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Lifestyle integrated functional exercise for people with interstitial lung disease (iLiFE): A mixed-methods feasibility study

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ABSTRACT

Background: People with interstitial lung disease (ILD) present low levels of physical activity (PA) and spend most of their time at home, especially in advanced stages of the disease. The Lifestyle Integrated Functional Exercise for people with ILD (iLiFE) embedding PA in patients' daily routines was developed and implemented.
Objectives: This study aimed to explore the feasibility of iLiFE.
Methods: A pre/post mixed-methods feasibility study was conducted. Feasibility of iLiFE was determined by participant recruitment/retention, adherence, feasibility of outcome measures and adverse events. Measures of PA, sedentary behaviour, balance, muscle strength, functional performance/capacity, exercise capacity, impact of the disease, symptoms (i.e., dyspnoea, anxiety, depression, fatigue and cough) and health-related quality of life were collected at baseline and post-intervention (12-weeks). Semi-structured interviews with participants were conducted in-person immediately after iLiFE. Interviews were audio-recorded, transcribed and analysed by deductive thematic analysis.
Results: Ten participants (5♀, 77±3y; FVCpp 77.1 ± 4.4, DLCOpp 42.4 ± 6.6) were included, but only nine completed the study. Recruitment was challenging (30%) and retention high (90%). iLiFE was feasible, with excellent adherence (84.4%) and no adverse events. Missing data were associated with one dropout and non-compliance with the accelerometer (n = 1). Participants reported that iLiFE contributed to (re)gain control in their daily life, namely through improving their well-being, functional status and motivation. Weather, symptoms, physical impairments and lack of motivation were identified as threats to keep an active lifestyle.
Conclusions: iLiFE seems to be feasible, safe and meaningful for people with ILD. A randomised controlled trial is needed to strengthen these promising findings.

Introduction

Interstitial lung disease (ILD) is a highly disabling group of chronic respiratory diseases (CRD) characterised by lung inflammation and/or fibrosis.[1] This population commonly experiences severe symptoms, which affects, progressively, their physical activity (PA) and ability to perform activities of daily living (ADLs).[2,3] Moreover, people with ILD spend most of their time at home[4] and adhere poorly to interventions,[5] which further intensifies their clinical decline.[6]

PA interventions have shown to improve symptoms management (e.g., dyspnoea, cough, fatigue) and performance of ADLs (e.g.,

Abbreviations: ADLs, activities of daily living; CRD, chronic respiratory diseases; HRQoL, health-related quality of life; ILD, interstitial lung disease; iLiFE, Lifestyle Integrated Functional Exercise for people with Interstitial Lung Disease; LiFE, Lifestyle Integrated Functional Exercise; PA, physical activity; RCT, randomised controlled trial

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dressing, mobility) in people with ILD,[7,8] however, they are typically founded on structured exercises, which do not engage people in PA neither sustain improvements over time.[9] Therefore, innovative models of PA interventions, performed at patients' home, adapted to their daily routines and developed according their preferences, needs and capacities may enhance individuals' motivation, self-confidence, adherence to PA and, ultimately, well-being.

The Lifestyle Integrated Functional Exercise (LiFE) is a home-based PA programme, developed originally for the elderly.[10] This programme is embedded in individuals' daily routines and has shown to reduce sedentary time and number of falls whilst maintaining the independence of older people in ADLs performance.[10] Conversely to other home-based PA programmes, LiFE presented high adherence rates and high levels of motivation and self-perceived health.[10] Therefore, LiFE seems to be an innovative and promising programme to be implemented in people with ILD, however, it was never adapted to this population. The Lifestyle Integrated Functional Exercise for people with Interstitial Lung Disease (iLiFE) is a home-based PA programme adapted from the original LiFE.[10] In addition to balance and lower limb muscle strength training, included in the original LiFE,[10] iLiFE also includes training of upper limb muscle strength, flexibility and exercise tolerance, and an educational and psychosocial component. iLiFE is a novel and pioneer intervention in people with ILD. Therefore, this study aimed to explore the feasibility of iLiFE.

Methods

Study design

Ethical approval was obtained from the Ethics Committee of the Centro Hospitalar do Baixo Vouga (N/ref.15-04-2019) and the Health Sciences Research Unit: Nursing from the Nursing School of Coimbra (P/N◦P619-10/2019). Data protection followed the European regulation (EU 2016/679). The trial was pre-registered in clinicaltrials.gov (NCT04224233). Informed consent was obtained from all participants prior to data collection.

A mixed-methods feasibility study was conducted and reported according to the Consolidated Standards of Reporting Trials (CONSORT) 2010 statement, Template for Intervention Description and Replication (TIDier) and Consolidated criteria for reporting qualitative research (COREQ) guidelines.[11-13] The qualitative research was conducted with one-to-one interviews.

Participants

People with ILD were recruited face-to-face using convenience sampling,[14] from the ILD outpatient clinic of Centro Hospitalar do Baixo Vouga, within October 2020 to August 2021. Firstly, people with ILD were identified by their pulmonologists, who explained the study briefly. Then, participants who were interested were contacted by one member of the research team (CP).

Adult individuals were included if diagnosed with ILD, presented no history of acute cardiac or other respiratory condition in the previous month, and lived at home, assisted-home or family home. Individuals were excluded if they presented a clinical condition which may limit their participation, and were participating, or had participated, in any exercise-based intervention in the last six months.

Intervention

Participants completed an individualised home-based PA programme (iLiFE), with the main aim of improving their PA levels and sedentary behaviour. Two main components were included in iLiFE: 1) PA and 2) education and psychosocial support. The PA component was embedded in individuals' daily routines and included everyday tasks to improve endurance (e.g., walking, stair climbing), balance, flexibility and muscle strength (i.e., functional-based activities, such as, walk with one foot in front of the other while changing rooms in the house). Strategies to reduce sedentary behaviour, such as, breaking up sitting time through getting up during TV commercial breaks, were also encouraged. The educational and psychosocial component was informed by the available literature[15] and adapted to participants' specific needs. It included talks/coaching, flyers and demonstration of practical strategies during face-to-face sessions.

Participants were supervised in face-to-face sessions (which lasted approximately 1 h) and phone calls by a physiotherapist with PA background to adapt the activities into daily routines. Face-to-face sessions aimed to adapt PA to everyday tasks, increase frequency and/or intensity, monitor progress, clarify questions, motivate higher daily energy expenditure and manage expectations. Phone-calls aimed to clarify doubts and to monitor individuals' motivation/evolution through motivational interview.[16] Significant person/carers were invited to be present at face-to-face sessions and the educational and psychosocial component. iLiFE lasted for 12-weeks, alternating face-to-face sessions with phone calls. At the beginning, all iLiFE sessions were face-to-face, and then, decreased over time, to gradually promote participants' independence. iLiFE included 32 sessions, 23 face-to-face and nine phone calls (Fig. 1).

At the end of the 1st month, individuals received a personalised manual (iLiFE manual) with a description of several PAs to perform throughout the day. Further details of the intervention can be found in supplementary material 1.

Outcome measures

Primary outcome measures were related with feasibility of iLiFE, i.e., participant recruitment and retention, adherence, feasibility of outcome assessments and adverse events. The number of potential eligible participants referred who agreed to participate and those who finished the intervention was recorded to assess recruitment and retention, respectively. Adherence to the intervention was determined by the number of attended face-to-face sessions and phone calls. Feasibility of outcome measures was measured by the time taken to complete the assessment, by the number of missing data and by participants' compliance with the use of activity monitors (i.e., number of days wearing the device). Reasons for noncompliance with this equipment were also collected. Adverse events (e.g., pain, falls and injuries)[17] were recorded during assessments, face-to-face sessions and phone calls.

Sociodemographic, anthropometric and general clinical data were first collected. Lung function was obtained from participants' medical records. Participants were classified according ILD-GAP (Gender, Age, Physiology) model.[18] The severity of comorbid diseases was scored using the Self-Administered Comorbidity Questionnaire.[19]

Outcomes foreseen to be used in the randomised controlled trial (RCT), i.e., PA, sedentary behaviour, balance, muscle strength, functional capacity and performance, exercise capacity, symptoms (dyspnoea, anxiety, depression, fatigue, cough and sputum), impact of the disease and HRQoL were also assessed. Detailed information about these outcomes can be found in supplementary material 2.

All measurements were collected at participant's home at baseline and immediately after the intervention (12 weeks), by a trained physiotherapist.

At 12-weeks, individual, semi-structured interviews, were also conducted at participants' home, with only the participant and the researcher (CP). The interviews were audio-recorded (Tascan DR-05X, TEAC America Inc, Santa Fe & Springs, CA). An interview guide using open-ended questions (supplementary material 3) was built informed by the literature, previous experience of the team, input from a patient and experienced qualitative researchers. It was used to explore the general opinion of participants about iLiFE and the impacts/effects, facilitators and barriers identified when participating in iLiFE.[20] Field notes were taken during the interviews as a source of information about participants' personal

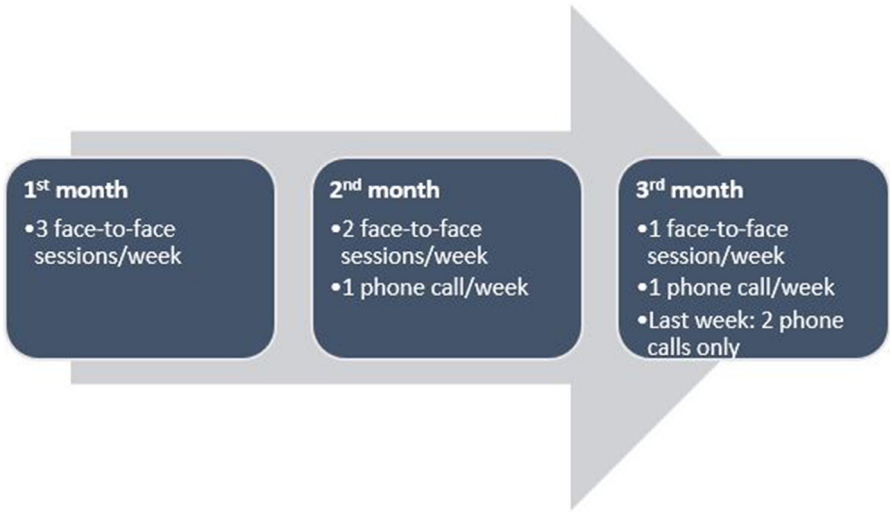

Fig. 1. Structure of Lifestyle Integrated Functional Exercise for people with interstitial lung disease (iLiFE).

experiences, mood and behaviours during data collection. Interviews were transcribed verbatim, with participants' name anonymised and analysed. We have attributed fictitious names to each participant to ensure confidentiality.

Research team and reflexivity

CP, physiotherapist (female, 30y) drafted the interview guide, contacted participants for the study, conducted and transcribed the interviews and was involved in the analysis. CP is a PhD student with a master's degree in respiratory physiotherapy and experience in assessing and treating people with CRD.

AM (female, 45y) reviewed the transcriptions and was involved in the analysis and interpretation. AM is an experienced researcher in respiratory field and qualitative studies who holds a PhD.

DB (female, 56y) reviewed the themes and coding and discussed them with CP and AM. DB is an experienced researcher in respiratory field who holds a PhD.

Before the start of the study, there was no relationship established between the researchers and the participants.

Trustworthiness and transparency of the study

Procedures to ensure trustworthiness, transparency and replicability of the study followed the criteria as recommended.[21,22] Detail description of the procedures performed for each criterion can be found in Table 1.

Table 1
Description of the procedures performed to ensure trustworthiness, transparency and replicability of the study.

Trustworthiness Criteria	Description of the procedures performed
Credibility	• Researcher triangulation - each interview was transcribed and preliminary coded by one researcher (CP) and then, the analysis was independently conducted by two researchers (CP and AM), which agreed on the final themes/subthemes; • Continuous discussion of the analysis and interpretation of data with all the research team; • Triangulation of methods collection, i.e., one-to-one interviews were conducted, and researcher field notes were kept • Presentation of all the representative quotes in the results and supplementary material.
Transferability	Detailed description of the sampling strategies, characteristics of the researchers, participants, data collection and all procedures of the analysis.
Dependability and confirmability	Revision of the interviews and quotes translation by a bilingual speaker (English and Portuguese) Discussing the independent analysis with two researchers with different experiences and backgrounds with all the research team
Transparency	
Criteria	**Description of the procedures performed**
Qualitative method	Mixed-methods feasibility study, through one-to-one interviews
Research setting	Home-based
Position of the researcher	Before the start of the study, there was no relationship established between the researchers and the participants.
Sampling procedures	Convenience sampling
Importance of the participants	No participant had a higher key participation than another.
Interactions with participants	All interviews were audio-recorded. Field notes were taken during the interviews as a source of information about participants' personal experiences, mood and behaviours during data collection. However, no significant interactions with participants was found.
Saturation point	Data saturation was defined as the point in coding where additional data do not lead to emergent new themes.[23] A maximum variation strategy (e.g., different subtypes of ILD and stages of the disease according ILD-GAP model) was used to guide recruitment. According to the literature, a sample of 10 participants was considered sufficient to inform trial feasibility for a RCT,[24] as well as to reach data saturation to qualitatively evaluate participants' perceptions.[25] The same sample was used for the quantitative and qualitative data.
Unexpected opportunities, challenges, and other events	One participant died during the intervention period (non-related with the intervention). Thus, only 9 participants were included in the interviews. Therefore, qualitative data should be interpreted with caution.
Data coding and analysis	The interviews were inserted in the Web Qualitative Data Analysis (WebQDA) software to assist the text analysis, i.e., in the process of coding and data management for analysis.

Sample size

Recruitment aimed to reach data saturation, i.e., the point in coding where additional data do not lead to emergent new themes.[23] A maximum variation strategy (e.g., different subtypes of ILD and stages of the disease according ILD-GAP model) was used to guide recruitment. According to the literature, a sample of 10 participants was considered sufficient to inform trial feasibility for a RCT,[24] as well as to reach data saturation to qualitatively evaluate participants' perceptions.[25] The same sample was used for the quantitative and qualitative data.

Data processing and analysis

The analysis included only participants who adhered to, at least, 60% of iLiFE.[26] Descriptive statistics were used for sociodemographic, anthropometric, general clinical data and for feasibility and other outcomes, using IBM SPSS Statistics version 27 (IBM SPSS, Chicago IL, USA).

Qualitative data were analysed following a deductive thematic analysis as there were expectations to find preconceived themes (i.e., experiences and facilitators/barriers from iLiFE). Nevertheless, flexibility still existed to allow the generation of new themes.[20] The six-step procedure was followed as recommended.[20]

Results

Primary outcomes

Feasibility of recruitment and retention

Forty-four people with ILD were screened, of whom 13 (30%) were assessed for eligibility and 10 proceeded to the intervention. One participant died (non-related with the intervention), thus, nine (90%) participants completed the intervention. Nine participants were included in the final analysis for feasibility and non-PA clinical outcomes and eight for PA outcomes and sedentary behaviour (Fig. 2).

Half of participants were male (n = 5, 50%), with a mean age of 77±3 years and a mean DLCO of 42.4 ± 6.6% of predicted. Detailed participants' characteristics are presented in Table 2.

Adherence

Three participants completed the full programme (range: 26–32 sessions). Remaining participants missed six (n = 2; reasons: diarrhoea, anxiety, medical appointment, eye surgery, holiday, emergency visit and no reason provided), two (n = 2; no reason provided) and one (n = 2; no reason provided) sessions. Most missed sessions occurred during the first month and in face-to-face sessions, with only two sessions being phone calls. The phone calls were well accepted by participants and had a duration of 3.2 [2.7–3.5] minutes. Adherence to the intervention was 84.4%. Three of five carers got involved in the sessions.

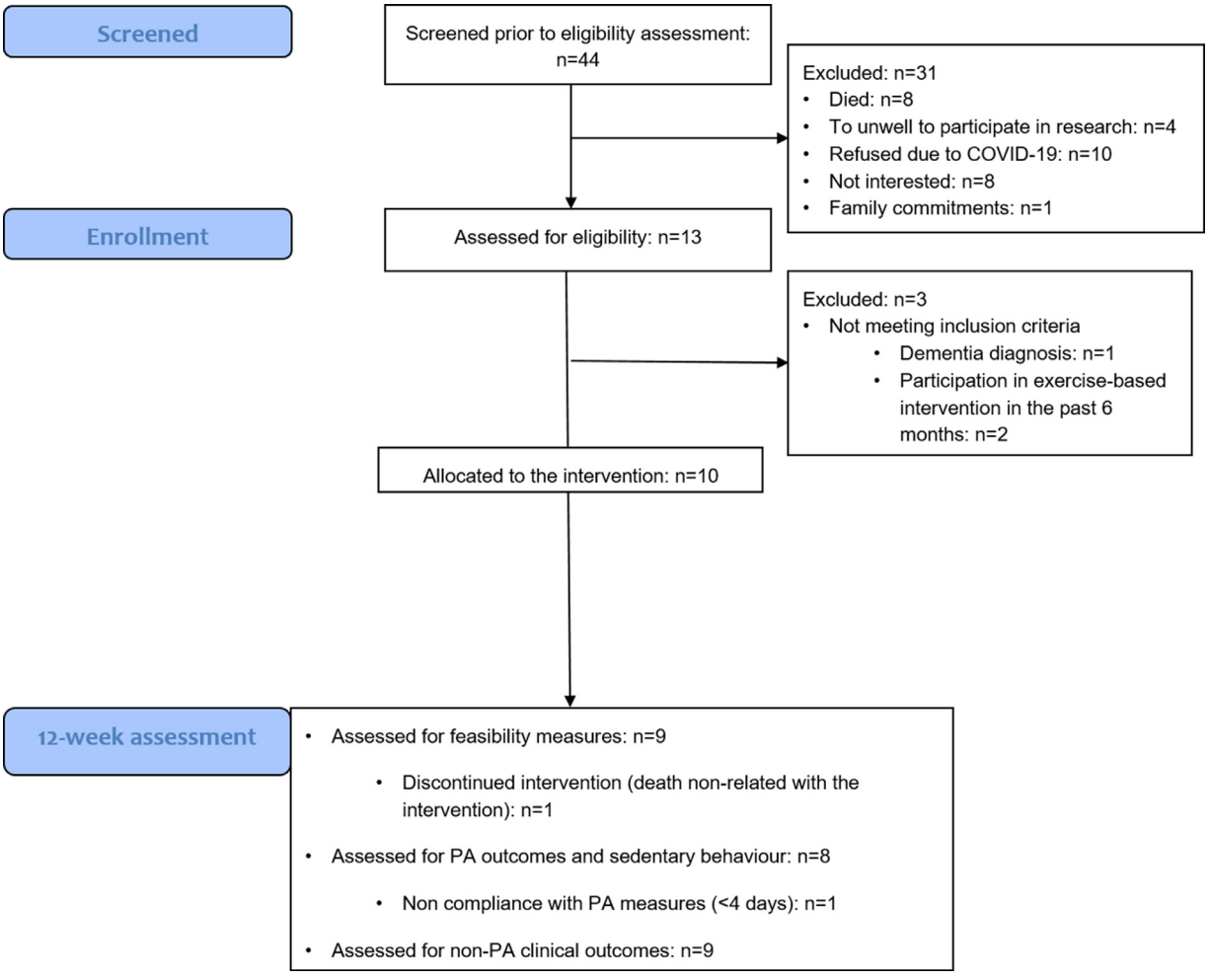

Fig. 2. Consolidated Standards of Reporting Trials (CONSORT) diagram. Legend: PA, physical activity.

Table 2
Baseline characteristics of participants included in the Lifestyle Integrated Functional Exercise for people with interstitial lung disease (iLiFE) (n = 10).

Characteristics	People with ILD (n = 10)
Age, years	77±3
Sex (male), n (%)	5 (50)
BMI, kg/m^2	26±1.4
Lung function	
FEV_1, L	1.7 ± 0.1
FEV_1,% predicted	80.7 ± 3.9
FVC, L	2.2 ± 0.2
FVC,% predicted	77.1 ± 4.4
FEV1/FVC,%	78.1 ± 4.1
DLCO,% predicted	42.4 ± 6.6
Exacerbations in the past year, median [IQR]	0 [0–0]
Falls in the past year, median [IQR]	1 [0–3]
ILD subtypes, n (%)	
IPF	5 (50)
fHP	4 (40)
CTD-ILD	1 (10)
ILD-GAP model, n (%)	
0–1	3 (30)
2–3	3 (30)
4–5	2 (20)
>5	2 (20)
Smoking status, n (%)	
Never	5 (50)
Former	5 (50)
Pack/years	28±12.1
SCQ (0–45)	6.3 ± 0.8
Pharmacological treatment for ILD, n (%)	
Antifibrotic	4 (40)
Bronchodilators	5 (50)
Oral corticosteroids	4 (40)
Immunosuppressants	4 (40)
LTOT, n (%)	6 (60)
Time in light PA, min/day	146.3 ± 83
Time in moderate PA, min/day	48.4 ± 29.9
Time in vigorous PA, min/day	1.3 ± 1.4
Time in MVPA, min/day	49.8 ± 31
Steps/day	3 391.2 ± 2 034.2
Time in sedentary behaviour, min/day	931.6 ± 283.9
Brief-BESTest (0–24), points	14.1 ± 5.3
QMVS-HHD, Kg/F	19.5 ± 7.8
Handgrip, Kg	20.4 ± 6.4
1-minSTS, repetitions	18.7 ± 9.3
PPT 9-items, 0–36 points (n = 4)	27.3 ± 3.8
PPT 7-items, 0–28 points (n = 9)	14.4 ± 5
LCADL, points	25.2 ± 10
LCADL,%	33.6 ± 13.3
CST, no steps	32.9 ± 24.4
mMRC, n (%)	
Grade 0	1 (10)
Grade 1	1 (10)
Grade 2	5 (50)
Grade 3	1 (10)
Grade 4	2 (20)
HADS-A, points	5.3 ± 5
HADS-D, points	7.1 ± 4.5
FACIT-FS, points	33.3 ± 9
FACIT-FS, 9 items subscale, points	21.3 ± 7.7
CASA-Q cough symptoms, points	83.3 [75–100]
CASA-Q cough impact, points	100 [78.1–100]
CASA-Q sputum symptoms, points	91.7 [58.3–100]
CASA-Q sputum impact, points	100 [95.8–100]
CAT, points	14.9 ± 8.4
SGRQ total score, points	48.6 ± 19.4

Values are presented as frequencies (percentages), mean±standard deviation or median [IQR].
Legend: 1-minSTS, 1-minute Sit-To-Stand test; BMI, body mass index; Brief-BESTest, Brief-Balance Evaluation Systems Test; CASA-Q, The Cough and Sputum Assessment Questionnaire; CAT, COPD Assessment Test; CST, Chester Step Test; CTD-ILD, Connective Tissue Disease-related ILD; DLCO, Diffusing Capacity for Carbon Monoxide; FACIT-FS, Functional Assessment of Chronic Illness Therapy-Fatigue Subscale; FEV_1, Forced Expiratory Volume in 1 second; fHP, fibrotic Hypersensitivity Pneumonitis; FVC, Forced Vital Capacity; HADS-A, Hospital Anxiety and Depression Scale – Anxiety subdomain; HADS-D, Hospital Anxiety and Depression Scale – Depression subdomain; ILD, Interstitial Lung Disease; ILD-GAP model, Interstitial Lung Disease-Gender, Age and Physiology model; IPF, Idiopathic Pulmonary Fibrosis; LCADL, London Chest Activities of Daily Living; LTOT, long-term oxygen therapy; mMRC, modified Medical British Research Council; MVPA, moderate-to-vigorous physical activity; PA, physical activity; PPT, Physical Performance Test; QMVS-HHD, quadriceps maximum voluntary isometric strength-hand-held dynamometry; SCQ, Self-Administered Comorbidity questionnaire; SGRQ, St. George's Respiratory Questionnaire.

Feasibility of outcome measures

Data collection lasted approximately 96±8.2 min at baseline and 57±3.2 min at 12-weeks. There was no missing data, besides the ones related to the dropout participant. Participants used the activity monitors during all days, except one that did not comply with the minimum of four days at the 12-week assessment (reason: hospitalisation due to dehydration). Measures were collected in one single session and were well tolerated by all participants; therefore, data collection was considered acceptable.

Adverse events

No adverse events were observed.

Other outcomes

Changes in the other outcomes measures are shown in Table 3.

Patients' perspectives

Baseline characteristics of each participant involved in interviews are detailed in supplementary material 4. Two main themes were identified: (re)gaining control of daily life and threats to keep an active lifestyle. Complete analysis with themes, subthemes and respective quotes can be found in supplementary material 5.

All participants who completed the study (n = 9) reported positive experiences with the iLiFE since they (re)gained control of their daily life, namely in well-being (n = 3, 33.3%), functional status (n = 6, 66.6%) and motivation (n = 8, 88.8%).

> *"(I enjoyed) the walks... we saw people and talked with them." John, 80y, Fibrotic Hypersensitivity Pneumonitis* (Well-being)

> *"Now, I can go hiking, which I didn't. I can climb stairs, which I couldn't. (...) Just climbing stairs, is a very good thing for me, because now I'm living in a house with stairs. (...) ... and having the joy that I've. These exercises are helping me because I can move..." Susan, 61y, Connective Tissue Disease-related ILD* (Functional status)

> *"What helped me a lot in the programme was the way how the physiotherapist taught me, help me to do the exercises. It helped... and motivated me, a lot. Until there, I didn't do exercises at all. I didn't... I was here at home and didn't do much exercise." Peter, 82y, Idiopathic Pulmonary Fibrosis* (Motivation)

Participants also perceived some threats to keep an active lifestyle, namely, weather (n = 1, 11.1%), symptoms (n = 4, 44.4%), physical impairments (n = 4, 44.4%) and lack of motivation (n = 3, 33.3%).

> *"We didn't do more (hikes) because of the weather... sometimes it doesn't allow us." John, 80y, Fibrotic Hypersensitive Pneumonitis* (Weather)

> *"Besides the anxiety I have had recently (...) ...what went less well was the tiredness after (the physiotherapist) leaving (at the end of*

Table 3
Results at baseline and at 12-weeks after the Lifestyle Integrated Functional Exercise for people with interstitial lung disease (iLiFE).

Outcome	Outcome measure	Baseline	12-weeks
PA (n = 8)	Time in light PA, min/day	146.3 ± 83	154.5 ± 84.3
	Time in moderate PA, min/day	48.4 ± 29.9	22.1 ± 12.6
	Time in vigorous PA, min/day	1.3 ± 1.4	3.2 ± 1.9
	Time in MVPA, min/day	49.8 ± 31	44±34.6
	Steps/day	3 391.2 ± 2034.2	3 746.7 ± 2573.8
Sedentary behaviour (n = 8)	Time in sedentary behaviour, min/day	931.6 ± 283.9	1 024.5 ± 308.1
Balance (n = 9)	Brief-BESTest (0–24), points	14.1 ± 5.3	19.8 ± 4.2
Muscle strength (n = 9)	QMVS-HHD, Kg/F	19.5 ± 7.8	22.6 ± 7.4
	QMVS-HHD,%predicted	71.5 ± 28	83.3 ± 27.2
	Handgrip, Kg	20.4 ± 6.4	22.2 ± 6
	Handgrip,%predicted	86.2 ± 21.8	91±20.7
Functional capacity	1-minSTS, repetitions (n = 9)	18.7 ± 9.3	21.6 ± 11
	1-minSTS,%predicted (n = 9)	61.4 ± 29.9	71.3 ± 37.4
	PPT 9-items, 0–36 points (n = 4)	27.3 ± 3.8	31.3 ± 2.1
	PPT 7-items, 0–28 points (n = 9)	14.4 ± 5	31.3 ± 2.1
Functional performance (n = 9)	LCADL, points	25.2 ± 10	21.3 ± 7.3
	LCADL,%	33.6 ± 13.3	28.4 ± 9.7
Exercise capacity (n = 9)	CST, no steps	32.9 ± 24.4	56.3 ± 32.5
Dyspnoea (n = 9)	mMRC, n (%)		
	Grade 0	1 (10)	1 (11.1)
	Grade 1	1 (10)	3 (33.3)
	Grade 2	5 (50)	4 (44.4)
	Grade 3	1 (10)	0 (0)
	Grade 4	2 (20)	1 (11.1)
Symptoms of anxiety and depression (n = 9)	HADS-A, points	5.3 ± 5	3.3 ± 3.9
	HADS-D, points	7.1 ± 4.5	5.2 ± 3.6
Fatigue (n = 9)	FACIT-FS, points	33.3 ± 9	36±9.6
	FACIT-FS, 9 items subscale	21.3 ± 7.7	23±7.5
Cough (n = 9)	CASA-Q cough symptoms, points	83.3 [75–100]	75 [50–91.7]
	CASA-Q cough impact, points	100 [78.1–100]	96.9 [93.8–100]
	CASA-Q sputum symptoms, points	91.7 [58.3–100]	83.3 [58.3–100]
	CASA-Q sputum impact, points	100 [95.8–100]	100 [95.8–100]
Impact of the disease (n = 9)	CAT, points	14.9 ± 8.4	13.7 ± 8.1
HRQoL (n = 9)	SGRQ, points	48.6 ± 19.4	42.2 ± 18.2

Values are presented as mean±standard deviation, frequencies (percentages) or median [IQR].
Legend: 1-minSTS, 1-minute Sit-To-Stand test; Brief-BESTest, Brief-Balance Evaluation Systems Test; CASA-Q, the Cough and Sputum Assessment Questionnaire; CAT, COPD Assessment Test; CST, Chester Step Test; FACIT-FS, Functional Assessment of Chronic Illness Therapy-Fatigue Subscale; HADS-A, Hospital Anxiety and Depression Scale – Anxiety subdomain; HADS-D, Hospital Anxiety and Depression Scale – Depression subdomain; LCADL, London Chest Activities of Daily Living; mMRC, modified Medical British Research Council; MVPA, moderate-to-vigorous physical activity; PA, physical activity; PPT, Physical Performance Test; QMVS-HHD, quadriceps maximum voluntary isometric strength-hand-held dynamometry; SGRQ, St. George's Respiratory Questionnaire.

the face-to-face sessions)." James, 68y, Idiopathic Pulmonary Fibrosis (Symptoms)

"What I find most difficult to do, is to walk with one foot in front of the other. (. . .) I do it but it is difficult for me. (. . .) Maybe, I don't do it perfectly well due to my poor balance. . ." Peter, 82y, Idiopathic Pulmonary Fibrosis (Physical impairments)

"And that is what I don't do (be more physically active), because I'm sitting here for two hours, watching movies. (. . .) I don't do (physical activity) very often, no. (. . .) I am a little lazy. (. . .) It is not because I am very tired, but because I have. . . I can't say it is laziness. . . (. . .) It seems I don't feel like doing the exercises. I don't feel like it." Peter, 82y, Idiopathic Pulmonary Fibrosis (Lack of motivation)

At study completion, three (33.3%) participants gave some suggestions for improving iLiFE:

"The only thing I would add is more abdominal breathing exercise." Peter, 82y, Idiopathic Pulmonary Fibrosis

"If I could I would add more months. For example, at the end of the year, at the Winter, I would like to repeat." Susan, 61y, Connective Tissue Disease-related ILD

"I would do 2x/week (instead of 3x/week at the 1st month)." Amelia, 75y, Idiopathic Pulmonary Fibrosis

Discussion

This study showed that iLiFE is feasible and safe. Additionally, the outcome measures used were feasible. iLiFE was perceived as meaningful for people with ILD, empowering them to better manage their daily life. This study also provided important additional information to inform the design of a future RCT.

Recruitment was challenging mainly because it occurred during the pandemic period however, other reasons included death of identified eligible participants and not having interest. Similar reasons were found in other interventional feasibility studies conducted in people with ILD.[27,28] It is known that people with ILD present high mortality rate due to the nature of the disease.[1] This fact, combined with the increased likelihood of developing serious illness if infected with SARS-CoV-2,[29] may explain the difficulties in the recruitment. To overcome recruitment barriers for the main study, some strategies will be considered, such as, establishing connections with several institutions treating people with ILD (e.g., hospital centres)[30] and reinforcing the role of physicians to raise awareness about research and iLiFE.[31,32] We anticipate these strategies, together with the relief of pandemic lockdown measures, may be sufficient to achieve the needed sample size for the main study.

In turn, retention presented high values (90%). These good values could be justified by the strategies used, namely: scheduling the assessments and face-to-face sessions within the timetable available and preference of each participant; communicating with patients effectively by explaining them the importance of the study, providing feedback about their assessments and intervention sessions, and making phone calls each week to follow their progress and check their health status; involving significant others/carers in the intervention according to their willingness.[33] These strategies will be used in the main study, to ensure that high retention rates are sustained and may be helpful to inform retention process in other clinical studies conducted in people with ILD.

Outcome measures used in this study were simple and feasible, which facilitated acceptance of the protocol. This acceptability is further validated by few missing data. Adherence to PA interventions in people with ILD has been varying according to setting and design of interventions.[34] PA interventions developed in a home-based setting present high adherence rates as they address an important barrier to adherence in centre-based interventions, i.e., travel/transportation.[34] Nevertheless, to increase adherence to PA interventions, some strategies namely, individualised tailoring of the intervention,[35] supervision/feedback,[35] telephone support[36] and written information for participants[37] could be included. iLiFE seem to be a promising person-centred intervention to increase PA and maximize health outcomes in people with ILD as it is conducted at home, integrated into patients' daily routines and includes all mentioned strategies. These aspects are possible reasons to justify the high adherence rate obtained, as well as the low dropout rate, which reflect a strong evidence for the acceptability of this intervention.

Regarding adverse events, none were reported, which is in line with the literature,[38] highlighting the safety of iLiFE. Additionally, following participants' perspectives, iLiFE is a meaningful intervention to develop skills in their daily routines. These findings are highly important, since people with ILD present limitations in their performance of ADLs, mainly in more advance stages of the disease.[32] These limitations affect patients' HRQoL and are associated with mortality.[32] Therefore, iLiFE seems to be a promising intervention as it allows patients to manage their daily life. Furthermore, iLiFE could address the threats identified by patients to maintain an active lifestyle (weather, symptoms, physical impairments and lack of motivation) as it is performed at home, tailored according individuals' capabilities and targets individuals' motivation. Nevertheless, the number of face-to-face sessions per week in the 1st month was perceived as a burden by some participants, both in qualitative data and in missed sessions in the 1st month. In the main study (RCT) the number of sessions in the 1st month need to be carefully considered and eventually reduced.

Limitations

This study has some limitations that need to be acknowledged. Firstly, as the interviews were conducted in Portuguese, some thoughts could have been missed in translation. We believe to have minimised the risk as interviews and quotes were revised by a bilingual speaker. Secondly, due to the nature of the study, a small sample size was included, hence inference regarding the efficacy and effectiveness of iLiFE was not addressed. Our sample was sufficient to determine the feasibility (aim of our study) and to assemble individuals' perceptions as recommended.[24,25] Moreover, a maximum variation strategy (e.g., different subtypes of ILD and stages of the disease according ILD-GAP model) was used to ensure the representativeness of the population. Lastly, there was a lack of a control group, which is crucial to assess the effectiveness of iLiFE.

Implications for future practice and research

Our study provides an important contribution to healthcare professionals to promote PA at home in people with ILD, with a safe, person-centred and innovative intervention.

There are important unanswered clinical questions that need to be investigated in future studies. First efficacy and effectiveness of iLiFE are still unknown hence, a larger study, with experimental and control groups, randomised and with a blinded assessor is now required. Moreover, ILD does not affect only patients, but also imposes a huge burden in their informal carers, who are patients' main source of daily support. Perceptions of loved ones about the impact of iLiFE would be fundamental to further improve meaningful care to this population.

Conclusion

This mixed-methods feasibility study provided valuable information on the recruitment and implementation of a home-based PA

programme for people with ILD, integrated in their daily routines. iLiFE is a feasible and safe intervention with high adherence, it is meaningful for people with ILD, and empowers them in their daily management. A RCT is being prepared to confirm these findings.

Ethical approval

Ethical approval was obtained from the Ethics Committee of the Centro Hospitalar do Baixo Vouga (N/ref.15–04–2019) and the Health Sciences Research Unit: Nursing from the Nursing School of Coimbra (P/N°P619–10/2019).

Declaration of Competing Interest

The authors have no conflicts of interest to declare.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.hrtlng.2023.02.018.

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