



BMJ Open Lung cancer survivors' views on telerehabilitation following curative intent therapy: a formative qualitative study

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ABSTRACT

Objectives To inform personalised home-based rehabilitation interventions, we sought to gain in-depth understanding of lung cancer survivors' (1) attitudes and perceived self-efficacy towards telemedicine; (2) knowledge of the benefits of rehabilitation and exercise training; (3) perceived facilitators and preferences for telerehabilitation; and (4) health goals following curative intent therapy.

Design We conducted semi-structured interviews guided by Bandura's Social Cognitive Theory and used directed content analysis to identify salient themes.

Setting One USA Veterans Affairs Medical Center.

Participants We enrolled 20 stage I–IIIA lung cancer survivors who completed curative intent therapy in the prior 1–6 months. Eighty-five percent of participants had prior experience with telemedicine, but none with telerehabilitation or rehabilitation for lung cancer.

Results Participants viewed telemedicine as convenient, however impersonal and technologically challenging, with most reporting low self-efficacy in their ability to use technology. Most reported little to no knowledge of the potential benefits of specific exercise training regimens, including those directed towards reducing dyspnoea, fatigue or falls. If they were to design their own telerehabilitation programme, participants had a predominant preference for live and one-on-one interaction with a therapist, to enhance therapeutic relationship and ensure correct learning of the training techniques. Most participants had trouble stating their explicit health goals, with many having questions or concerns about their lung cancer status. Some wanted better control of symptoms and functional challenges or engage in healthful behaviours.

Conclusions Features of telerehabilitation interventions for lung cancer survivors following curative intent therapy may need to include strategies to improve self-efficacy and skills with telemedicine. Education to improve knowledge of the benefits of rehabilitation and exercise training, with alignment to patient-formulated goals, may increase uptake. Exercise training with live and one-on-one therapist interaction may enhance learning, adherence, and completion. Future work should determine how to incorporate these features into telerehabilitation.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ A contemporary sample of lung cancer survivors within 6 months of curative intent therapy.
- ⇒ Use of Bandura's Social Cognitive Theory to guide study design, analysis and interpretation, enhancing transferability.
- ⇒ In-depth illustrations of participants' views, with almost all of participants having had experience with telemedicine, enhancing credibility.
- ⇒ Absence of subgroup comparisons, including by age, sex and socioenvironmental factors, to better understand perceived self-efficacy, facilitators/preferences, health goals, and fear about lung cancer status.
- ⇒ Feasibility and acceptability of telerehabilitation intervention not evaluated.

INTRODUCTION

Lung cancer is the second most frequently diagnosed cancer in the USA¹ and the world.² In the USA, 40%–50% of lung cancers are diagnosed at stage I–IIIA,^{3,4} most of which are eligible for curative intent therapy through a combination of surgery, definitive radiation, and/or concurrent chemoradiation, with or without neo/adjuvant therapy.^{5,6} The number of lung cancer survivors eligible for curative intent therapy is expected to increase⁷ alongside efforts to improve lung cancer screening uptake,⁸ additional advances in diagnostic,^{9,10} and therapeutic modalities.^{11–15} Following curative intent therapy, many survivors (ie, anyone living with or beyond a lung cancer diagnosis) experience significant symptom burden,¹⁶ impairments in physical and psychological function,¹⁷ disability,¹⁸ and poor health-related quality of life.¹⁹ As such, approaches are needed to improve these survivorship outcomes.²⁰

Exercise training and rehabilitation for lung cancer survivors following surgical treatment increase exercise capacity and may

improve physical function and symptom control.^{21 22} However, there is a need for home-based interventions, particularly with personalisation,²² to increase uptake, adherence and completion. Telerehabilitation is an emergent model to increase uptake and completion of rehabilitation services.²³ Telerehabilitation has also been used in cancer care to improve adherence and maintain intervention goals.²⁴ However, little is known about lung cancer survivors' views on telerehabilitation following curative intent therapy, to personalise interventions and better meet their needs.

Therefore, we conducted this formative qualitative study to gain in-depth understanding of lung cancer survivors' views on telerehabilitation following curative intent therapy. Our research questions were: what are lung cancer survivors' (1) attitudes and perceived self-efficacy towards telemedicine; (2) knowledge of the benefits of rehabilitation and exercise training; (3) perceived facilitators and preferences towards telerehabilitation; and (4) health goals following curative intent therapy.

METHODS

Context and sampling

Between April and October 2022, we recruited lung cancer survivors who received care at the Rocky Mountain Regional Veterans Affairs Medical Center (RMR VAMC). The RMR VAMC is a hub site for the Lung Precision Oncology Program, providing lung cancer care for USA Veterans from Eastern and Western Colorado, Wyoming, and Montana. We followed the Standards for Reporting Qualitative Research recommendations²⁵ to report this study.

We recruited patients from: (1) pulmonary nodule conference and clinic; (2) scheduled bronchoscopies for suspected or diagnosed lung cancer; (3) thoracic surgery clinic; and (4) multidisciplinary tumour board. We enrolled USA Veterans with stage I–IIIA lung cancer who completed the primary mode of curative intent therapy (ie, surgical resection, definitive radiation, or concurrent chemoradiation) in the prior 1–6 months. We excluded patients with severe cardiopulmonary disease (ie, heart failure with reduced ejection fraction <25% or any condition requiring >6L/min of supplemental oxygen), any neurological (eg, dementia) or psychiatric disorders (eg, psychosis) precluding informed consent, or with an estimated life expectancy <6 months.

Researcher characteristic

Three researchers (DMH, MAN, RPK) conducted semi-structured interviews, coding, and data analysis. DMH is a pulmonologist and physician investigator. MAN and RPK are health sciences specialists with qualitative research expertise. No researcher self-identified as a lung cancer survivor, Veteran, or as having strong views on telemedicine.

Qualitative approach

We used a formative qualitative research approach^{26 27} to explore lung cancer survivors' views prior to conducting

a telerehabilitation intervention, guided by Bandura's Social Cognitive Theory (SCT).²⁸ The SCT postulates that knowledge of health risks and benefits initiates the process of possible behaviour change, with behaviour influenced by (1) perceived self-efficacy, (2) facilitators and impediments, (3) outcome expectations, and (4) goals (online supplemental figure 1).²⁸ The SCT has been applied to increase physical activity among cancer survivors²⁹ with moderate and sustained effects.³⁰ We adapted the SCT (with modifications in parentheses) to gain in-depth understanding of lung cancer survivors' (1) (attitudes and) perceived self-efficacy towards telemedicine; (2) (knowledge of accurate) outcome expectations (eg, benefits) of rehabilitation and exercise training; (3) perceived facilitators (and preferences) towards telerehabilitation; and (4) health goals following curative intent therapy (online supplemental figure 1).

Data collection and processing

We developed interview questions guided by the SCT, with additional questions on post-treatment experience, sociodemographic characteristics, home internet access, and patient-reported measures on health literacy and frailty (online supplemental table 1). We also asked about participants' views on the terms 'rehabilitation' or 'rehab', due to concerns for stigma associated with these terms,³¹ which may hinder uptake of rehabilitation services. We conducted and audio-recorded semi-structured interviews using Microsoft Teams (Microsoft Corporation). We transcribed interviews verbatim, 16 of which with institutionally approved professional transcription services, and 4 with Microsoft Teams transcription. Following each interview, we used a debrief guide (online supplemental table 2) to reflect and document feelings on how the interviews went, what was heard, and potential codes.

Data analysis

We used directed content³² and primarily deductive³³ qualitative data analysis guided by the SCT. We developed codes a priori based on our research and interview questions, along with a list of operational definitions of terminologies to guide analysis and interpretation, including to distinguish 'telerehabilitation' (ie, the delivery of therapeutic rehabilitation at a distance or offsite using telecommunications technologies) from 'telemedicine' (ie, the delivery of health services via remote telecommunications) (online supplemental table 3). We first conducted team-based coding, with all three researchers coding the same transcript. After discussion of this transcript, we agreed on codes and thereafter, conducted individual coding. We merged all coded transcripts and queried transcripts using codes mapped to our interview guide and research questions. To identify themes,³⁴ we reviewed codes across and within transcripts, conducted weekly team meetings to discuss and obtain consensus, and identified illustrative quotes reflective of themes. To consolidate findings on health goals, we additionally used a cancer survivorship care framework (on cancer

recurrence, physical and psychosocial effects of cancer and treatment, chronic conditions, and health promotion and disease prevention).³⁵ For analyses, we used ATLAS.ti V.22 (ATLAS.ti).

Sample size

We estimated that 20 participants would be needed to identify salient themes to answer our four research questions (ie, on self-efficacy, benefits, facilitators/preferences, and health goals). This estimate was based on a suggested range of 20–30 interviews for qualitative inquiry³⁶ and supported by a systematic analysis of 214 published qualitative studies in which the median sample sizes ranged 15–31 interviews.³⁷ After analysis of 20 transcripts, we assessed thematic saturation using an evidence-derived approach consisting of three primary elements—Base Size, Run Length and New Information Threshold.³⁸ We used a Base Size of four themes (centred around the four SCT constructs), Run Length of two (potential) additional interviews, and decided there was a very low probability of acquiring New Meaningful Information, particularly with themes defined as prevalent among half of participants.³⁴

Patient and public involvement

This study involved semistructured interviews with patients, but neither the patients nor the public were involved in the design, conduct, reporting or dissemination plans of this research.

RESULTS

We identified 31 stage I–IIIA lung cancer survivors, excluded 2 (due to patient preference of not undergoing lung cancer treatment), with 5 patients unable to be reached within the eligibility period; 3 declined enrolment due to hearing difficulties, and another reported competing priorities. Among 20 participants enrolled (table 1), 85% had prior experience with telemedicine; none participated in a rehabilitation or telerehabilitation programme for lung cancer. The median (and range) interview duration was 37 (19–46) min.

We identified four salient themes to describe lung cancer survivors' views on telerehabilitation following curative intent therapy: (1) telemedicine is convenient, however impersonal and technologically challenging, with most perceiving low self-efficacy towards telemedicine; (2) limited knowledge of the benefits of rehabilitation and exercise training; (3) live therapist interaction as a facilitator and a predominant preference for one-on-one over group telerehabilitation; and (4) somewhat poorly formulated and no predominant health goals following curative intent therapy, with common questions and concerns about lung cancer status.

1. *Telemedicine is convenient (table 2A), however impersonal (table 2B) and technologically challenging (table 2C), with most reporting low perceived self-efficacy towards telemedicine*

Table 1 Participant characteristics

Characteristic (N=20)	Value
Age, years, mean±SD	71.2±5.5
Age ≥65 years, %	80
Male, %	90
White, non-Hispanic, %	95
Married, %	65
College education or higher, %	65
Employed, %	10
Marginal or limited health literacy (BRIEF scale), %	40
Frail (FRAIL scale), %	40
Home access to internet, %	85
Rural living environment*, %	25
Prior experience with telemedicine†, %	85
Smoking status‡, %	
Current	45
Former	55
Comorbidities, %	
COPD§	90
Oxygen therapy (1–6 L/min)	40
OSA	25
Psychiatric illness¶	40
Lung cancer characteristics, %	
Screen detected	35
Adenocarcinoma**/squamous/small cell/presumed	60/25/5/10
Collaborative stage IA/IIA/IIIA	75/10/15
Curative intent therapy modality, %	
Surgical resection††	40
SBRT	40
Chemoradiation	20
Time since primary treatment completion, months, median (range)	2 (1–6)

*Defined by the Veterans Health Administration Office of Rural Health (ie, areas with <30% of the population residing in an urbanised area) using zip code of residence.

†Via telephone or video visits.

‡As documented clinically in participants' electronic health records.

§Defined as post-bronchodilator FEV₁/FVC <70%.

¶Defined as clinically diagnosed depression, anxiety, post-traumatic stress disorder, bipolar, or schizophrenia.

**Including one case of adenosquamous carcinoma.

††Of which six were lobectomies and two sublobar (one segmentectomy, one wedge) resections.

COPD, chronic obstructive pulmonary disease FEV₁, forced expiratory volume in 1 s; FVC, forced vital capacity; OSA, obstructive sleep apnoea; SBRT, stereotactic body radiotherapy.

Many participants viewed telemedicine as convenient, less time-consuming, and easier to access: 'I actually think [my doctor and I] accomplish more

Table 2 Attitudes and perceived self-efficacy towards telemedicine

Illustrative quotes	Participant ID
(A) Telemedicine is convenient	
'It's nice to have a [telemedicine visit], talk about things and not have to worry about showing up somewhere...100-and-some miles away. I think (telemedicine is very) darn convenient.'	Participant 7
'I think [telemedicine] is a good idea. Some people...come in-person to see an actual physician, but if they can see [the physician] on the phone, talk to [him or her remotely], I think it works out great.'	Participant 2
'Some appointments...have to be physical, but unless [the doctor's] physical presence is required, I'm going to, as much as possible, work on video appointments.'	Participant 12
'I think [telemedicine] is a great idea...it keeps everybody safer [because] people aren't driving to the hospital sick...to go in for a meeting [with a clinician].'	Participant 18
'I think [telemedicine] would be a lot more convenient, rather than having to go to a building [for in-person visits].'	Participant 13
(B) Telemedicine is impersonal	
'Depending on the [health] issues...you have to (be in person) to see what's going on. You can't listen to breathing over [the] internet [or] phone...I'd rather have a one-to-one in-person appointment.'	Participant 2
'I like the face-to-face [visits]. When it comes to issues like what I have, I want face-to-face [visits]. I want to feel comfortable with who I'm talking to...[telemedicine] is too cold and sterile.'	Participant 17
'[I've had experience with telemedicine (video and telephone)], and I think that the video takes away [the hands-on interaction]. In-person visits [are] better.'	Participant 16
'I'd rather go physically [for my appointments] and have them talk to my face.'	Participant 20
'I've talked to my heart doctor now and again about changing my medicine [over the phone]. But that's about it [regarding my experience with telemedicine]. Otherwise, I go to the VA [physically for my appointments]. I'm very happy with the VA. I'd rather [have my visits] in-person.'	Participant 15
'[I am hesitant to use telemedicine]. I like the one-on-one health experiences.'	Participant 10
(C) Telemedicine is technologically challenging	
'[I've had experience with remote care] a couple of times...with video, and as far as the technology, I had a (heck) of a time with it. I had to actually go into the VA and have the nurse show me how to do it because I'm not really [technical].'	Participant 7
'[I've received care remotely], via video...[but at times needed] to use the telephone. I'm just not computer literate [...]. I did get a tablet from the VA [for remote care]...but now I don't know my password. I forgot it.'	Participant 3
'[I've not received remote care via video because] I'm not too computer savvy.'	Participant 9
'My computer skills are limited...I would have to have hands-on teaching [to have video visits].'	Participant 8

Continued

Table 2 Continued

Illustrative quotes	Participant ID
'[I anticipate that with video visits, I would have] my standard problems (with the software) and beat[ing] my head against the wall trying to get it going, but I'll get it going if I need to.'	Participant 11
'I don't know how to use the computers. I'm challenged with the computer ...[I would be more comfortable with video visits if] somebody [could] walk [me] through it, like over the phone.'	Participant 5
'[I've received care remotely], over the phone...I'm probably not as versed as most people [with video visits]. [For video visits], I [would] get my daughter over here and help me, maybe.'	Participant 10
VA, Veterans Affairs.	

in a small[er] amount of time because of the fact I didn't have to drive [to the medical center], wait until...my turn, then get in [the medical office] and tell the doctor everything [was] alright. I enjoy [telemedicine]...I think it's great' (Participant 18). Others viewed telemedicine as a solution to overcome distance barriers: '[I think telemedicine] is a great way [to receive health care]. It saves...time, gas, and travel expenses [...]' (Participant 7). However, many participants also voiced concerns about the impersonality of remote care, preferring live and in-person contact to develop a therapeutic relationship: 'I don't like [telemedicine]...[when] people talk to me, I want to see their eyes. I want to hear...from them [in person], not out of the television screen' (Participant 6). Some were reluctant to receive care remotely: 'I'm...old-fashioned. I like person-to-person [visits] with a doctor [...]' (Participant 2). Most participants voiced concerns about their ability to use technology to access healthcare, with several reporting being not 'tech savvy': 'I...got this smartphone...about two years ago. I'm still trying to figure out how to use [it], and setting up that VA Video Connect (software platform for telemedicine visits at RMR VAMC) call...I didn't have a clue how to do that' (Participant 7); and others simply not wanting to use telemedicine: 'I'd rather do it (receive care) in person. I'm not very technical' (Participant 15).

2. Limited knowledge of potential benefits of rehabilitation and exercise training (table 3A)

Most participants reported no knowledge of the types of exercises or how they could improve health following lung cancer treatment: 'I have no knowledge at all' (Participant 3). There was also limited knowledge of exercise training regimens to address specific symptoms or impairments: 'I wasn't even aware that there was an exercise you could do to deal with [shortness of breath]' (Participant 7); and 'I don't know much about [the specific types of exercises] that would help with shortness of breath, fatigue, or falls' (Participant 18). Among those who received lung cancer resection surgery, a few recalled

Table 3 Knowledge of benefits of rehabilitation and exercise training

Illustrative quotes	Participant ID
(A) Limited knowledge of benefits of rehabilitation/exercise training	
'You're talking in strange territory there [about the types of exercises or how to do them]. I've had no instructions whatsoever...other than the [incentive] spirometer. About breathing exercises or any of that stuff, I just haven't had any [instructions].'	Participant 1
'I really don't have any [understanding of the types of exercises and how they can or cannot help with my health].'	Participant 9
'The only [type of exercise] I can think of is cardio [...]. Rehab [for me has to] have something to exercise the lungs [...]. If there were exercises that would help me with my falls, yeah [I'd also be interested to learn]; I've got scars all over my face.'	Participant 17
'I really learned to exercise in the Army. I don't use them all, but I exercise once in a while.'	Participant 6
(B) Neutral to positive views on rehabilitation	
'I think [of rehabilitation as] a physical therapy thing, not getting over being a drunk [or substance use disorder]...for me, [rehabilitation is] to keep my body working the way it's supposed to be working.'	Participant 1
'[Rehabilitation or exercise would help] quite a bit [with my health]. I would feel better. Anytime I exercise it helps me feel better.'	Participant 3
'Rehabilitation means...to get yourself better, to work yourself through something to make your life better.'	Participant 18
'Rehab would be trying to make my lungs better and techniques to be more comfortable, and hopefully I can deal with the issues from lung cancer much better, like breath control...things that I could use if I start getting short of breath.'	Participant 2
'My thing with rehabilitation is if you have a problem, you need to get somebody to help you solve your problem. That's rehabilitation. I don't care if drugs or alcohol, eating disorder, or something, all kinds of stuff out there. People need rehab, they need it.'	Participant 6
'To me [rehabilitation is] extremely positive.'	Participant 12

their hospital discharge instructions on the importance of physical activity to prevent respiratory symptoms: '[to walk] at a good [and] calm pace...around the block [so that] phlegm [wouldn't] build up in [the] lungs' (Participant 20). Others drew from common knowledge: '[Exercise] keeps you healthy, except for cancer; it doesn't do anything to alleviate cancer' (Participant 17); or when asked about reasons why they engaged in exercise—the benefits they experienced: '[I exercise] for state of mind' (Participant 4), 'to maintain what I have' (Participant 15); or their beliefs about it: 'If I... don't move around... eventually I'm [going to] die...[sitting] on the couch' (Participant 7).

Moreover, most participants viewed rehabilitation as primarily to improve physical health, to 'make [one's] body better' (Participant 11), or 'get back to...as good a

Table 4 Perceived facilitators and preferences towards telerehabilitation

Illustrative quotes	Participant ID
(A) Live therapist interaction as a facilitator	
'[It is] absolutely important [to have live interaction with a therapist [...]. By having [live interaction with] a PT (physical therapy) person, [the therapy is] more specifically tailored for me....'	Participant 12
'[Having live interaction with a therapist is] very important to make sure if I'm doing things the right way, [particularly] if there's some kind of technique or twisting or bending motion.'	Participant 2
'[Telerehabilitation] would be fine as long as they could view me while the session was going on...I think it would be very important to [to have live interaction with a therapist].'	Participant 8
'[Having live interaction with a therapist is] the ideal for me.'	Participant 6
'If there is not an instructor or something, I probably wouldn't do it.'	Participant 3
(B) Predominant preference for one-on-one over group telerehabilitation	
'I prefer one-on-one's. I've always been that way... I'm kind of shy in front of big groups...I don't like being around a lot of people...I feel like everybody is staring at me.'	Participant 18
'[My ideal telerehabilitation program] would be face-to-face conference... [one-on-one] if the clinician isn't overworked.'	Participant 11
'If you had a bunch of other people [in telerehabilitation together], I'd feel kind of inadequate...I'm not tech savvy.'	Participant 13
'I think having one-on-one is probably ideal, but I think you could probably get the same message, especially if it's people that had the same surgery and they're recovering from the same thing, then the group would probably work fine.'	Participant 5

shape [as] before' (Participant 5). Most equated the terms 'rehabilitation' or 'rehab' as physical, not psychological (ie, for substance use disorder) rehabilitation. In addition, all reported neutral to positive views, with no participant raising concerns about the terms 'rehabilitation' or 'rehab' being negative or stigmatising. These views were true even in the context of substance use: '[To me these terms are generally] positive...especially physically...with the drug situation, it's a harder nut to crack...but both of them are beneficial' (Participant 17) (table 3B).

3. *Live interaction with a therapist as a perceived facilitator (table 4A) and a predominant preference for one-on-one over group-based telerehabilitation (table 4B)*

There was a predominant preference for live and one-on-one rehabilitation, with many participants raising concerns about learning the correct training techniques: '[Telerehabilitation] takes away the hands-on...you get better understanding of what the therapist...is trying to tell you...when you...get hands-on treatment...they show you what to do' (Participant 16). Participants were open to telerehabilitation if there were live therapist interaction

to ensure they were learning the correct training techniques: 'I think [live interaction] is [very] important, so [that] I can find out if I am even doing [the exercises] right' (Participant 3). Participants also viewed that live interaction would help them stay motivated and accountable: 'as long [as] I was being viewed [I would be willing to participate]...I wouldn't want [a situation] where I was telling [the therapist] I was doing something, and I wasn't. [I want] accountability' (Participant 8). In addition, live and one-on-one therapy was viewed as enhancing communication: 'I would prefer one-on-one...it makes it a little easier...to communicate back and forth. If you've got six people...and they're all asking different questions, it's a little hard' (Participant 7). Another facilitator was ready to engage in exercise training, with several participants reported being 'reasonably ready' to 'very ready', particularly among those with little to no significant health issues post-treatment (Participants 2, 3, 7, 8, 9). A few were open to group-based telerehabilitation with therapist interaction: 'Live interaction, that would be great. Either one-on-one or in a group [is fine] (Participant 17) .

4a. Somewhat poorly formulated and no predominant health goal within 1–6 months following curative intent therapy, with common questions or concerns about lung cancer status (table 5A)

When asked about their health goals in the next few months and beyond, most participants had trouble verbalising their explicit health goals, with some simply stating to 'stay healthy' (Participants 4, 17) or 'alive' (Participants 15, 19), and others reporting that health goals were 'not something [they]...[thought] about' (Participant 5), or that they '[had] none (health goals)' (Participant 6). A common concern participants voiced was uncertainty about their lung cancer status. Many reported being in a state of waiting for the next CT scan to determine if their lung cancer were in remission: 'I guess they kind of left me hanging. I don't know if I still have [lung cancer] or if [the treatment] worked...I won't get another CT scan until October, so I really don't know what my situation is' (Participant 9). Some expressed fear about treatment failure:

They're [going to] do a CT scan on me on the first [of the month], and we'll be able to determine then whether or not they've got it – the cancer beat or not. Personally, it makes me wonder if the radiation...has done any good...if I'm [going to] be terminal or are they [going to] cure this thing [...]. You're kind of out here in no man's land, and until we get the CT scan back...we just don't know for sure. (Participant 13)

4b-i. Physical and psychosocial functioning, and comorbid conditions

While most participants lacked explicit health goals, some expressed wanting control of symptoms and functional challenges: 'I would like to be able to walk better, have more energy, and breathe better' (Participant 3). Another participant reported wanting to have 'more control over [his] breathing', to 'get rid of the swelling

Table 5 Health goals following curative intent therapy of lung cancer

Illustrative quotes	Participant ID
(A) Common questions or concerns about lung cancer status	
'I'm thinking about [recovering]. I'm [going to] find out...in a couple of weeks whether or not this [radiation treatment] did any good.'	Participant 7
'I haven't seen anybody since my treatment. I don't have an appointment... until the 23rd of September...when I go in...to do another CT scan to see if they got all of the cancer [...]. Then on the 27th or 29th (of September) [my oncologist] will go ahead and give me the results of the CT scan and let me know, 'hey, it's all gone', or 'hey, there's still something there' or what we're [going to] do next.'	Participant 18
'The only concern I have [is about] the lung cancer coming back.'	Participant 17
'I'm kind of in a limbo until I know [about my lung cancer status]. And once I know one way or another, what the deal is, I'll remain in limbo. After I find out for sure what's happening [with my lung cancer status], then I can be more [purposeful] as far as what my aspirations are.'	Participant 13
'Well, naturally, [my goal is] to improve. Hopefully the radiation...has done its job and taken care of it – the lung cancer that I had, the spot wasn't that big.'	Participant 4
'I'm basically doing pretty good right now [...]. I just won't know [about my lung cancer status] until July.'	Participant 6
(B-i) Physical and psychosocial functioning, and comorbidity control	
'I'd like to have better balance [with walking].'	Participant 8
'I'd like to improve my mobility [...]. I'm [also] hoping to relieve some pain [...]. I walk about 15 minutes and...I'm spent.'	Participant 10
'[My goal is to be] able to get around without breathing hard.'	Participant 14
'Hopefully the neuropathy will dissipate, and I can go back to doing my needlework (art craft).'	Participant 2
'I'm getting TMS (transcranial magnetic stimulation, an approach to treat anxiety and depression) so I want to finish that.'	Participant 3
'I have arthritis; I try to walk one mile every morning.'	Participant 15
(B-ii) Health promotion and disease prevention	
'My health goals are to stay healthy [...]. I'm 64 years old, and because I've taken care of myself and [have] had plenty of exercise, I'm still pretty healthy.'	Participant 17
'I'd like to get out a little bit more [...]. I like going to the park but I get a little bit apprehensive to get out and walk too long.'	Participant 20
'I'm a smoker, so I'm trying to quit. That's my big goal.'	Participant 15
'[My goal is to try] to quit smoking.'	Participant 4

in the feet', get back to '[doing] the things [he] enjoyed doing', and have 'better [physical] stability at work' (Participant 2). Some also reported wanting to address specific conditions beyond lung cancer: '[My health goals

are to] basically start working on the other things that are wrong with me, like managing the COPD (chronic obstructive pulmonary disease) better' (Participant 18). One participant reported sequential goals: 'I'd like to get a clean bill of health on my cancer for one...and then get my knee taken care of (replaced), and [then] I can get out and exercise' (Participant 16) (table 5B-i).

4b-ii. Health promotion and disease prevention

Some participants spoke about maintaining an active lifestyle: 'Three days a week...I go over to the YMCA and play pickleball [...]. I think it's important...to keep exercising' (Participant 1). Others spoke about positive changes: 'I'd like to be able to quit smoking. I'd like to be more [physically] active than I am' (Participant 9); or 'see if I can [quit smoking] and lose some weight' (Participant 15). Some also reported having survived lung cancer as a reason for change: 'Because I had lung cancer...I feel like I need to exercise more' (Participant 13), and with another participant, to return to previous behaviour: 'this [lung cancer]...has kind of forced me to go back to using the bicycle four or five times a week' (Participant 11). One participant wanted to reduce substance use: 'I'm trying to cut down on the alcohol use' (Participant 7); and another, improve sleep: 'I need to work on my sleep habits [...]. I get up [in the morning] and I go back to sleep' (Participant 8) (table 5B-ii).

DISCUSSION

In this study, we found that lung cancer survivors perceived telemedicine as convenient, however impersonal and technologically challenging, with most reporting low self-efficacy in their ability to use technology to access healthcare. Almost all had little to no knowledge of the potential benefits of specific exercise training regimens to reduce dyspnoea, fatigue, or falls. If they were able to design their own telerehabilitation programme, participants strongly preferred live and one-on-one interaction with a therapist to enhance therapeutic relationship and ensure correct learning of the exercise training regimens. Participants were often unable to formulate health goals, with many having questions or concerns about their lung cancer status. These findings have important implications in the design of telerehabilitation interventions to improve the physical and psychological function of lung cancer survivors following curative intent therapy.

The contrasting views on telemedicine we identified are similar to a previous meta-synthesis of qualitative studies, in which adult cancer survivors identified the convenience and burden of telemedicine interventions.³⁹ Similar to our findings, a meta-synthesis reported that while telemedicine enabled survivors to feel more connected with clinicians, many also perceived it as impersonal.³⁹ These contrasting views have been described in systematic reviews involving patients with COPD,⁴⁰ cardiovascular disease⁴¹ and care across different healthcare settings,⁴² and may reflect subgroup or individual perspectives, or differences in context (eg, telemedicine

modality, purpose). The possibility of 'trade-offs' between convenience and impersonality of telemedicine were not explored.

There is paucity of knowledge on lung cancer survivors' views on telemedicine to deliver rehabilitation services (ie, telerehabilitation) following curative intent therapy. One study with lung cancer survivors within 2 years of surgical resection found that approximately half were willing to use a prototype, web-based exercise programme, with higher perceived acceptance of a mobile-based symptom and activity monitoring system.⁴³ Another study of stage I–IIIA lung cancer survivors' perspectives on a prototype mindfulness-based mobile application identified convenience and potential health benefits as attractive features, with concerns also raised about technological challenges and absence of live therapist interaction.⁴⁴ The predominant preference for live and one-on-one telerehabilitation we identified contrasts with previous studies reporting varied preferences on physical activity programming,^{45–48} possibly due to the telerehabilitation context, shorter time since treatment completion, and patient cultural and/or organisational characteristics. The importance of supervision by an exercise or physiotherapy professional for training has been reported, although not in the telerehabilitation context^{45 46 49} or exclusively involving lung cancer survivors.⁵⁰

Lung cancer survivors in our study also had limited knowledge regarding the role of exercise training regimens to address specific symptom or functional challenges, including shortness of breath, fatigue, or falls, all of which are highly prevalent and important to stage I–III survivors.⁵¹ Moreover, most patients equated rehabilitation as a strategy to improve physical, not psychological function. This view is in contrast with the definition and intention of 'pulmonary rehabilitation'—'a comprehensive intervention... designed to improve the physical and psychological condition of people with chronic lung disease...'⁵²—and could reflect low accessibility or utilisation of pulmonary rehabilitation services. In addition, patients in our study had no concern about the terms 'rehabilitation' or 'rehab' being negative or stigmatising. These positive to neutral views are in contrast to a prior editorial³¹ reporting that patients with COPD voiced concerns about 'rehab', due to common media stories of popular television personalities undergoing treatment for substance use disorders. These findings have important implications on the messaging related to rehabilitation services.

Many survivors in our study had questions or concerns about their lung cancer status, with some understandably fearing treatment failure. Fear of cancer recurrence—common among cancer survivors⁵³ including among those without comorbid psychiatric disorders⁵⁴—has been associated with lower engagement in healthful behaviours,⁵⁵ higher physical and psychological impairment,⁵⁶ and increased healthcare use.⁵⁷ These feelings, generally not addressed in lung cancer, may also hinder patients from planning for the future or formulate

health goals. Our findings suggest that following curative intent therapy and prior to the guideline-recommended 6-month interval, surveillance chest CT,²⁰ strategies to manage worry or fear of treatment failure or cancer recurrence⁵⁸ may also be needed. Psychological support could enhance awareness of emotions about cancer, reduce the influence of rigid or distressing thoughts, clarify personal values, and commit to meaningful life activities,⁵⁹ may reduce fear and facilitate the formulation of health goals. Such strategy could be delivered concurrently or sequentially,⁶⁰ depending on patient physical and/or psychological needs,⁶¹ to arrive at multi-targeted rehabilitation.⁶²

The perceived low self-efficacy towards telemedicine suggests that hybrid strategies of remotely delivered and in-person rehabilitation may be needed to enhance therapeutic relationships and ensure delivery of essential components (ie, exercise training, education, and behavioural support).^{23 52} Education could enhance knowledge or learning about the potential benefits of exercise training regimens on impairments (eg, inspiratory muscle training to alleviate dyspnoea)⁶³ and self-management skills (eg, of comorbid cardiopulmonary disease).⁶⁴ Behaviour change support may incorporate techniques that align with the SCT (eg, formulate goals).³⁰ Psychological interventions to reduce worry or fear may also be beneficial.

Strengths and limitations

Strengths of our study include trustworthiness: we developed codes a priori and used multiple interviewers and coders (enhancing dependability); provided in-depth illustrations of participants' views, with almost all of participants having had experience with telemedicine (credibility); and adapted the SCT to guide study design, analysis, and interpretation (transferability). Additional strengths include a real-world and contemporary sample of lung cancer survivors within 6 months of curative intent therapy, providing valuable insights into this unique patient population at an often overlooked period in the cancer survivorship continuum, with implications to improve downstream survivorship outcomes.

Our study is limited by the absence of subgroup comparisons (eg, by age, sex, upstream time from possible to diagnosed lung cancer, prior life-threatening diagnoses including another cancer), with limited time-elapsing post-treatment, precluding definitive conclusions on worry or fear. In addition, we did not use other theoretical frameworks, inquire about specific socioenvironmental factors, nor conduct longitudinal interviews, which may be important to inform intervention design. Further, we included participants from a single USA VAMC, most of whom were male, with significant cigarette smoking and comorbid COPD, limiting transferability. Women's perspectives could reveal important health-related attitudes, knowledge or behaviours not captured in our study. Last, we do not know the feasibility or acceptability of a telerehabilitation intervention in this population.

CONCLUSION

Features of telerehabilitation interventions for lung cancer survivors following curative intent therapy may need to include strategies to improve self-efficacy and skills in telemedicine. Education to improve knowledge of potential benefits of rehabilitation and exercise training may increase uptake. Exercise training with live therapist interaction, to target specific symptoms, physical and psychological impairments, and/or facilitate comorbidity control, with alignment to patient-formulated goals, may enhance learning, adherence, and completion. Future work should determine how to incorporate these features into telerehabilitation programmes.

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