214

(*Continued*)

Table 4. (*Continued*)

Patient-reported Outcome Measure	Description	Validated Disease and MCID*	Key Features	References
Sleep disorders				
ESS	Consists of eight items on a 0–3 response scale measuring daytime sleepiness	IPF (MCID, N/A)	It is a quick, easy tool for use in daily practice and is well validated and reliable. Limited experience in ILD. It was not originally developed in ILD.	215–217
SA-SDQ	Consists of 12 items on a 1–5 response scale measuring sleep-related breathing disorders	IPF (MCID, N/A)	It is quick and easy to complete. Limited experience in ILD. It was not originally developed in ILD.	216, 218
Generic HRQOL questionnaires				
SF-36	Generic questionnaire with 36 items measuring functional health and well-being	IPF (MCID, 2–4) and SSc-ILD (MCID, N/A)	It is a widely used and accepted global health assessment measure. It is not specific to ILD and was not originally developed in ILD.	166, 219–223
EQ-5D-5L	Generic questionnaire assessing health status with five dimensions	ILD (MCID, N/A)	Quality-adjusted life-years can be measured. It was developed to improve the instrument's sensitivity and to reduce ceiling effects, as compared with the other version. It is not specific to ILD. Limited experience in ILD. It was not originally developed in ILD.	224–227
PROMIS-29	Generic measurement of HRQOL across multiple health domains	IPF and other ILD (MCID, N/A)	Still limited use in ILD.	33, 199, 228–230

Definition of abbreviations: ATAQ-IPF = A Tool to Assess Quality of Life in IPF; BDI-TDI = Baseline Dyspnea Index TDI; CAT = COPD Assessment Test; COPD = chronic obstructive pulmonary disease; CQLQ = Cough Quality of Life Questionnaire; CTD-ILD = connective tissue disease–associated ILD; D-12 = Dyspnea-12; EQ-5D-5L = EuroQol-5 Dimension-5 Level; ESS = Epworth Sleepiness Scale; FAS = Fatigue Assessment Scale; GAD-7 = Generalized Anxiety Disorder-7; HADS = Hospital Anxiety and Depression Scale; HRQOL = health-related QOL; ILD = interstitial lung disease; IPF = idiopathic pulmonary fibrosis; IPF-PREM = IPF Patient-reported Experience Measure; IPF-PROM = IPF Patient-reported Outcome Measure; K-BILD = King's Brief Interstitial Lung Disease health status questionnaire; LCQ = Leicester Cough Questionnaire; L-IPF = Living with IPF; MCID = minimal clinically important difference; MFI = Multidimensional Fatigue Inventory; mMRC = modified Medical Research Council dyspnea scale; N/A = not applicable; PESaM = Patient Experiences and Satisfaction with Medication; PROMIS = Patient-reported Outcome Measurement Information System; QOL = quality of life; SA-SDQ = sleep apnea scale of sleep disorders questionnaire; SF-36 = Short Form-36; SGRQ = St. George's Respiratory Questionnaire; SGRQ-I = IPF-specific version of the SGRQ; SSc-ILD = systemic sclerosis–related ILD; TDI = Transition Dyspnea Index; UCSD-SOBQ = University of California San Diego Shortness of Breath Questionnaire.
*The MCID varies depending on the cohort and research.

breathlessness, and the impact of breathlessness on activity (47). Several dyspnea-specific scales are available, with each scale measuring different dimensions of the symptom (Table 4).

Cough is a common and often debilitating symptom in patients with ILD. Cough may be a result of the disease itself, a side effect of a therapy, or a comorbid condition (48–50). There are numerous physical, psychological, and social consequences of cough that may influence HRQOL (51, 52). Although identified as an important symptom by patients, cough has generally been excluded as an endpoint in ILD therapy trials (53), either because the mechanism of the intervention is not expected to affect cough or because it is difficult to determine whether cough is due to the ILD or a comorbid condition. Some interventions have targeted cough (54), and there are several questionnaires available that focus on cough should researchers choose to include this as an endpoint in their study (Table 4).

Although prevalent among patients with ILD, fatigue has received little attention as a potential study outcome (55, 56). Fatigue can affect QOL, constrain daily activities, limit productivity, impair physical functioning, and precipitate

feelings of depression and guilt (57–60). As with cough, fatigue may be caused by ILD or any of several other contributors (e.g., sleep-disordered breathing, mood disturbance, comorbid physical conditions, and medications used to treat the ILD), and this makes it a more challenging ILD-related endpoint (61). Patients and researchers alike may have difficulty distinguishing breathlessness from fatigue, as do many currently available dyspnea scales. We currently lack an in-depth understanding of fatigue in patients with ILD, which limits our ability to advocate for its inclusion as an endpoint in trials. Investigations are needed to inform understanding of the experiences of fatigue in patients living with ILD, to define the correlates of fatigue in ILD, and to identify optimal management strategies (62).

We recommend the following:

- That investigators define which aspect(s) of which symptom(s) they wish to investigate and how those can be measured appropriately in their study. For example, is it a qualitative aspect? Frequency? Severity? Is it the limitations the symptom imposes? This will inform the decision of what measurement instrument is chosen or whether a new measure needs to be developed.
- The choice of which symptom PRO to include depends on the research question, and candidate instruments should be reviewed by multidisciplinary research staff, including patients. There are several available PROs for dyspnea and cough used in ILD, and these may be appropriate for use in the design of a research study (Table 4). One may also consider an HRQOL instrument if the goal is to better understand the impact of the burden of a particular symptom.
- Fatigue should be explored as an endpoint in appropriate ILD studies. More work is needed to characterize patients' fatigue in ILD and to develop and validate outcome measures of fatigue in patients with ILD.
- Consider a mixed-method study design with a qualitative component that will capture individual patient perspectives of a symptom and help to understand why the change in the symptom score occurred. More work is needed to determine implementation strategies of this study design in the context of a large clinical trial, and this will require the involvement of multidisciplinary stakeholders and those with experience with this methodology and data analysis.
- More work is needed to develop an individualized approach to symptom measurement in a research study whereby the symptoms measured are determined at study initiation on the basis of what an individual patient designates as their most distressing or bothersome symptoms.

Functional Status

Functional status is generally defined as the ability to accomplish routine activities of daily living required to maintain health and well-being. Patients greatly value being able to do the things they want or need to do, and in the way they desire (e.g., at a certain pace, without needing to take the time to rest). Even patients with mild or subclinical ILD may experience limitations in their performance of activities of daily living and their physical activity (63), which typically worsen as ILD progresses. Limitations in functional status affect QOL and are strongly associated with mortality.

Functional status has been included as an endpoint in several ILD studies (64–69). There are several questionnaires that assess functional status, with many having been studied in patients with fibrotic ILD. Most functional status questionnaires attempt to distinguish functional capacity (someone's peak ability) from functional performance (what someone regularly does) (70). Many dyspnea and QOL questionnaires include functional status as a distinct domain (e.g., the physical functioning domain from the Short Form-36, the activity component of the St. George's Respiratory Questionnaire, or the activity domain of the King's Brief ILD health status questionnaire) (35, 71, 72).

There are three important challenges in assessing functional status by patient report. First, reduced functional status can result from derangement in any number of different body systems. Second, a patient's expectations for their functional status may change over time. For example, older, less physically active adults with chronic lung disease are less likely to report impairment in their activities compared with younger adults with chronic disease (67). Expectations are also altered by the presence of comorbid conditions, the use of medications with adverse effects, and patients' ability or desire to adapt to changes in disease status and how they define or conceptualize functional status. Third, none of the currently available functional status questionnaires were derived specifically for patients with ILD, and, therefore, they may be suboptimal for use in these patients.

Aside from assessing functional status by patient report, there are patient-worn devices and laboratory tests at various stages of use. Portable devices that measure functional status in daily living situations are growing in popularity. They offer a well-rounded assessment of physical activity and performance in "real-world" situations (73) and may have the potential to motivate patients by stimulating physical activity, thus, potentially, improving QOL (74). There are several devices available, and many have been studied in patients with chronic lung diseases, such as chronic obstructive pulmonary disease (COPD) (75). The experience with these devices in patients with ILD is still limited (76).

Accelerometers—portable electronic devices worn on a patient's wrist, thigh, or waist to detect acceleration along multiple axes (77, 78)—are reported to be well tolerated by patients with ILD and have demonstrated feasibility in small studies that included patients with IPF (73, 79, 80). Accelerometers measure step count, intensity of activity (i.e., metabolic equivalents), energy expenditure, and time spent in sedentary activity (81–84). Pedometers are less expensive devices that measure step count. They frequently underestimate the number of steps in patients with moderate to severe lung disease who have slow walking speed (85–87). Global Positioning System (GPS) trackers, or satellite-based global navigation systems, capture a person's precise location at any point on earth (88), giving additional information on *where* and *when* people are moving. GPS tracking also allows quantification of other psychosocial and geographic factors that inform physical activity and functioning aside from disease severity (i.e., a patient's "activity space") (89).

Despite the multiple options for monitoring functional status in daily living situations, operational challenges and considerations remain. For example, these devices are effort and motivation dependent, and there are privacy issues for some of these trackers. The use of these devices may be more challenging for those who have difficulty using technology. Although promoted as patient centered (because they capture information valued by patients),

monitoring devices do not provide the patient perspective on physical function. Despite these limitations, these devices have significant potential for providing real-world data on functional status in patients with ILD.

Laboratory-based tests of functional capacity are performed in a healthcare setting because they require specialized equipment and/or personnel. These objective studies offer some understanding of the effects of an intervention on functional status (90). These tests measure aspects of functional status, including endurance, strength, and physical performance. Endurance has been measured using a standardized walk test (usually 6 min in duration) (91), stair/step climbing or repeated sit-to-stand tests (92–94). Cardiopulmonary tests provide a measure of maximal endurance (i.e., functional capacity), with the added advantage of providing detailed information on causes of functional limitation (95, 96). Strength is typically measured using either grip strength (97, 98) or quadriceps force (98, 99). General physical performance can also be measured using four-meter gait speed (100, 101) and up-and-go tests (102).

Drawbacks of laboratory-based tests include the requirement for patient travel, the need for specialized equipment and environments, and/or the need for highly trained personnel. There is also some debate as to whether or not the current standard walk test (6-min-walk test) is a true test of endurance in ILD (103–105). In addition, most laboratory-based tests measure functional capacity, not functional performance, often making it difficult to translate results to day-to-day living.

We recommend the following:

- When including patient-reported functional status as an outcome in their study, investigators should choose a PRO on the basis of the type of information they want to learn (e.g., someone's functional capacity from functional performance).
- More research is needed to assess the feasibility and acceptability of using accelerometers and GPS tracking devices in different patient populations and to assess the correlation of the information output from these devices with other patient-centered outcomes.
- In any one study, both subjective (questionnaire-based) and objective data are needed if the intent is to capture a comprehensive understanding of a patient's functional status.
- More research is needed to identify the most acceptable test of endurance for patients with ILD.

Psychological and Emotional Well-Being

The committee considered this outcome to represent the collective impact of disease on the emotional well-being and psyche of an individual patient. Psychological and emotional well-being includes, but is not limited to, coping, stress, grief, resilience, satisfaction, depression, anxiety, interpersonal relationships, and self-esteem. Interpersonal relationships may include such aspects as those with family and friends or those related to a person's sexuality (106–108). Although there has been some attention paid to the assessment of psychological and emotional well-being in ILD, for the most part, it has been narrowly focused around the clinical concepts of depression and anxiety. Depression is a well-documented comorbidity in ILD (109–113). The use of depression and anxiety scales has largely been to assess the prevalence of the problem and the relationship with disease diagnosis or its severity (114). For example, correlations have been reported between depression and anxiety and various factors, including dyspnea, pain, sleep quality, functional status, and FVC (109, 115, 116). Depression and anxiety also have a negative effect on HRQOL in ILD (117–119).

PROs assessing anxiety and depression have been included as endpoints in a small number of ILD studies; most are observational and assess the effects of multidisciplinary palliative interventions for advanced disease or the impact of pulmonary rehabilitation (101, 120–122). Pharmaceutical trials in ILD have largely excluded this endpoint (unless in the context of an HRQOL domain). The most commonly used PROs for psychological and emotional well-being in ILD are documented in Table 4. Validity testing of these measures has not been widely performed in the ILD-specific patient population.

Although anxiety and depression are important, other outcomes also deserve mention; for example, grief is a distinct manifestation that is present in many patients with IPF (123). The impact of social support on psychological well-being has been preliminarily studied (124). Small observational studies in ILD have reported on general well-being indices, patient satisfaction, and perceived stress in the context of a mindfulness-based stress reduction program (125–127). Although this is a terrific start, more research is needed. Targeted qualitative studies integrating more comprehensive assessments of psychological and emotional well-being are warranted. There are limited metrics to measure the global emotional impact of living with ILD. There is also a dearth of literature focused on the positive aspects of adaptation, resilience, and coping (128).

We recommend the following:

- Consider measuring aspects of psychological and emotional well-being as distinct outcomes in studies instead of only as predictor variables in models measuring other outcomes (e.g., symptoms, pulmonary function tests, and HRQOL).
- More studies are needed to assess the validity of currently available measures of depression and anxiety in ILD and when it is appropriate to use stakeholder engagement to modify existing instruments for use in ILD. If a strong need to generate a new measure of psychological and emotional well-being is identified, this should be designed with stakeholder engagement and developed using baseline qualitative studies that include patients with ILD.
- More research is needed (including summarizing existing and generating new qualitative work) to better understand and determine how to measure other aspects of psychological and emotional well-being (aside from depression and anxiety) that are not currently captured, including coping effects, stress, resilience, satisfaction, interpersonal relationships, and self-esteem.
- Given the significant psychological impact of ILD on patients, pharmaceutical trials studying medications (aside from ILD disease-modifying medications) targeting improvement in primary psychological endpoints are warranted.

Hospitalizations and Survival

Several observational studies and therapeutic trials have assessed survival as an outcome. These include retrospective studies from the late 1990s that led to significant advances in the field's understanding of ILD and, in particular, how radiopathological classification affects

survival (129, 130); observational studies aimed at identifying individual or combinations of variables that predicted time to death; and late-phase trials of drugs for IPF that included progression-free survival as a primary endpoint (131, 132).

Length of survival is an outcome that holds meaning to almost every patient, but many value quality over duration. So, for many patients with ILD, the relevant question is not "how long will I live with ILD?" but "how long will I be able to live well with ILD?" Of course, "living well" depends entirely on a person's circumstance, values, and judgments.

The committee recognized the merits of progression-free survival as an important outcome but viewed hospitalization as a serious threat to living well with ILD. Large therapeutic trials for patients with ILD have generally either included an "acute exacerbation" secondary endpoint or no hospitalization-related endpoint at all (8, 9, 12, 13, 133). Few secondary analyses have sought to primarily address the question of respiratory-related and non–respiratory-related hospitalizations (134). Studying this endpoint is challenging, as there are multiple reasons for hospitalization, including an exacerbation of the disease itself, a comorbidity of the disease (such as pulmonary hypertension), a medication-related side effect, or a psychosocial issue. The optimal way to define a hospitalization in ILD and incorporate this outcome into an intervention trial as a high-tier endpoint remains an important area of investigation.

We recommend the following:

- The following outcomes are potentially capable of capturing aspects of hospitalizations and/or survival in the most patient-centered way: 1) hospital-free days, 2) disease-related hospitalization, and 3) quality-adjusted life-years.
- More work is needed to best define and include a hospitalization endpoint in the context of ILD and its therapies.

Supplemental Oxygen Needs

The committee chose to highlight supplemental oxygen needs as a separate outcome given the multiple emotional, physical, and economic complexities of oxygen use and the potential significance that the prescription of oxygen has on patients' emotional well-being and QOL. The committee considers oxygen as a prescription medication. Because of the lack of controlled long-term trials of supplemental oxygen in ILD, it has historically been difficult to provide guidance around appropriate timing and criteria for oxygen prescription, and most recommendations have been extrapolated from the COPD literature (1, 135–138). Recently, groups of experts have formulated recommendations for oxygen to ILD and put forth initial guidelines on the use of home oxygen therapy, while simultaneously highlighting the need for additional research to guide clinical practice (139, 140).

Some healthcare professionals may be more inclined to prescribe oxygen to their patients with ILD for symptomatic relief alone (141); however, it is also important to understand that the initiation of oxygen can have potential detrimental effects on both patients and their families (142). Oxygen is frequently viewed as a marker of disease progression, and, for some, it brings with it the stigma of being sick. As oxygen needs increase, the patient's ability to live "carefree" declines, benchmarking a significant transition in the patient's disease journey (143).

Patients have described the multiple potential benefits of oxygen, including improved physical symptoms, increased functional capacity, relief of psychological symptoms, and improved QOL (144, 145). Despite the nearly ubiquitous use of supplemental oxygen among patients with fibrotic ILD, there are only limited data to suggest that these benefits offset the burdens that oxygen users experience related to the psychosocial ramifications, potential mechanical problems, access to the correct type of delivery device, economic considerations, and lack of education about the equipment at the patient, informal caregiver, and provider levels (39, 146–148). The number of patients using oxygen in any study is characterized in patient demographics. To our knowledge, the need for supplemental oxygen (as in a new prescription for oxygen during the time course of the study) as an endpoint in a therapeutic or longitudinal study has yet to be used. This may be in part because guidelines for oxygen prescription are not yet widely established.

We recommend the following:

- Continued efforts to produce standardized and data-driven practice guidelines for supplemental oxygen prescription in ILDs.
- When designing a longitudinal study or therapeutic trial, consider inclusion of "oxygen need" as a patient-centered endpoint in the trial. More work is needed on how to best define and measure this endpoint.

Acquisition of Knowledge

Although knowledge acquisition of ILDs in the lay community has increased substantially over the last two decades, ILD remains a relatively enigmatic condition compared with asthma and COPD. Like people with any medical condition, patients with ILD value an improved understanding of why they developed ILD, where in the lung ILD occurs, which tests are required to make the diagnosis and to follow the condition over time, what treatments are available and why one therapeutic approach might be chosen over another, and many more aspects about their potentially life-altering condition (149–151).

Investigators have conducted studies to assess the specific informational/educational needs of patients with ILD (specifically those with IPF) and in what formats and settings the knowledge could/should be delivered (152, 153). The subcommittee recognized the importance of making sure patients with ILD (and their caregivers) are knowledgeable about all aspects of ILD and found a paucity of research on the effects of the acquisition of knowledge on outcomes of importance to patients with ILD. Three studies have tested the effect of education and support programming, designed for dyads of patients with IPF and their caregivers, on various behavioral health outcomes, including stress, anxiety, and HRQOL (154–156). Although disease-related education was provided in these studies, only one focused on the acquisition of knowledge, with an assessment of knowledge gained from before to after program completion. The substantial challenges with diagnostic ambiguity and paucity of robust evidence to guide management or prognosticate are barriers to providing sufficient education to patients living with ILD. There is also limited experience determining the most effective and patient-centered way of delivering this information.

We recommend the following:

- Moving forward, for investigations focusing on the effects of disease-related education, the committee strongly believed that some assessment of knowledge should be performed.
- Further investigation is warranted to determine the best way to deliver disease-related information to patients,

with consideration of including stakeholders with expertise in dissemination and implementation science methods to achieve this.

Considerations for Use of Digital Technology to Facilitate PCOR In ILD and Immersion with Clinical Practice

As we outlined in detail in this statement, use of PROs is one method of measuring and reporting patient-centered outcomes. New technologies may facilitate different ways of implementing PROs in both research and clinical practice. It is important to recognize the potential role of digital technology in the collection of patient-reported data now more than ever. The recent coronavirus disease (COVID-19) pandemic and need for social distancing (157) has increased the need to establish remote avenues of data collection and study visits. This holds true for both research studies and clinical office visits. The committee advocates that the value of PROs extends beyond research studies to clinical practice. There is value in following outcomes in real-world practice simultaneously with our research efforts to formulate data-driven patient-centered recommendations for our patients.

Given the amount of information needed to be collected during any visit and being mindful of the burden that this places on the patient, we should strongly consider how to achieve this using simpler methods of detecting change in outcomes. This information may be gathered using a shorter questionnaire or through a visual analog scale. An example of an innovative way to assess health status with the shortest possible PRO is computer adaptive testing (CAT). With CAT, questions are tailored to the individual patient. The questions are drawn from an item response theory–based item bank (a large set of questions measuring the same construct, e.g., fatigue). The questions are ranked in order of difficulty. With each response, the computer refines a person's score and determines what the next relevant (most informative) question would be. Irrelevant questions are skipped, so the number of questions is kept to a minimum (4–10 items), without losing precision (158). Some preliminary studies outside of ILD have evaluated the use of PRO collection using CAT questionnaires before clinic visits with positive results (159, 160); however, more work is needed, and, to our knowledge, this has not yet been tested in the ILD patient population specifically.

Another way of implementing digital technologies is to administer electronic PROs. Instead of spending valuable time in the clinic on completing questionnaires, patients can do this at home online or in the clinic on a computer or tablet before the consultation. A potential advantage in ILD is that this minimizes the number of in-person visits that are needed, something that may benefit those with advanced and functionally limiting forms of the disease and that is also of value in the current age of physical distancing (161). This will also allow patients to self-evaluate the effect of changes in management. In addition to the option for completing PROs electronically from home, there is also opportunity to collect clinical data such as home spirometry and pulse oximetry/oxygen saturation values. Home monitoring of patients with IPF using a combination of spirometry and PROs has been piloted, with promising results of feasibility (162). More work is needed in the broader ILD patient population, including larger samples with varying age, education levels, and socioeconomic backgrounds to determine widespread feasibility. In addition, with the rise of telehealth visits and patient portals (in which patients have access to their own electronic health records), there is opportunity to evaluate this approach in real-world settings.

In addition to addressing the feasibility of using these technologies and platforms for the collection of patient-centered outcome data in ILD, there is little research on how using digital methods of data collection in ILD affect patient-centered outcomes (163). Over the past few years, there are many initiatives and applications catering to digital home assessment for research and clinical care but very little research about their impact on patient well-being, medical outcomes, or implication for healthcare consumption, and economic burden. We have little understanding about which of these platforms is best suited for patients with ILD and what the optimal design should be. More research is needed to address these gaps (Table 2).

Conclusions

ILDs are often chronic and debilitating conditions that affect many aspects of a person's life. There has been great progress made in our understanding of disease pathophysiology and the identification of therapeutic targets; however, additional research is needed to advance our understanding of how ILD affects patients on a day-to-day basis and to determine how best to measure those effects. This document provides an overview of several common patient-centered outcomes identified by our interdisciplinary expert committee (including patients). This overview should not be seen as an all-inclusive list. It is up to us as researchers and clinicians to continue looking at the patients as individuals who have their own set of goals, values, and beliefs. Listening to patients, hearing what they say, and working together has set a strong foundation for patient-centered research in ILD. Moving forward in partnership, our future interventions must continue to address the outcomes that are most important to those who will potentially benefit from them—patients. ■

This official research statement was prepared by an *ad hoc* subcommittee of the ATS Assembly on Clinical Problems.

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