

The lived experiences of individuals with early stage non-small cell lung cancer following lung surgery: A rapid ethnographic approach

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Abstract

Background: Individuals with early-stage non-small cell lung cancer (NSCLC) often show reduced exercise capacity and physical activity (PA) after surgery, with or without (neo-)adjuvant therapy. However, understanding of peoples' lived-lives following lung cancer diagnosis and surgery remains unknown. **Objective:** This study aimed to deeper understand how lung cancer diagnosis and surgery shape individuals' daily lives within one to three months post-surgery. **Methods:** Adults (18+) with stage I–IIIa NSCLC were recruited one to three months after surgery or (neo-)adjuvant therapy including radio-/chemo-/immunotherapy. A rapid ethnographic approach was used. Participants were observed at home during three two-hour visits, with a semi-structured interview during the last visit. Field notes and transcripts were thematically analyzed in Atlas.ti using a hybrid approach. Initial themes were deductively guided by the 14-domain TDF and inductively refined. Final themes were mapped onto the COM-B model. **Results:** 16 individuals (69% female; 69±7 years; 3820±2207 steps/day; 6±8 min/day moderate-to-vigorous PA; 44% received (neo-)adjuvant therapy) participated in home observations (86h total, range 4–6h) and a semi-structured interview during the last visit (383min total, range 16–44min). Four key themes were identified; 1) Physical consequences affecting daily life; 2) Emotional and social coping; 3) Motivation and barriers influencing PA and rehabilitation; 4) Gaps in education and guidance. **Conclusion:** Lung cancer surgery (with or without (neo-)adjuvant therapy) causes physical, emotional, and social challenges that impair daily life. PA and engagement to rehabilitation is often limited by symptoms and contextual barriers. Tailored rehabilitation addressing individuals' living conditions, physical, and emotional needs are considered crucial for recovery.

Keywords

non-small cell lung cancer, lung surgery, physical activity, pulmonary rehabilitation, patient experiences, rapid ethnographic approach

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Introduction

Lung cancer is the most commonly diagnosed cancer in men and the third most commonly diagnosed cancer in women worldwide.¹ Non-small cell lung cancer (NSCLC) is the most common subtype of lung cancer, accounting for approximately 85% of all cases.² Thirty-five percent of NSCLC individuals are diagnosed with early-stage (stage I-IIIa) NSCLC.³ The preferred treatment option for early-stage NSCLC is lung resection, with or without (neo-)adjuvant chemo- and/or immunotherapy.⁴ Impaired exercise capacity and physical activity (PA) are common in individuals following lung surgery for NSCLC and may negatively impact health-related quality of life (HRQoL), reflecting the influence of both disease- and surgery-related factors.^{5,6,7} Both are therefore considered important treatable traits for non-pharmacological interventions.⁸

Individuals after surgery for NSCLC are potentially excellent candidates for rehabilitation programs. To date, moderate-to high-certainty evidence shows that structured exercise training programs combining aerobic and resistance exercises improve exercise capacity, quadriceps muscle force, HRQoL, and symptoms of dyspnea in individuals with NSCLC following lung surgery.⁸ Interventions focusing on behavior change, as successfully applied in individuals with chronic obstructive pulmonary disease (COPD), could also provide valuable benefits to improve low levels of PA, alongside exercise training, in people with lung cancer.⁹ Cancer survivors are recommended to engage in at least 150 minutes of moderate PA per week and return to normal daily activity as soon as possible following diagnosis and treatment.¹⁰

Despite evidence supporting the role of rehabilitation, it remains grossly underutilized.¹¹ In individuals with chronic respiratory disease, barriers to perform exercise training or PA include travel issues, suboptimal scheduling, and other commitments (e.g., caring for others, work responsibilities, and social commitments), as well as cost, illness, and the impact of comorbidities.¹² Previous research in individuals with breast, prostate, or head and neck cancer has revealed similar barriers, along with cancer-specific symptoms and issues, such as fatigue, breathing difficulties, and pain, that can hinder the initiation and/or maintenance of exercise training or PA after treatment.^{13–15}

However, many of these findings are based on interviews and may not fully capture the complexity of people's daily lives, hiding deeper concerns that are not easily expressed.¹⁶ As a result, current insights may only offer a limited view, making it difficult to design effective, person-centered solutions. To gain a deeper understanding of individuals' lived experiences within a limited timeframe, this study employed a rapid ethnographic approach that allowed consideration of the clinical and contextual aspects of postoperative recovery. By spending time in people's everyday environments, this approach allows us to observe what shapes their behaviours, routines, and decisions about PA and rehabilitation.

An in-depth insight into the impact of lung cancer diagnosis and treatment on peoples' lived-lives is crucial to inform strategies that improve engagement in exercise, PA, and rehabilitation.¹⁷ Therefore, this study aimed to explore how lung cancer diagnosis and surgery shape individuals' daily lives within one to three months post-surgery, with or without (neo-) adjuvant therapy.

Methods

Study design

A rapid, flexible, and pragmatic ethnographic approach was used, informed by the Theoretical Domains Model (TDM).¹⁸ A rapid ethnographic approach gathers rich, contextual insights over a short time frame (e.g., days to weeks), while still using core ethnographic methods like observations, interviews, and engagement in natural settings.¹⁶ Three home observations (two hours each, one week apart) with informal conversations were completed and during the last visit, a recorded semi-structured interview (15–45 min) was conducted to explore key themes in more depth. Participants were specifically asked to describe perceived changes in physical function, symptoms, and activity levels compared with their pre-surgery status, to help differentiate limitations related to lung surgery from those associated with pre-existing conditions. Topics were predefined, according to the TDM, but adapted based on individual observations and conversations. To ensure consistency in data collection and reporting, all assessments and observations were conducted by the same investigator across all participants. This study was conducted and reported in accordance with the Standards for Reporting Qualitative Research (SRQR) (Supplement S1).¹⁹ The study was approved by the ethics committees of Ziekenhuis Oost-Limburg and Hasselt University (NO. Z-2023064; B3712023000005) on 18/10/2023.

Participants

Adults (18+) with stage I–IIIa NSCLC were included one to three months after surgery or after (neo-)adjuvant therapy including radio-/chemo-/immunotherapy. Exclusion criteria were progressive/recurrent lung cancer, other malignancies (<2 years), performing structured exercise, non-independent living, psychiatric/cognitive disorders, or inability to

understand Dutch. Individuals were recruited during post-treatment consultations and provided written informed consent. This study employed a purposive sample of sixteen individuals, with variation in sex, age, educational level, employment status, rehabilitation status (accepted/declined), and (neo-)adjuvant therapy (yes/no), to ensure the inclusion of diverse perspectives.¹⁶

Data collection

Individual characteristics, the lived experiences of individuals, objectively measured physical activity, and patient-reported outcome measures were assessed ([Supplement S2](#)).

Data analysis

Individual characteristics, objectively measured physical activity and PROMs were analysed using IBM SPSS statistics version 28 (IBM Corp., Armonk, NY, USA). All data is presented as means \pm standard deviation (SD), median [Q1; Q3] or percentages.

During observations, informal conversations arose naturally and were documented in field notes. Reflexive notes were kept during and after the observations to document researcher thoughts, assumptions, and evolving interpretations. A structured template was used to capture contextual details, reflections, and emerging insights. Semi-structured interviews were audio-recorded, transcribed using TurboScribe, and cross-checked. Field notes and interview transcripts were independently coded and analyzed in Atlas.ti by two researchers (SH, AJLM), and discrepancies were resolved through discussion. Quotes were translated by one researcher (SH).

The analysis process was regularly discussed within the research team for peer debriefing. A hybrid thematic analysis combined deductive guidance from the 14-domain TDF,²⁰ with inductive refinement as data collection progressed. Analysis began after initial observations and interviews, with field notes and transcripts analysed simultaneously to ensure a comprehensive understanding of the context and participant perspectives. Final themes were mapped onto the COM-B model.²¹ Participants were invited to review their interview transcripts for accuracy (member checking).

Results

A total of 28 individuals with NSCLC who had surgery were screened, of whom nineteen individuals met the eligibility criteria and were contacted. Sixteen individuals agreed to participate and signed the informed consent, while three declined due to a lack of interest. Recruitment occurred between December 2023 and June 2024, with all participants completing three home observations and a recorded semi-structured interview ([Figure 1](#)).

Individual characteristics

Participants (69% female) had a mean age of 69 ± 7 years and were included 62 ± 13 days post-surgery or (neo-) adjuvant therapy, and nearly half of them (31%) received (neo-)adjuvant therapy. One participant had a squamous cell carcinoma, however histological subtype is unlikely to have substantially influenced postoperative symptom experiences, which are primarily driven by surgical and functional factors rather than tumor histology. Although 88% of participants initiated post-operative rehabilitation prior to inclusion, this care was primarily delivered in community-based primary care physiotherapy settings. Adherence was limited, with most participants completing approximately 8 ± 2 sessions of 37 ± 11 minutes on average, compared with the minimum of 18 sessions typically prescribed in Belgium. Seven participants had primary education, seven completed secondary, and two tertiary education. Eleven participants were retired, three were housewives, one employed, and one received invalidity benefits. The sample reflects variation in age and treatment, though gender, education level and employment diversity were limited. Individual demographic characteristics are detailed in [Table 1](#).

Lived experiences of individuals

Four key themes emerged; 1) Physical consequences affecting daily life; 2) Emotional and social coping; 3) Motivation and barriers influencing PA and rehabilitation; 4) Gaps in education and guidance ([Figure 2](#)). The interview questions, mapped to TDF and COM-B, with themes, subthemes, and key findings, are further detailed in [Table 2](#). Detailed observations and quotes can be found in [Table 3](#).

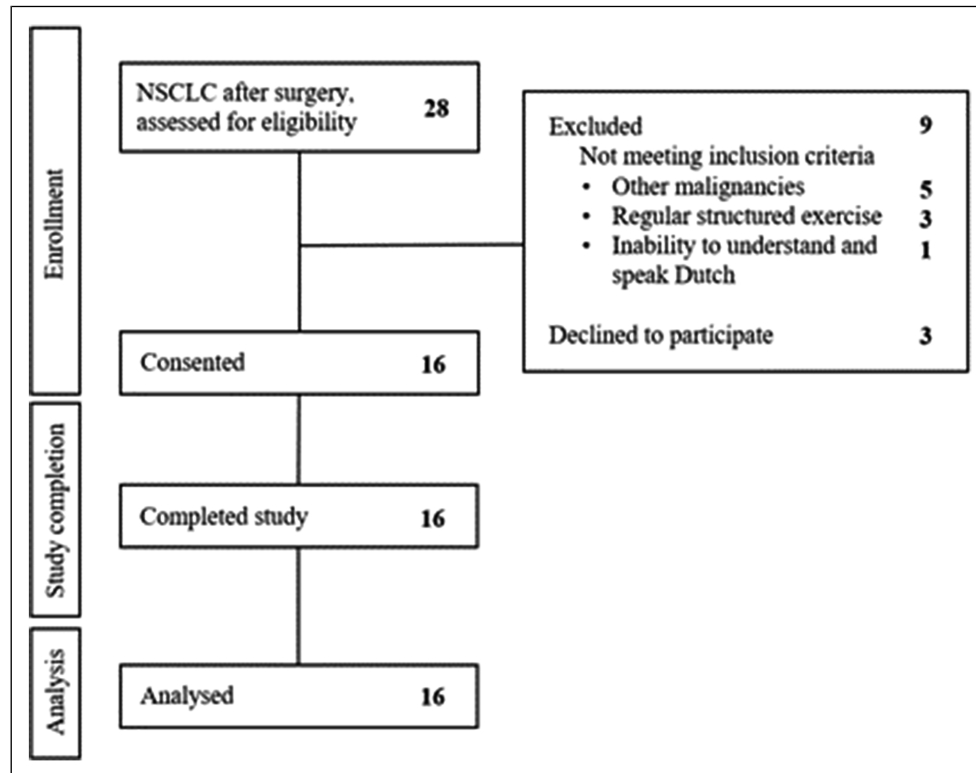


Figure 1. Consort diagram.

Physical consequences affecting daily life

Individuals described a range of physical consequences such as wound discomfort (pain, soreness, pulling sensation), respiratory complaints (shortness of breath, coughing), fatigue, and weakness that interfered with daily activities. One woman (P07) avoided walking outside since surgery, as cold air caused wound pain. This was also seen during the observations, as another participant (P03) struggled to reach a glass of water on a nearby table, and one woman (P01) limited cooking to twice a week because it required too much energy.

Many participants reported in interviews adapting their daily routines, such as pacing activities throughout the day or taking frequent rest breaks, or modifying their home environments, for example by rearranging furniture to minimize effort or using assistive devices to facilitate mobility and household tasks, in order to reduce discomfort. For instance, a small chair was used to reach cupboards, but post-surgery pain prevented one woman (P06) from using it, forcing her to stop storing essentials, such as tins of beans, within easy reach. She consequently shopped more often, which was difficult due to pain. Another participant (P10) moved his bed to the living room as stairs were unmanageable, while one woman (P01) avoided stairs by getting ready in her living room, keeping deodorant, perfume, and a mirror there, which restricted its social use.

Despite such adjustments, physical limitations hindered daily activities and exercise, increasing reliance on family or caregivers. Participants commonly reported avoiding stair climbing, window cleaning, reaching overhead, and lifting heavy objects like groceries. When tasks were performed independently, they were often observed to be broken into smaller steps, such as taking one plate at a time from the cupboard or leaving dishes on counters to put away later (P02). These prolonged efforts reduced energy for health-promoting behaviors, leading to more sedentary lifestyles.

Although some participants described improvements in symptoms and functional abilities across the three visits, observations showed that others maintained or increased adaptations, underscoring variability in recovery trajectories.

Emotional and social coping

Participants frequently expressed during interviews their reliance on loved ones for emotional comfort and practical support during recovery. Emotional responses such as fear, anxiety, and stress, often related to uncertainty about relapse, were commonly articulated and were also seen during observations. For example, one participant (P10) became emotional several times when discussing the future, seeking comfort from his wife, who provided reassurance through gentle words.

Table 1. Demographic characteristics of individuals.

ID	Sex	Age (years)	BMI (kg/m ²)	Mean daily step count (steps/day)	Mean daily MVPA (min/day)	Smoking pack years	Highest level of education	Employment	Cancer type	Cancer stage	Surgery type	Days since lung surgery at visit 1	(Neo-) adjuvant therapy	Comorbidities
1	Female	54	22.6	2073	9.20	76	Primary education	Invalidity	Adenocarcinoma	IA	RAL LUL lobectomy	71	No	Hypertension, CLBP
2	Male	59	23.9	1173	0.11	45	Primary education	Employed	Adenocarcinoma	IIIA	RLL lobectomy	43	Yes	Venous thromboembolism
3	Female	81	27.0	1257	0.16	45	Primary education	Housewife	Adenocarcinoma	IIB	uVATS RLL lobectomy	30	Yes	COPD, blood anaemia, rheumatoid arthritis, chronic kidney insufficiency, hypertension
4	Male	71	21.3	2009	0.85	20	Secondary education	Retired	Spino-cellular	IB	Uni LUL lobectomy	90	No	Hypertension, CLBP, nonSTEMI
5	Female	65	20.5	7562	19.43	40	Secondary education	Retired	Adenocarcinoma	IB	Uni RML lobectomy	39	No	COPD, ulcer/stomach disease, CLBP
6	Female	65	28.0	3499	0.00	24	Secondary education	Retired	Adenocarcinoma	IB	RAL RUL lobectomy	69	No	CLBP, stroke, COPD, osteoarthritis
7	Male	75	26.6	5971	12.67	59	Tertiary education	Retired	Adenocarcinoma	IA	Uni LUL segmentectomy	84	No	Heart disease, rheumatoid arthritis, hypertension
8	Female	70	27.5	3692	0.40	10	Secondary education	Retired	Adenocarcinoma	IIIA	RLL lobectomy	57	Yes	Hypertension, ulcer/stomach disease, CLBP
9	Female	70	22.9	3313	2.17	38	Secondary education	Retired	Adenocarcinoma	IB	uVATS RUL lobectomy	42	Yes	Osteoarthritis/arthritis, CLBP
10	Male	82	22.2	1302	0.29	23	Tertiary education	Retired	Adenocarcinoma	IIB	RLL lobectomy	55	Yes	Heart disease
11	Female	66	35.1	8156	2.75	31	Secondary education	Retired	Adenocarcinoma	IB	Uni RUL segmentectomy	41	No	Hypertension, ulcer/stomach disease, osteoarthritis, CLBP
12	Female	65	36.5	4940	3.75	42	Primary education	Housewife	Spino-cellular	IB	RAL LUL lobectomy	52	No	Hypertension, liver disease, CLBP, neurological disease, chronic kidney failure
13	Male	69	24.3	8612	27.67	29	Secondary education	Retired	Adenocarcinoma	IA	RAL RML lobectomy	43	No	Heart disease, blood anaemia, rheumatoid arthritis, CLBP
14	Female	73	35.7	2030	2.20	60	Primary education	Housewife	Adenocarcinoma	IB	LUL lobectomy	45	No	Hypertension, COPD, osteoarthritis
15	Female	71	20.7	2869	9.33	29	Primary education	Retired	Adenocarcinoma	IIB	RUL lobectomy	41	No	Hypertension, COPD, ulcer/stomach disease, osteoarthritis, CLBP, skin cancer
16	Female	71	20.0	3238	0.50	42	Primary education	Retired	Adenocarcinoma	IB	RAL left segmentectomy	61	No	Heart disease, hypertension, diabetes type I, CLBP

Note: Data are expressed as mean \pm SD. Abbreviations: ID: Identification; F: Female; M: Male; BMI: Body Mass Index (kg/m²); Mean steps/day: Mean steps per day; MVPA: Moderate-to-Vigorous Physical Activity (min/day); RAL: Robot-Assisted Lobectomy; uVATS: uniportal Video-Assisted Thoracoscopic Surgery; Uni: Uniportal; LUL: Left Upper Lobe; RUL: Right Upper Lobe; RLL: Right Lower Lobe; CLBP: Chronic Low Back Pain; COPD: Chronic Obstructive Pulmonary Disease. During the first observation, sex, age, self-reported height, and weight, smoking status, pack years, highest level of education, and employment were recorded. Cancer type, cancer stage (TNM 8th edition), medical treatment, days since medical treatment, and comorbidities were retrieved from the medical record. Post-operative rehabilitation uptake was assessed through self-reported data.

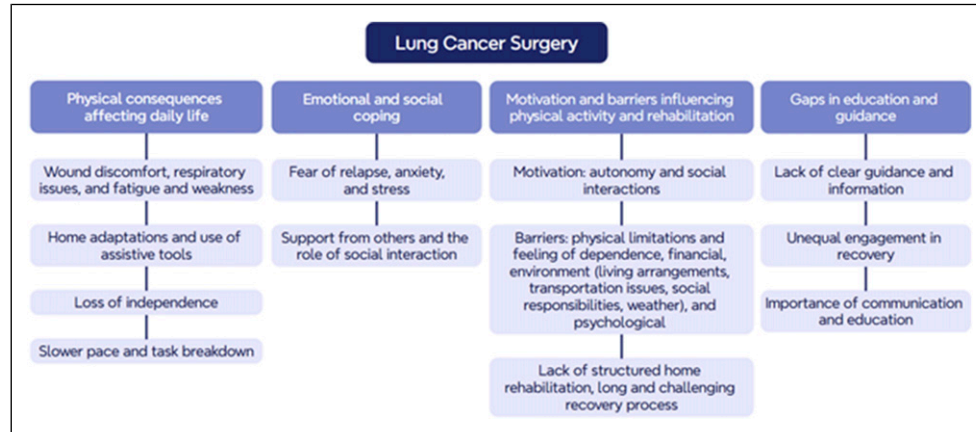


Figure 2. Representation of the four key themes identified through observations and semi-structured interviews.

Observations further illustrated how social support functioned in daily life. One participant (P01), living on the first floor, remotely opened the door for visitors, unable to manage the stairs. Her downstairs mailbox was observed to be overflowing. She explained that she was waiting for her neighbour to collect the mail for her. While such support eased physical limitations, having others around also created responsibilities. In another home (P14), a crowded calendar filled with social visits, and household tasks suggested that social obligations restricted availability for PA and rehabilitation. This contrast illustrates how social ties could both enable and constrain recovery, depending on the nature of support and expectations.

While some individuals reported feelings of loneliness and insufficient support, others described finding strength and comfort through these social connections, highlighting the wide range of social experiences during recovery.

Motivation and barriers influencing physical activity and rehabilitation

During observations, many individuals showed strong motivation to regain autonomy. For example, one participant (P04) attempted to complete household tasks independently; when his wife offered to unload the dishwasher, he became visibly frustrated and declined assistance. This behavior aligned with interview statements expressing a desire to remain independent. While social interaction often encouraged activity, participants described how dependence on others or limited support could also act as barriers. One participant (P03) expressed a wish to gradually resume household tasks herself, pointing out areas she felt were inadequately cleaned by her husband or daughter, concerns that reflected her need for control and autonomy.

Participants reported several environmental and financial barriers to PA. Those living in social housing (P01, P02, P09, P13, P15, P16) described limited space and resources for rehabilitation, which was confirmed during observations of small or cluttered living environments. Environmental constraints such as stairs, transportation difficulties, and weather conditions were frequently mentioned. For example, one participant (P15) living in a small apartment struggled with stairs and limited space, which constrained indoor PA. In another case (P05), taking the bus to rehabilitation was possible, but she felt unsafe and unsure about the fare, often arriving exhausted. Another individual (P02) mentioned that environmental factors, such as bad weather, discouraged outdoor walking. Psychological challenges post-surgery, including fear of illness, particularly lung-related conditions like bronchitis (P01), also limited engagement.

Although several participants stated they felt confident exercising independently at home, observations revealed little evidence of structured or guided home-based rehabilitation. Exercise equipment was rarely observed, and limited space or unsuitable surroundings posed additional challenges. Although some mentioned wearables like step counters or smart-watches as motivational tools, only a few were actually seen using them. Participants noted that the recovery journey was often longer and more difficult than anticipated, highlighting the interplay of personal motivation, environmental factors, social support, and psychological barriers.

Gaps in education and guidance

Participants frequently reported insufficient guidance from healthcare professionals regarding safe activity, rehabilitation options, and recovery expectations. Observations reinforced these concerns, revealing environmental and safety risks such as loose rugs, narrow hallways, and cluttered spaces that increased fall risk. One participant (P11) described a misstep at a doorstep during the first week after surgery due to dizziness and weakness. These concerns, combined with a mismatch between perceived and actual ability, highlights the need for professional support in creating a safe recovery environment.

Table 2. The interview questions, mapped to the TDF domains and COM-B components, alongside the corresponding themes, subthemes, and key findings.

COM-B component	TDF domain	Interview question	Themes	Subthemes/key findings
Capability – Psychological	Knowledge, skills, memory, attention and decision processes	1b. What does physical activity and exercise mean to you, especially after your surgery?	Motivation and barriers influencing physical activity and rehabilitation; gaps in education and guidance	Motivation: autonomy and social interactions; barriers: physical limitations and feeling of dependence, financial, environment (living arrangements, transportation issues, social responsibilities, weather), and psychological; lack of clear guidance and information; unequal engagement in recovery; importance of communication and education
		5. What are your expectations from an exercise or rehabilitation program, particularly in the context of your recovery from surgery?		
		10. What are your experiences with the doctors at the hospital in relation to your surgery and rehabilitation?		
Capability – Physical	Behavioural regulation, skills	11. How do you feel about the treatment process you've gone through since the surgery?	Physical consequences affecting daily life; motivation and barriers influencing physical activity and rehabilitation	Wound discomfort, respiratory issues, and fatigue and weakness; home adaptations and use of assistive tools; loss of independence; slower pace and task breakdown; motivation: autonomy and social interactions; barriers: physical limitations and feeling of dependence, financial, environment (living arrangements, transportation issues, social responsibilities, weather), and psychological
		12. How did the referral process to rehabilitation go, and how was it influenced by your surgery?		
		1a. How has your lung surgery impacted your ability to be physically active?		
		2a. What does physical activity and exercise mean to you, especially after your surgery?		
		3. What limitations or barriers do you face in being active due to the surgery?		
		6. Do you prefer to train or exercise in a group or individually? With supervision or without? How does your experience with surgery influence this preference?		
		7. What have been your experiences with rehabilitation after the surgery?		
		8. What kind of progress or improvements would be important for you to see after participating in an exercise or rehabilitation program?		

(continued)

Table 2. (continued)

COM-B component	TDF domain	Interview question	Themes	Subthemes/key findings
Opportunity – Social	Social influences	<p>4. What motivates you to stay active or to become more active, especially after the surgery?</p> <p>6. Do you prefer to train or exercise in a group or individually? With supervision or without? How does your experience with surgery influence this preference?</p> <p>7b. What would encourage you to attend physical therapy more regularly (facilitators)?</p> <p>10. What are your experiences with the doctors at the hospital in relation to your surgery and rehabilitation?</p> <p>11. How do you feel about the treatment process you've gone through since the surgery?</p> <p>13. Is there anything else you'd like to add about your recovery, physical activity, or rehabilitation following your lung surgery?</p>	<p>Emotional and social coping; motivation and barriers influencing physical activity and rehabilitation; gaps in education and guidance</p>	<p>Fear of relapse, anxiety, and stress; support from others and the role of social interaction; motivation: autonomy and social interactions; barriers: physical limitations and feeling of dependence, financial, environment (living arrangements, transportation issues, social responsibilities, weather), and psychological; lack of clear guidance and information; unequal engagement in recovery; importance of communication and education</p>

(continued)

Table 2. (continued)

COM-B component	TDF domain	Interview question	Themes	Subthemes/key findings
Opportunity – Physical	Environmental context and resources	<p>1. What are your experiences with being physically active and exercising?</p> <p>2. What does a typical day look like for you? What activities do you do on an ordinary day?</p> <p>2a. How do you incorporate physical activity into your daily life and routine, considering the effects of your surgery?</p> <p>2b. What activities do you enjoy doing now, and how have they changed since your surgery?</p> <p>3. What limitations or barriers do you face in being active due to the surgery?</p> <p>6. Do you prefer to train or exercise in a group or individually? With supervision or without? How does your experience with surgery influence this preference?</p> <p>7a. What barriers do you encounter when attending physical therapy post-surgery?</p> <p>9. What are your experiences with using a pedometer or health apps on your phone, and how has this been affected by your surgery?</p> <p>12. How did the referral process to rehabilitation go, and how was it influenced by your surgery?</p>	Physical consequences affecting daily life; motivation and barriers influencing physical activity and rehabilitation	Wound discomfort, respiratory issues, and fatigue and weakness; home adaptations and use of assistive tools; loss of independence; slower pace and task breakdown; motivation; autonomy and social interactions; barriers: physical limitations and feeling of dependence, financial, environment (living arrangements, transportation issues, social responsibilities, weather), and psychological

(continued)

Table 2. (continued)

COM-B component	TDF domain	Interview question	Themes	Subthemes/key findings
Motivation – Reflective	Social/professional role and identity, beliefs about capability, optimism, beliefs about consequences, intentions, goals	<p>1b. What does physical activity and exercise mean to you, especially after your surgery?</p> <p>4. What motivates you to stay active or to become more active, especially after the surgery?</p> <p>5. What are your expectations from an exercise or rehabilitation program, particularly in the context of your recovery from surgery?</p> <p>8. What kind of progress or improvements would be important for you to see after participating in an exercise or rehabilitation program?</p> <p>13. Is there anything else you'd like to add about your recovery, physical activity, or rehabilitation following your lung surgery?</p>	Motivation and barriers influencing physical activity and rehabilitation; gaps in education and guidance	Motivation: autonomy and social interactions; barriers: physical limitations and feeling of dependence, financial, environment (living arrangements, transportation issues, social responsibilities, weather), and psychological; lack of clear guidance and information; unequal engagement in recovery; importance of communication and education
Motivation – Automatic	Social/professional role & identity, optimism, reinforcement, emotion	<p>1. What are your experiences with being physically active and exercising?</p> <p>3. What limitations or barriers do you face in being active due to the surgery?</p> <p>4. What motivates you to stay active or to become more active, especially after the surgery?</p> <p>7a. What barriers do you encounter when attending physical therapy post-surgery?</p> <p>10. What are your experiences with the doctors at the hospital in relation to your surgery and rehabilitation?</p> <p>11. How do you feel about the treatment process you've gone through since the surgery?</p> <p>13. Is there anything else you'd like to add about your recovery, physical activity, or rehabilitation following your lung surgery?</p>	<p>Emotional and social coping; motivation and barriers influencing physical activity and rehabilitation; gaps in education and guidance</p>	<p>Fear of relapse, anxiety, and stress; support from others and the role of social interaction; motivation: autonomy and social interactions; barriers: physical limitations and feeling of dependence, financial, environment (living arrangements, transportation issues, social responsibilities, weather), and psychological; lack of clear guidance and information; unequal engagement in recovery; importance of communication and education</p>

Table 3. Overview of observations and individual quotes by theme and subtheme.

Main theme	Subtheme	Quote	ID
Physical consequences affecting daily life	Wound discomfort	"I have pain at the wound site. It's really just wound pain. When I bend down, I still feel pain where they cut the tissue between my ribs."	P11
		<i>One woman limited her cooking to twice a week because it demanded too much energy. She prepared a large pot of chicken and potato soup, which she ate multiple times a day over several days, with bread. Her fridge was nearly empty, reflecting how concerns about physical strain shaped not only her activity patterns but also her nutritional habits.</i>	P01
	Respiratory issues	<i>Individuals were often seen pressing on their surgical wound to ease pain during activities that triggered respiratory symptoms, such as shortness of breath or coughing. One woman hadn't walked outside since her surgery, as the cold air caused wound pain. Pressing on the wound while walking had become too difficult, making outdoor activity unmanageable.</i>	P07
		"Moving was difficult at first. I got out of breath with activity. Overhead activities and bending down—it pulls, it hurts, it's numb, I'm getting out of breath."	P06
	Fatigue and weakness	"I'm only doing about ten percent of what I used to do. Maybe a little more. It's because I feel fatigued and my legs feel weak."	P10
		<i>During the observation, the individual appeared physically limited by fatigue and weakness, struggling to reach a glass of water on a nearby table, a simple task that seemed to require significant effort. He remained seated in a recliner throughout, shifting uncomfortably and visibly bracing himself when attempting to lean forward, ultimately appearing unable to get up without difficulty.</i>	P03
	Home adaptations and use of assistive tools	<i>It was observed that he even adjusted his living arrangements, such as moving their bed to the living room as he found stairs too challenging to manage. This adaptation allowed easier access but often made the living room unusable as a social or leisure space, reflecting the significant impact on daily life.</i>	P10
		"When I exert myself, I have to stop—two, three minutes, sit down, breathe calmly. I press on my wound with my hands to ease the pain until I'm rested. Then I try again and continue."	P01
	Loss of independence	<i>During the observation, it was noted that a small chair was placed beneath the high cupboards, which she used to reach items stored there. Since her surgery, pain prevented her from using the chair, so she stopped placing everyday essentials in those cupboards and lost access to items important for her daily routine. This forced her to leave certain tasks undone or ask others for help, which affected her independence.</i>	P06
		<i>One woman avoided the stairs by getting ready in her living room, where she kept her deodorant, perfume, and a mirror to comb her hair. This adaptation allowed easier access but often made the living room unusable as a social or leisure space, reflecting the significant impact on daily life.</i>	P01
Fear of relapse, anxiety, and stress	"If I can't walk further, I call someone to pick me up. I always have someone I can call."	P01	
	<i>Carrying heavy grocery bags had also become difficult, and tasks like cleaning the outside windows, which required her to sit on the windowsill, were no longer possible. These adjustments reflect how physical limitations and fear of strain reshaped her daily routine and environment, now requiring support from others.</i>	P16	
Emotional and social coping	<i>It was also observed that tasks were frequently broken down into smaller steps, such as taking one plate at a time from the cupboard or leaving clean dishes on kitchen surfaces to be put away later. As a result of these prolonged efforts, less time and energy appeared to be available for engaging in health-promoting behaviors.</i>	P02	
	"Before, I used to clean the whole house. Now I do just one area and then I have to rest."	P08	
Support from others and the role of social interaction	"I am currently cancer-free. But the cancer isn't gone, it's still in my body. I have to go for check-ups every three months. You're just left with that uncertainty."	P02	
	<i>During the observation, it was noted that he became emotional multiple times when discussing the uncertainty of the future, seeking comfort and support from his wife during these moments. She offered reassurance through gentle words, physical touch such as holding his hand or hugging, and attentive listening.</i>	P10	
	"Only we can understand that. Your life changes. And it's never the same as it was before. Even if you're declared cancer-free, you always fear it might come back"	P06	
	<i>It was observed that many individuals were observed to rely on others for both emotional comfort and practical assistance during their recovery. A participant lived on the first floor and opened the door remotely using a buzzer, calling down from the top of the stairs to indicate coming directly upstairs. Her mailbox was observed to be overflowing with post. When asked about it, she explained that she was waiting for her neighbour to collect the mail for her, as she was no longer able to manage the stairs herself. Such moments illustrated the subtle but significant ways in which individuals relied on others for everyday tasks.</i>	P01	
	"Normally, making the bed takes ten minutes. Now, I have to wait until my daughter helps me."	P15	

(continued)

Table 3. (continued)

Main theme	Subtheme	Quote	ID	
Motivation and barriers influencing physical activity and rehabilitation	Motivation: autonomy and social interactions	"I want to feel better and be independent, to do things faster again, to feel fit and healthy. It motivates me to regain the life I once had and to become more active again. My husband supports me too, which really encourages me."	P15	
		<i>During the observation, the individual demonstrated strong motivation to regain autonomy. He attempted to complete household tasks independently and expressed visible frustration when assistance was offered for activities he preferred to do on his own. For example, when his wife offered to unload the dishwasher, he declined her help and showed clear signs of irritation. The individual hoped to gradually resume household tasks as her condition improves. She made it clear that she dislikes being dependent on her husband. She also pointed out areas in the house that, in her view, were not cleaned thoroughly enough, emphasizing that she could do a better job herself.</i>	P04	
	Barriers: physical limitations and feeling of dependence	"I get exhausted quickly. Even just doing household tasks, everything takes longer."	P03	
		<i>It was also noted that the financial aspect plays a significant role, as some participants lived in small apartments in social housing neighbourhoods, where financial constraints were apparent and seemed to influence their access to rehabilitation resources or additional support.</i>	P15 P11	
	Barriers: financial	"I received a bill to pay, and I haven't gotten anything back from the insurance yet. I think that's a lot of money, you know? Because you have to pay upfront. Yes, you have to cover the cost first. I don't know how much you're going to get back; I have no idea. But I think that's a lot to pay. If you're living alone, in the end, then you still have to pay."	P14	
		<i>In one case, although taking the bus to rehabilitation was technically possible, the individual described feeling too unsteady and unsafe to wait at bus stops, and unsure if she could afford the fare. She showed visible tension when speaking about the effort; it took to prepare and commute, often arriving exhausted. Planning travel in advance to avoid busy times added further emotional and cognitive strain to what seemed like a simple journey.</i>	P05	
	Barriers: environment (living arrangements, transportation issues, social responsibilities, weather)	<i>One individual lived in a small apartment and struggled with stairs and limited space, which constrained indoor PA.</i>	P15	
		"No, I can't get there by bus. Sorry, then I have to travel just to sit with the physiotherapist for half an hour, and that makes it a whole day of traveling. I'd have to take three buses to get there."	P01	
	Gaps in education and guidance	Lack of structured home rehabilitation, long and challenging recovery process	<i>A busy schedule was observed on the calendar hanging in the participant's kitchen, with notes about family events, social visits, and household tasks filling most days of the week. This suggested limited availability for additional activities such as rehabilitation or structured physical exercise.</i>	P14
			"Because I don't have time. It's my granddaughter's birthday tomorrow... Then on Wednesday the cleaning lady comes, and in the afternoon we always visit friends. And Thursday we're going shopping or something. And Friday I do the groceries. So I just don't have time this week."	P14
Barriers: psychological		"If it rains, I won't go outside to walk. I don't want to end up sick [...] You can dress warmly for the cold, but you always get soaked in the rain."	P02	
		"In the beginning, it [rehabilitation] was difficult and scary, worrying that I might do something wrong."	P13	
Lack of clear guidance and information		"Since the surgery, I've been afraid of getting sick, of catching bronchitis or something with my lungs."	P01	
		<i>Some people feel they can perform exercises independently at home, yet it was observed that many individuals still appeared physically weak, and there was little evidence of structured or guided home-based rehabilitation. Exercise equipment was rarely observed in the home environments, and limited space or unsuitable surroundings often posed additional challenges for exercise or PA.</i>	P02	
Unequal engagement in recovery		"It [rehabilitation] doesn't make enough of a difference. I don't get enough satisfaction from it, what I can do at the physiotherapist, I can also do here at home."	P04	
		"It's gradually getting better and better. I want to return to doing the work I used to enjoy, but it is very challenging. Now, it's just helping out around the house and working on my bike. After the surgery, I couldn't do that anymore. But it's starting to improve little by little."	P11	
Importance of communication and education		<i>Home environments were not always safe or suitable for recovery, with risks such as loose rugs and cluttered spaces increasing the chance of falls. One participant described a misstep at a doorstep during the first week after surgery due to dizziness and weakness, further highlighting the need for professional guidance.</i>	P02	
		"I didn't receive much information. They didn't really refer me to rehabilitation, didn't really talk about it. Yes, she did say, of course, to try to move as much as possible. And that's it."	P04	
		<i>During home visits it was observed that one participant was unsure how to perform exercises safely or how to access local rehabilitation programs, resulting in avoidance of activity and waiting passively for her partner. She depended heavily on external support and showed less personal initiative.</i>	P12	
		"The doctor said a lot, but you don't retain it. You think, 'Oh, I have cancer,' and that's all you focus on. But I think good communication is very necessary."	P13	
		"I am very satisfied with the medical staff. They provided me with excellent support and guidance."	P13	

However, many individuals reported receiving insufficient information about available services, which contributed to feelings of frustration and uncertainty. For instance, it was observed that one participant (P04) was unsure how to perform exercises safely or how to access local rehabilitation programs, resulting in avoidance of activity and waiting passively for her partner. She depended heavily on external support and showed less personal initiative.

Given the emotional burden of a cancer diagnosis, participants consistently emphasized during interviews that support from family and friends remained vital, with individuals often feeling more comfortable sharing concerns with loved ones.

Objectively measured physical activity

People wore the PA monitor for 5 ± 2 days, with an average wearing time of 827 ± 100 minutes/day. Nearly all participants (94%) fell below the recommended 7500 steps/day, averaging 3820 ± 2207 steps/day. Average sedentary time was 601 ± 105 minutes/day and time spent in light physical activity (LPA) averaged 220 ± 80 minutes/day. Engagement in moderate-to-vigorous physical activity (MVPA) was minimal, averaging 6 ± 8 minutes/day.

Patient-reported outcome measures

As a further characterization of the cohort, patient-reported outcome measures with reference and normative values are presented in [Table 4](#).

Discussion

This ethnographic study uncovered complex, context-specific barriers and facilitators influencing PA and exercise after lung cancer surgery. Beyond known physical symptoms, environmental constraints, such as small living spaces, safety hazards, and limited access to rehabilitation resources, emerged as critical factors limiting activity engagement. Social support and individual motivation were important facilitators but often insufficient without tailored healthcare guidance. Importantly, the findings highlight that generic exercise recommendations may not align with individuals' lived realities, emphasizing the need for personalized, context-aware rehabilitation plans that integrate individuals' home environments and social circumstances to improve adherence and recovery outcomes after lung surgery for NSCLC.

The physical burden of lung cancer surgery is compounded by psychosocial challenges such as fear, anxiety, and uncertainty about relapse. Similar psychological distress has been documented across various cancer populations, where fear of disease progression or relapse can severely affect mental well-being.^{30,31} Additionally, individuals with NSCLC who had surgery report lower health-related QoL compared to healthy adults, with scores comparable to or slightly better than those with advanced COPD or pulmonary fibrosis.³² This underscores the critical need for rehabilitation and ongoing support, which have proven benefits in improving quality of life in chronic respiratory diseases.³³

Although most participants initiated post-operative rehabilitation, this care was primarily delivered in community-based primary care settings rather than within specialized oncology rehabilitation programs. The limited number of attended sessions, combined with variability in program content and disease-specific expertise, may help explain why individuals continued to report uncertainty regarding safe exercise performance and self-management. Participants described several potential reasons for limited engagement, including a low perceived usefulness of supervised sessions, the belief that exercises could be performed independently at home, and variable access to physiotherapists with specific expertise in post-lung surgery care. These findings align with previous qualitative research indicating that individuals may perceive structured rehabilitation as insufficiently beneficial and prefer more flexible, self-managed exercise options.³⁴ Overall, these findings suggest that initiation of rehabilitation alone does not necessarily translate into sufficient perceived competence or knowledge, highlighting the need for more structured, tailored, and sustained guidance following lung surgery. In other populations, preference-based or home-based models, particularly in prostate cancer, often improve adherence compared with standard RCT formats,³⁵ while in other chronic conditions, structured, team-based programs combining exercise, education, and support can achieve excellent adherence (77%).³⁶ Additionally, the adoption of wearable activity trackers is limited by unfamiliarity, poor understanding of PA metrics, and lack of confidence-building strategies. Addressing these barriers requires integrated interventions, including home-based programs and PA tele-coaching.^{9,37,38}

Despite nearly all individuals (94%) falling below the recommended 7500 steps/day,³⁹ they recognize the importance of PA (8/10^{8,10}) and show motivation to be physically active (8/10^{5,8}). However, confidence in engaging in PA is often low, as individuals are afraid of causing damage to the surgical wound or hindering their recovery. Exercise self-efficacy in this study aligns with previous findings where people with higher self-efficacy were more physically active, while those with lower self-efficacy had a higher risk of not achieving the recommended 7500 steps/day.³⁸

Table 4. Patient-reported outcome measures.

Questionnaire	Median [Q1; Q3]	Reference (+) and normative (*) values (median [Q1; Q3])
Motivation and self-efficacy		
Importance of PA (0-10)	8 [8; 10]	
Motivation for PA (0-10)	8 [5; 8]	
Confidence in PA (0-10)	6 [4; 9]	
ESES (0-60)	34 [28; 38]	32 [2;60] ⁺ ²²
LASA-LIVAS (10-50)	26 [24; 28]	28 [22;33] [*] ⁷
SRQ-E (16-112)	7 [5; 13]	≥ 8 ⁺ ²³
Psychosocial factors		
TAMPA (17-68)	38 [29; 46]	> 37 ⁺ ²⁴
DASS-21 depression (0-42)	7 [2; 16]	≥ 9 ⁺ ²⁵
DASS-21 anxiety (0-42)	3 [0; 12]	≥ 7 ⁺ ²⁵
DASS-21 stress (0-42)	9 [5; 10]	≥ 14 ⁺ ²⁵
Loneliness (0-11)	2 [0; 4]	≥ 3 ⁺ ²⁶
Symptoms		
MFI-20 (20-100)	46 [27; 65]	51 [39;63] [*] ⁷
mMRC (0-4)	2 [1; 3]	≥ 2 ⁺ ²⁷
Quality of Life		
SF-36 general health (0-100)	55 [50; 71]	75 [21;72] ⁺ ²⁸
SF-36 physical functioning (0-100)	63 [51; 79]	86 [20;42] ⁺ ²⁸
SF-36 social functioning (0-100)	75 [41; 97]	86 [21;18] ⁺ ²⁸
SF-36 pain score (0-100)	68 [45; 86]	74 [25;83] ⁺ ²⁸
SF-36 energy/fatigue (0-100)	53 [41; 65]	61 [20;61] ⁺ ²⁸
EORTC QLQ C30 GH (0-100)	63 [50; 73]	50 [51;33] ⁺ ²⁹
EORTC QLQ C30 SS (0-100)	18 [3; 35]	18 [9;31] ⁺ ²⁹
EORTC QLQ C30 FS (0-100)	79 [70; 90]	58 [58;67] ⁺ ²⁹
EORTC-LC13 (0-100)	38 [23; 60]	19 [11;24] [*] ⁷
EQ-5D health status (0-100)	70 [51; 80]	70 [68;83] [*] ⁷

Note. Data are expressed as median [Q1; Q3]. ⁺ Indicates reference values. ^{*} Indicates normative values.

Abbreviations; PA: Physical Activity; ESES: Exercise Self-Efficacy Scale; LASA: Longitudinal Aging Study Amsterdam – Lifestyle for Vital Ageing Scale; SRQ-E: Self-Regulation Questionnaire - Exercise; TAMPA: Tampa Scale for Kinesiophobia; DASS-21: Depression, Anxiety, and Stress Scale - 21 items; MFI-20: Multidimensional Fatigue Inventory – 20 items; mMRC: Modified Medical Research Council Dyspnea Scale; SF-36: Short Form-36; EORTC QLQ C30: European Organization for Research and Treatment of Cancer Quality of Life Questionnaire Core 30; GH: General Health; SS: Symptom Severity; FS: Functional Status; EORTC-LC13: European Organization for Research and Treatment of Cancer Lung Cancer 13-item module; EQ-5D: EuroQol-5D.

Notably, some participants felt fully recovered despite ongoing limitations, highlighting the need for education to prevent underestimation of rehabilitation needs. Reassurance that symptoms like pain or breathlessness rarely indicate relapse, and that exercise is safe, is crucial. However, many participants (7 out of 16) had only primary education. This lower educational attainment is often associated with reduced health literacy. Limited health literacy could affect individuals' understanding of postoperative care instructions, rehabilitation options, and recommendations for PA, potentially influencing their experiences and engagement with rehabilitation. Therefore, tailored education, incorporating simplified and visual educational materials, social support, and practical strategies, preferably delivered face-to-face by specialized professionals and reinforced through repeated explanations using teach-back techniques, may enhance individual engagement in rehabilitation.^{40,41} However, current rehabilitation models may not suit all individuals: home-based programs can be impractical in small spaces, and centre-based care may be inaccessible. Addressing these challenges may require flexible delivery models, such as transport support or delivering rehabilitation in local community settings.

Strengths and limitations

A major strength of this study was its detailed qualitative approach, combining in-home observations with semi-structured interviews to capture lived experiences. The TDF provided a structured framework for analyzing behavioral influences on PA and rehabilitation. Home visits also offered unique insights into their recovery environment and eliminated the need for travel, including a more diverse sample, and reducing selection bias. Integrating informal observations with detailed field notes helped mitigate recall and social desirability bias. Finally, conducting observations at multiple times and days allowed a comprehensive understanding of daily routines.

Limitations include potential observer effects, as participants may have altered behavior or environment. Several participants also had multiple comorbidities that may have influenced physical function, PA and recovery. A high comorbidity burden is commonly reported in individuals undergoing lung cancer surgery,⁴² reflecting the clinical complexity of this population. While participants were prompted to focus on lung surgery-specific changes, the influence of pre-existing conditions cannot be fully excluded. Observations during home visits and structured assessments were interpreted in relation to each participant's baseline functioning to minimize misattribution. Further, focusing on early post-surgical recovery may not capture longer-term challenges. Continuing to wear PA monitors after interviews may have influenced activity, though inactivity remained common. Despite purposive sampling, diversity in gender, employment, and educational level was limited due to recruitment constraints. As a result, our findings predominantly reflect the experiences of individuals with similar sociodemographic characteristics and may underrepresent perspectives related to different work demands, socioeconomic contexts, or access to rehabilitation and support services.

Future recommendations

Interventions for lung cancer survivors should address their specific physical, social and emotional challenges related to exercise and PA. Providing the right knowledge and tools can improve engagement, adherence to rehabilitation, and long-term recovery.^{43–45} Although education about rehabilitation is crucial, it is often underused due to gaps in clinical pathways, inconsistent delivery, and a lack of focus. Referrals to specialized rehabilitation are sometimes unclear, causing delays or missed care. Practical strategies to overcome barriers to rehabilitation and PA could include home-based adaptations to facilitate exercise, tele-coaching to provide remote guidance and support, transport assistance for attending sessions, and individualized guidance from healthcare professionals to ensure exercises are safe and appropriate for each individual. Implementing such strategies may enhance adherence, engagement, and overall recovery outcomes.

Conclusion

Lung cancer surgery (with or without (neo-)adjuvant therapy) causes physical, emotional, and social challenges that impair daily life and engagement in PA and rehabilitation. Despite motivation, PA and engagement to rehabilitation is often limited by symptoms and contextual barriers. Tailored, integrated rehabilitation addressing individuals' living conditions and their physical and emotional needs are crucial for recovery.

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Ethical considerations

The study was approved by the Institutional Ethics Committee of Hospital East-Limburg and Hasselt University (NO. Z-2023064; B3712023000005, dd. 18 October 2023).

Consent to participate

All participants gave written informed consent before data collection began.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Clinical trial registration

[ClinicalTrials.gov](https://clinicaltrials.gov) ID: NCT06536140.

Supplemental material

Supplemental material for this article is available online.

References

1. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians* 2021; 71(3): 209–249. <https://doi.org/10.3322/caac.21660>
2. Molina JR, Yang P, Cassivi SD, et al. Non-small cell lung cancer: epidemiology, risk factors, treatment, and survivorship. In: *Mayo clinic proceedings*. Elsevier, 2008.
3. Ehrenstein V, Eriksen K, Taylor A, et al. Characteristics and overall survival of patients with early-stage non-small cell lung cancer: A cohort study in Denmark. *Cancer Med* 2023; 12(1): 30–37. <https://doi.org/10.1002/cam4.4946>
4. Khakwani A, Harden S, Beckett P, et al. Post-treatment survival difference between lobectomy and stereotactic ablative radiotherapy in stage I non-small cell lung cancer in England. *Thorax* 2020; 75(3): 237–243. <https://doi.org/10.1136/thoraxjnl-2018-212493>
5. Haesevoets S, Arents E, Cops D, et al. The impact of lung surgery, with or without (neo-)adjuvant therapy, on physical functioning in patients with nonsmall cell lung cancer: a scoping review. *Eur Respir Rev* 2025; 34(175): 240156. <https://doi.org/10.1183/16000617.0156-2024>
6. Jiao M, Liang H and Zhang M. Effect of exercise on postoperative recovery of patients with non-small cell lung cancer: a systematic review and meta-analysis. *Discov Oncol* 2024; 15(1): 230. <https://doi.org/10.1007/s12672-024-01079-w>
7. Quadflieg K, Arents E, Haesevoets S, et al. Impact of cancer treatment on physical functioning, symptoms and health-related quality of life in patients with non-small cell lung cancer: a longitudinal observational study. *Respir Med* 2025; 247: 108283. <https://doi.org/10.1016/j.rmed.2025.108283>
8. Cavalheri V, Tahirah F, Nonoyama M, et al. Exercise training undertaken by people within 12 months of lung resection for non-small cell lung cancer. *Cochrane Database Syst Rev* 2019; 6(6): Cd009955. <https://doi.org/10.1002/14651858.CD009955.pub2>
9. Demeyer H, Louvaris Z, Frei A, et al. Physical activity is increased by a 12-week semiautomated telecoaching programme in patients with COPD: a multicentre randomised controlled trial. *Thorax* 2017; 72(5): 415–423. <https://doi.org/10.1136/thoraxjnl-2016-209026>
10. Zhou W, Webster KE, Smith EL, et al. Physical activity in surgical lung cancer patients: a systematic review. *Support Care Cancer* 2022; 30(8): 6473–6482. <https://doi.org/10.1007/s00520-022-07018-1>
11. Granger CL, Parry SM, Denehy L, et al. Evidence, education and multi-disciplinary integration are needed to embed exercise into lung cancer clinical care: a qualitative study involving physiotherapists. *Physiotherapy theory and practice* 2018; 34(11): 852–860. <https://doi.org/10.1080/09593985.2018.1425939>
12. Holland AE, Cox NS, Houchen-Wolloff L, et al. Defining Modern Pulmonary Rehabilitation. An Official American Thoracic Society Workshop Report. *Ann Am Thorac Soc* 2021; 18(5): e12–e29. <https://doi.org/10.1513/AnnalsATS.202102-146ST>
13. Hefferon K, Murphy H, McLeod J, et al. Understanding barriers to exercise implementation 5-year post-breast cancer diagnosis: a large-scale qualitative study. *Health Education Research* 2013; 28(5): 843–856. <https://doi.org/10.1093/her/cyt083>
14. Brunet J, Taran S, Burke S, et al. A qualitative exploration of barriers and motivators to physical activity participation in women treated for breast cancer. *Disability and Rehabilitation* 2013; 35(24): 2038–2045. <https://doi.org/10.3109/09638288.2013.802378>
15. Ottenbacher AJ, Day RS, Taylor WC, et al. Exercise among breast and prostate cancer survivors—what are their barriers? *Journal of Cancer Survivorship* 2011; 5(4): 413–419. <https://doi.org/10.1007/s11764-011-0184-8>
16. Vindrola-Padros C and Vindrola-Padros B. Quick and dirty? A systematic review of the use of rapid ethnographies in healthcare organisation and delivery. *BMJ Quality & Safety* 2018; 27(4): 321–330. <https://doi.org/10.1136/bmjqs-2017-007226>
17. Garratt AM, Solheim E and Danielsen K. *National and cross-national surveys of patient experiences: a structured review*. Nasjonalt kunnskapssenter for helsetjenesten, 2008.

18. Atkins L, Francis J, Islam R, et al. A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. *Implementation Science* 2017; 12(1): 77. <https://doi.org/10.1186/s13012-017-0605-9>
19. O'Brien BC, Harris IB, Beckman TJ, et al. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med* 2014; 89(9): 1245–1251. <https://doi.org/10.1097/ACM.0000000000000388>
20. Clarke V and Braun V. Thematic analysis. *The journal of positive psychology* 2017; 12(3): 297–298. <https://doi.org/10.1080/17439760.2016.1262613>
21. Timlin D, McCormack JM and Simpson EE. Using the COM-B model to identify barriers and facilitators towards adoption of a diet associated with cognitive function (MIND diet). *Public Health Nutrition* 2021; 24(7): 1657–1670. <https://doi.org/10.1017/S1368980020001445>
22. Kroll T, Kehn M, Ho PS, et al. The SCI exercise self-efficacy scale (ESES): development and psychometric properties. *International Journal of Behavioral Nutrition and Physical Activity* 2007; 4: 1–6. <https://doi.org/10.1186/1479-5868-4-34>
23. Rahmanian Z, Vaez Mousavi M and Sohrabi M. Psychometric properties of the exercise self-regulation questionnaire. *Sport Psychology Studies* 2015; 3(8): 19–32.
24. Swinkels-Meewisse EJ, Swinkels RAHM, Verbeek ALM, et al. Psychometric properties of the Tampa Scale for kinesiophobia and the fear-avoidance beliefs questionnaire in acute low back pain. *Man Ther* 2003; 8(1): 29–36. <https://doi.org/10.1054/math.2002.0484>
25. Coker AO, Coker O and Sanni D. Psychometric properties of the 21-item depression anxiety stress scale (DASS-21). *African Research Review* 2018; 12(2): 135–142. <https://doi.org/10.4314/affrev.v12i2.13>
26. De Jong-Gierveld J and Van Tilburg T. Manual of the loneliness scale *Manual of the loneliness scale*. Methoden en technieken, 1999.
27. Stenton C. The MRC breathlessness scale. *Occupational Medicine* 2008; 58(3): 226–227. <https://doi.org/10.1093/occmed/kqm162>
28. Garratt A and Stavem K. Measurement properties and normative data for the Norwegian SF-36: results from a general population survey. *Health and quality of life outcomes* 2017; 15: 1–10. <https://doi.org/10.1186/s12955-017-0625-9>
29. Diouf M, Bonnetain F, Barbare JC, et al. Optimal cut points for quality of life questionnaire-core 30 (QLQ-C30) scales: utility for clinical trials and updates of prognostic systems in advanced hepatocellular carcinoma. *Oncologist* 2015; 20(1): 62–71. <https://doi.org/10.1634/theoncologist.2014-0175>
30. Mas S, Quantin X and Ninot G. Barriers to, and Facilitators of Physical Activity in Patients Receiving Chemotherapy for Lung Cancer: An exploratory study. *Journal of Palliative Care* 2015; 31(2): 89–96. <https://doi.org/10.1177/082585971503100204>
31. Gildea GC, Spence RR, Jones TL, et al. Barriers, facilitators, perceptions and preferences influencing physical activity participation, and the similarities and differences between cancer types and treatment stages - A systematic rapid review. *Prev Med Rep* 2023; 34: 102255. <https://doi.org/10.1016/j.pmedr.2023.102255>
32. Habraken JM, ter Riet G, Gore JM, et al. Health-related quality of life in end-stage COPD and lung cancer patients. *J Pain Symptom Manage* 2009; 37(6): 973–981. <https://doi.org/10.1016/j.jpainsymman.2008.07.010>
33. Spruit MA, Singh SJ, Garvey C, et al. An official American Thoracic Society/European Respiratory Society statement: key concepts and advances in pulmonary rehabilitation. *Am J Respir Crit Care Med* 2013; 188(8): e13–e64. <https://doi.org/10.1164/rccm.201309-1634ST>
34. Yang X, Tang W, Xu L, et al. Factors influencing adherence to home based pulmonary rehabilitation programme by high risk patients awaiting lung surgery: mixed methods study. *BMJ Open* 2024; 14(12): e082933. <https://doi.org/10.1136/bmjopen-2023-082933>
35. Alibhai S, Papadopoulos E, Durbano S, et al. Preference-based versus randomized controlled trial in prostate cancer survivors: Comparison of recruitment, adherence, attrition, and clinical outcomes. *Frontiers in Oncology* 2022; 12: 1033229. <https://doi.org/10.3389/fonc.2022.1033229>
36. Bullard T, Ji M, An R, et al. A systematic review and meta-analysis of adherence to physical activity interventions among three chronic conditions: cancer, cardiovascular disease, and diabetes. *BMC Public Health* 2019; 19(1): 636. <https://doi.org/10.1186/s12889-019-6877-z>
37. Liu XL, Tan JY, Wang T, et al. Effectiveness of home-based pulmonary rehabilitation for patients with chronic obstructive pulmonary disease: a meta-analysis of randomized controlled trials. *Rehabilitation Nursing* 2014; 39(1): 36–59. <https://doi.org/10.1002/rnj.112>
38. Zhang N, He X, Zhang H, et al. Influencing Factors of Physical Activity in Patients with Lung Cancer Surgery and Its Correlation with Exercise Self-Efficacy and Perceived Social Support. *Evid Based Complement Alternat Med* 2022; 2022: 7572530. <https://doi.org/10.1155/2022/7572530>
39. Demeyer H, Mohan D, Burtin C, et al. Objectively Measured Physical Activity in Patients with COPD: Recommendations from an International Task Force on Physical Activity. *Chronic Obstr Pulm Dis* 2021; 8(4): 528–550. <https://doi.org/10.15326/jcopdf.2021.0213>
40. Avancini A, Sartori G, Gkoutakos A, et al. Physical Activity and Exercise in Lung Cancer Care: Will Promises Be Fulfilled? *Oncologist* 2020; 25(3): e555–e569. <https://doi.org/10.1634/theoncologist.2019-0463>
41. Avancini A, Trestini I, Tregnago D, et al. Willingness, preferences, barriers, and facilitators of a multimodal supportive care intervention including exercise, nutritional and psychological approach in patients with cancer: a cross-sectional study. *J Cancer Res Clin Oncol* 2023; 149(7): 3435–3445. <https://doi.org/10.1007/s00432-022-04232-6>

42. Benker M, Citak N, Neuer T, et al. Impact of preoperative comorbidities on postoperative complication rate and outcome in surgically resected non-small cell lung cancer patients. *Gen Thorac Cardiovasc Surg* 2022; 70(3): 248–256. <https://doi.org/10.1007/s11748-021-01710-5>
43. Granger CL, Connolly B, Denehy L, et al. Understanding factors influencing physical activity and exercise in lung cancer: a systematic review. *Support Care Cancer* 2017; 25(3): 983–999. <https://doi.org/10.1007/s00520-016-3484-8>
44. Granger CL, Denehy L, Remedios L, et al. Barriers to Translation of Physical Activity into the Lung Cancer Model of Care. A Qualitative Study of Clinicians' Perspectives. *Ann Am Thorac Soc* 2016; 13(12): 2215–2222. <https://doi.org/10.1513/AnnalsATS.201607-540OC>
45. Granger CL, Parry SM, Denehy L, et al. Evidence, education and multi-disciplinary integration are needed to embed exercise into lung cancer clinical care: A qualitative study involving physiotherapists. *Physiother Theory Pract* 2018; 34(11): 852–860. <https://doi.org/10.1080/09593985.2018.1425939>