

# Qualitative assessment of expectations on the content, form and way of delivery of a prehabilitation programme in patients with lung resection surgery – A Swiss tertiary centre experience

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## Abstract

**Objective:** To assess the interest in a prehabilitation programme of patients awaiting lung resection and to identify expectations from such a programme.

**Introduction:** At present, in Switzerland, there are no multimodal clinical prehabilitation programmes for lung resection patients awaiting surgery.

**Methods:** Semi-structured face-to-face interviews were conducted with patients who have had or were awaiting lung resection at a Swiss tertiary centre. Thematic analysis was performed to identify common prespecified themes.

**Results:** Twenty-two patients (45.5% female, age  $70.6 \pm 16.6$  years) were interviewed. Seventy-seven percent were interested in a prehabilitation programme. Sixty-two percent, 67% and 90% were interested in endurance, strength and respiratory training, respectively. Six patients (27%) were active smokers, of whom two (one-third) were interested in a smoking cessation programme. Seventy-six percent were interested in nutrition counselling and 90% in receiving education on risk factor management. Forty percent preferred centre-based training/counselling sessions, 20% preferred home-based training/counselling and 30% found both forms acceptable. Patients were willing to perform prehabilitation activities on 2.6 days/week for a total of 162 min/week. Participating in peer groups was desired by only 25%.

**Conclusions:** Patients with lung resection were highly interested in participating in prehabilitation, albeit only for a mean time cost of 2.7 h per week. Offering a prehabilitation programme with a combination of in-hospital group sessions and home-based training seems feasible.

## Keywords

Semi-structured interviews, prehabilitation, exercise, smoking cessation, patient involvement, non-small cell lung cancer, patient education, respiratory training

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## Implications for prehabilitation

- (1) Given the high priority of education, the Prehabilitation Team of the Department of Anaesthesiology and Pain Medicine, University Hospital Bern will co-create online educational material as to how patients may benefit from the components of the prehabilitation programme.
- (2) Patients will have one session with an advanced practitioner nurse who will be their single point of contact and who will answer questions the patients may have with regard to their diagnosis, their surgery and their prognosis.

- (3) The prehabilitation programme will consist of one 90-min physical therapy group session weekly where patients get instructions for further respiratory, endurance and strength training at home.
- (4) Smoking cessation will be addressed by the nurse if applicable and guided smoke-stop initiated if desired.

## Introduction

Thoracic surgery impairs postoperative respiratory function resulting in a relatively high risk of developing postoperative pulmonary complications (PPCs), with an incidence of 19%–59%.<sup>1</sup> PPCs prolong the hospital length of stay, thereby



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increasing medical costs and reducing the hospital case load, and may decrease patients' quality of life and survival.<sup>2-4</sup> It is estimated that more than 1 million PPCs occur annually in the United States, with 46,200 related deaths and 4.8 million additional hospitalisation days.<sup>5</sup>

Advanced age, severity of cardiopulmonary diseases, complex and prolonged surgical procedures and mechanical ventilation, poor nutritional status as well as low aerobic capacity all have been identified as risk factors for PPCs.<sup>6-8</sup> Prehabilitation, defined as a proactive approach to optimise a patient's functional capacity prior to a major surgery or treatment, has become an increasingly popular area of research in recent years<sup>9</sup> and has been shown to reduce the risk of developing PPCs for people with non-small cell lung cancer (NSCLC).<sup>10-12</sup> However, these training interventions are often cumbersome, with low compliance in some patients and obvious difficulties to implement in a busy clinical practice within the short preoperative time period.<sup>13</sup> To our knowledge, so far, only one U.K. study has assessed qualitatively the perceived need for and expectations from prehabilitation in patients awaiting lung resection.<sup>14</sup>

One key approach to designing effective prehabilitation interventions that maximise compliance is by patient and public involvement (PPI). PPI involves engaging patients and members of the public in the research process, from study design until dissemination of final results. By involving patients and the public in the prehabilitation research process, researchers can enhance their understanding of patient needs and preferences and, therefore, design (study) interventions that are more likely to be accepted and adhered to.<sup>15,16</sup> By bringing unique perspectives and experiences to the research process, patients and the public can help researchers to identify and address potential barriers to prehabilitation uptake and adherence.

At present, in Switzerland, no multimodal clinical prehabilitation programmes are on offer. A prehabilitation study (NCT04461301) has been running at our centre since February 2022 for patients with surgery preparation times of at least 2 weeks. For the planning purpose of an additional study assessing feasibility and effects of a prehabilitation programme for patients awaiting lung resection with shorter surgery awaiting times, we performed a qualitative patient need assessment in the initial planning stages.

As a consequence, the aim of the present study was to assess qualitatively by means of semi-structured interviews (1) whether patients would welcome and participate in a prehabilitation programme in the short time before scheduled lung resection surgery, (2) what content patients would engage in, (3) how much time they would be willing to invest in such a programme, (4) what form of delivery they would

prefer (face-to-face or remote), and (5) whether they or their family were interested in engaging in a peer-group.

## Methods

### Study design and procedure

This study used a qualitative approach with thematic and focussed content analysis coding of semi-structured interviews.<sup>17</sup> Patients from the thoracic surgery consultation list of the Inselspital were contacted by phone and asked whether they were willing to participate in a face-to-face interview. Written informed consent was obtained from all patients before the study. This study was performed as clinical quality management control and did not require approval by our ethics committee according to the Swiss Human Research Act.<sup>18</sup> The guidelines by Swiss ethics with regard to distinguishing studies for research or quality control can be downloaded here: [https://swissethics.ch/assets/pos\\_papiere\\_leitfaden/191223\\_abgrenzung-qualitatssicherung-von-forschung\\_finalisierte-version\\_de\\_en.pdf](https://swissethics.ch/assets/pos_papiere_leitfaden/191223_abgrenzung-qualitatssicherung-von-forschung_finalisierte-version_de_en.pdf)

The Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist was followed to assure adequate reporting (Supplemental Material).<sup>19</sup>

### Study population

Consecutive patients who were seen in the rooms of the thoracic surgery department of our tertiary centre between 20 March 2023 and 10 May 2023 for planned lung resection due to NSCLC or metastatic disease, as well as patients completing a follow-up visit of lung resection surgery were eligible for this study. We decided to include patients both pre- and post-surgery because pre-surgical patients reflected the actual situation of the prehabilitation population and post-surgical patients had more distance to the pre-surgical situation and perhaps more insights of how they may have benefitted from prehabilitation. Exclusion criteria were insufficient proficiency in German or scheduling of the surgery consultation during times when the interviewer was unavailable.

### Data collection

Pilot interviews were conducted in five patients. Based on these interviews, a non-validated guide for the semi-structured interviews in this study was drafted and closed categories were formed for the question regarding the content of a prehabilitation programme as the pilot patients had no suggestions to the content. This draft was then tested in the first five study patients and slightly adjusted. All interviews were conducted by the same investigator (CK, female, medical student, trained

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by DE). She introduced herself to the patients as staff of the prehabilitation study team when she contacted patients by phone in advance during the recruitment process. At the beginning of the actual face-to-face interview conducted at the clinic, she informed the participants that the objective of the interview was to assess whether there was a patient need for a prehabilitation programme during the short waiting period for lung resection and how this programme should optimally be designed to meet patients' needs. She said that she was employed for an internship and had no personal interests in the programme. Then, participants were asked whether the interview could be audio-recorded. All questions were asked as open-ended as possible to encourage the flow of speech and to not restrict participants to pre-formulated responses. The interviews were held in Swiss German to create a pleasant and natural atmosphere for the participants and lasted between 25 and 45 min. To engage with the situation of the patient, the patient was first asked about his/her physical and mental well-being, his/her concerns, worries and sleeping problems awaiting surgery, whether or not they got support by family or friends, whether they felt physically fit, and what their expectations were from surgery and experiences with surgery in case of post-surgical patients. In the latter case, it was explained to the patients that they should give answers as they see fit now with regard to a potential prehabilitation programme during the time windows before surgery (i.e., would it have been beneficial to them to perform a prehabilitation programme, which content would have been important, etc.).

The interview included open questions on general interest in a prehabilitation programme, a question with closed categories on desired content of the programme (endurance, strength, respiratory training, relaxation and stress reduction techniques, nutrition counselling and substitution, smoking cessation, education on benefit of programme content and risk factor management, psychological counselling, counselling on sleep improvement), and further open questions on interest in shared decision-making for programme content, place of programme delivery (centre-based or remote), time commitment to the programme, readiness to use digital tools for remote delivery, involvement of family into the programme, and interest in peer groups. Detailed questions and verbal support when patients did not understand questions are shown in Table 1. Ideas, suggestions and other comments relating to the prehabilitation programme content or delivery that patients expressed outside the catalogue of questions were noted and discussed in the study team. If they were found to be relevant to the prehabilitation programme, they were included into a list. The study team then classified these comments and discussed the consequence that these comments could have on designing the prehabilitation programme.

### Data processing

The audio files of the interviews were transcribed by translating Swiss dialect into Standard German. The transcripts were

then either coded thematically or focussed deductively by assigning statements to a predefined code, such as (1) not at all important; (2) somewhat important; (3) quite important; and (4) very important, or by generating a new code when needed to capture all answers.<sup>17</sup> For each thematically coded item, it was noted in which context the statement was made in order to later identify possible context-specific patterns and to compare the different contexts. A table was created to group statements according to their codes. Data coding was conducted by CK. After the first five interviews, the questions and their order were reviewed and discussed in the study team and adjusted as appropriate.<sup>20</sup> Since the interviews were only partly transcribed, they were not returned to participants.

Smoking was coded as never smoking (0), past smoking (smoke stop  $\geq 3$  months previously) and present smoking (active smoking and time since smoke stop  $< 3$  months), whereby passive smoking was also grouped into present or past smoking. Pack-years (PY, number of cigarettes packs per day multiplied by years of smoking) were calculated for smokers only.

### Statistical analysis

Edited transcription, coding (both thematic and focussed) was performed in Microsoft Excel (Microsoft Office 2016). Descriptive non-parametric statistics were performed using R (Version 4.1.0, R Core Team; <https://www.r-project.org/>) to present the results. Sample size was based on previous similar studies assessing expectations from prehabilitation programmes.<sup>21–24</sup>

## Results

### Study population

Thirty patients were identified suitable from a thoracic surgery list and were contacted by phone. Of these, three did not answer the call and five declined participation (two had no interest in participating in a study, two were unavailable with such short notice and one needed time to get to grips with the cancer diagnosis). Twenty-two patients (45.5% female, mean age  $70.6 \pm 7.7$  years) were willing to perform the interview and consented to their data and answers being used for publication.

Of the 22 semi-structured interviews, 21 interviews went well and answers to most questions could be received. One interview was dominated by a patient raising concerns about her experience with surgery and the lack of alternative therapies at this tertiary clinic and consequently not all interview questions could be addressed. Seventeen patients completed the interview alone, while five patients were accompanied by family (two by spouse and three by sons/daughters). One patient only spoke broken German and his daughter helped with translation when necessary.

Nineteen patients (86%) had NSCLC and three patients had metastatic cancer (Table 2). The majority of the study

**Table 1.** Questions used in the semi-structured interviews. Question 11 contained closed category answers. Closed category answers for questions 18–21 were conveyed to patients only when the patients could not give a spontaneous answer.

Themes	Questions
Setting the scene	<ol style="list-style-type: none"> <li>1. What is your diagnosis and how are you feeling/did you feel while awaiting surgery?</li> <li>2. What is/was your personal motivation regarding the surgery?</li> <li>3. What are/were your greatest concerns about the planned surgery?</li> </ol> <p>The first three questions were not evaluated but served the purpose of the interviewer and the patient getting to know each other</p>
Mental and physical state before surgery	<ol style="list-style-type: none"> <li>4. Do/did you suffer from anxiety, worries, nervousity, agitation or circling of thoughts awaiting surgery?</li> <li>5. Do/did you get support by relatives or friends?</li> <li>6. How do/did you sleep?</li> <li>7. Do/did you feel physically fit?</li> </ol>
Knowledge of and opinion about a prehabilitation programme	<ol style="list-style-type: none"> <li>8. How important do/did you think it is to prepare yourself personally for the surgery?</li> <li>9. Have you ever heard of prehabilitation?</li> <li>10. Would you be/have been willing to participate in an individualised surgery preparation programme? If not, why not?</li> </ol>
Content of prehabilitation programme	<ol style="list-style-type: none"> <li>11. What would a prehabilitation programme need to include for you to benefit from it?               <ol style="list-style-type: none"> <li>(a) Increase in physical activity/endurance</li> <li>(b) Increase in muscle strength</li> <li>(c) Optimisation of nutrition and/or taking supplements</li> <li>(d) Training of the respiratory muscles</li> <li>(e) Meditation/relaxation techniques and/or breathing exercises</li> <li>(f) Smoking cessation (with nicotine substitution products)</li> <li>(g) Education about risk factor management</li> <li>(h) Psychological support</li> <li>(i) Peer group for patients</li> <li>(j) Peer group for relatives</li> </ol> </li> </ol>
Mode of physical activity	<ol style="list-style-type: none"> <li>12. If you are/were interested in physical activity, what kind of sport (walking, hiking, gymnastics, swimming, etc.) do you prefer?</li> </ol>
Involvement of family	<ol style="list-style-type: none"> <li>13. Do you think your family would like/have liked to be involved into prehabilitation (to exchange with other relatives, to exchange with former patients/relatives, to attend information events)?</li> </ol>
Smoking cessation	<ol style="list-style-type: none"> <li>14. Do you or did you smoke?</li> <li>15. If you are/were a current smoker, would you be/have been interested in a guided smoke stop (with nicotine supplements)?</li> <li>16. If you are/were a former smoker, when did you stop smoking and did you stop with a guided smoke stop programme?</li> </ol>
Activity tracking	<ol style="list-style-type: none"> <li>17. Would you be willing to wear a device that records your physical activity and sleep?</li> </ol>
Time commitment for prehabilitation	<ol style="list-style-type: none"> <li>18. How many days per week would you be/have been able to spend on a prehabilitation programme?  <input type="checkbox"/> 1–2 days <input type="checkbox"/> 3–4 days <input type="checkbox"/> 5–6 days <input type="checkbox"/> every day</li> <li>19. How much time would you be/have been willing to spend per day on a prehabilitation programme?  <input type="checkbox"/> 15 min <input type="checkbox"/> 30 min <input type="checkbox"/> 45 min <input type="checkbox"/> 60 min <input type="checkbox"/> more than 60 min</li> </ol>
Programme delivery	<ol style="list-style-type: none"> <li>20. Which type of programme delivery would you prefer/have preferred?  <input type="checkbox"/> Individual <input type="checkbox"/> in a group <input type="checkbox"/> Independently <input type="checkbox"/> With guidance/supervision</li> </ol>
Programme location	<ol style="list-style-type: none"> <li>21. Which location would you prefer/have preferred?  <input type="checkbox"/> At home <input type="checkbox"/> Close to home <input type="checkbox"/> In hospital</li> </ol>
Contact during home-based programme	<ol style="list-style-type: none"> <li>22. If the programme was delivered home-based, would you be willing to be contacted by telephone or by video conference during the programme?</li> <li>23. Do you have a smartphone; Internet connection; Email address?</li> <li>24. Can you operate a tablet?</li> <li>25. Can you attend a zoom meeting?</li> </ol>
Shared decision-making	<ol style="list-style-type: none"> <li>26. How would you like to receive information/education about a prehabilitation programme?            By App; video; flyer; Email with digital flyer</li> <li>27. With regard to shared decision-making, would you like to self-direct your training programme or would you rather have a prescribed programme?</li> <li>28. Do you feel that you have been involved in decision-making during your treatment so far?</li> </ol>

participants (81.8%) performed the interview after lung resection, with a mean time of 12.6 months (SD 14.6) after surgery. Six patients were current and 11 were past-smokers,

of whom one patient was a passive smoker. Nearly half (45%) of the patients reported to fulfil the recommended 150 min of at least moderate physical activity per week. Twelve patients

**Table 2.** Baseline characteristics of the 22 study participants. Shown are mean  $\pm$  standard deviation or number of patients (percent).

Variable	mean $\pm$ standard deviation or number of patients (percent)
Age, years	70.6 $\pm$ 7.6
Female sex	10 (45.5)
Diagnosis	
NSCLC	19 (86.4) <sup>a</sup>
Metastatic disease	3 (13.6)
Time of the interview	
Preoperative	4 (18.2)
Postoperative	18 (81.8)
Median time (months) passed since surgery in postoperative patients	7.5
Smoking	
Present smoking	6 (27.3)
Past smoking <sup>b</sup>	11 (50.0)
Pack years of present smokers	37.8 $\pm$ 12.4
Pack years of past smokers	59.2 $\pm$ 44.1
Physical activity	
$\geq$ 2.5 h per week	10 (45.5)
<2.5 h per week	12 (54.5)

NSCLC: non-small cell lung cancer.

<sup>a</sup>In one case NSCLC was suspected only.

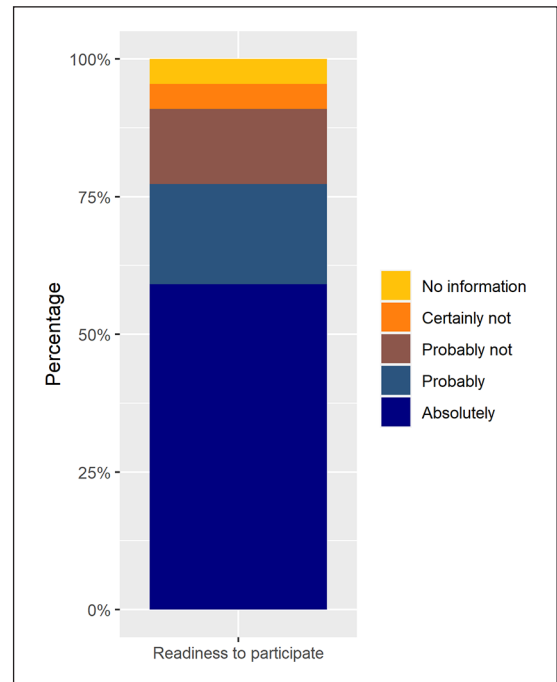
<sup>b</sup>In one case past smoking was passive smoking.

felt that they were physically fit (of whom two said that they felt mentally drained), eight patients said that their physical limitation was due to a previous surgical intervention, accident or illness, and only one patient stated that he was physically unfit because of his lung disease.

The motivation to undergo surgery was to regain an active lifestyle without being physically limited in nine patients, to cope with activities of daily living in two patients, to become healthy again in six patients, to receive an unambiguous diagnosis in two patients, to see her grandchildren grow in one patient and to start a smoke-free life in one patient.

Eleven patients felt tense, nervous and agitated awaiting surgery, six patients were afraid of the surgery and potential complications, two patients were anxious about the diagnosis following surgery, one patient was afraid of the hospital stay, one patient worried about his family and one patient worried about financial difficulties. Nevertheless, three patients said they were trying to stay positive, three patients tried to not think about their diagnosis and one patient said that she was hopeful for the future.

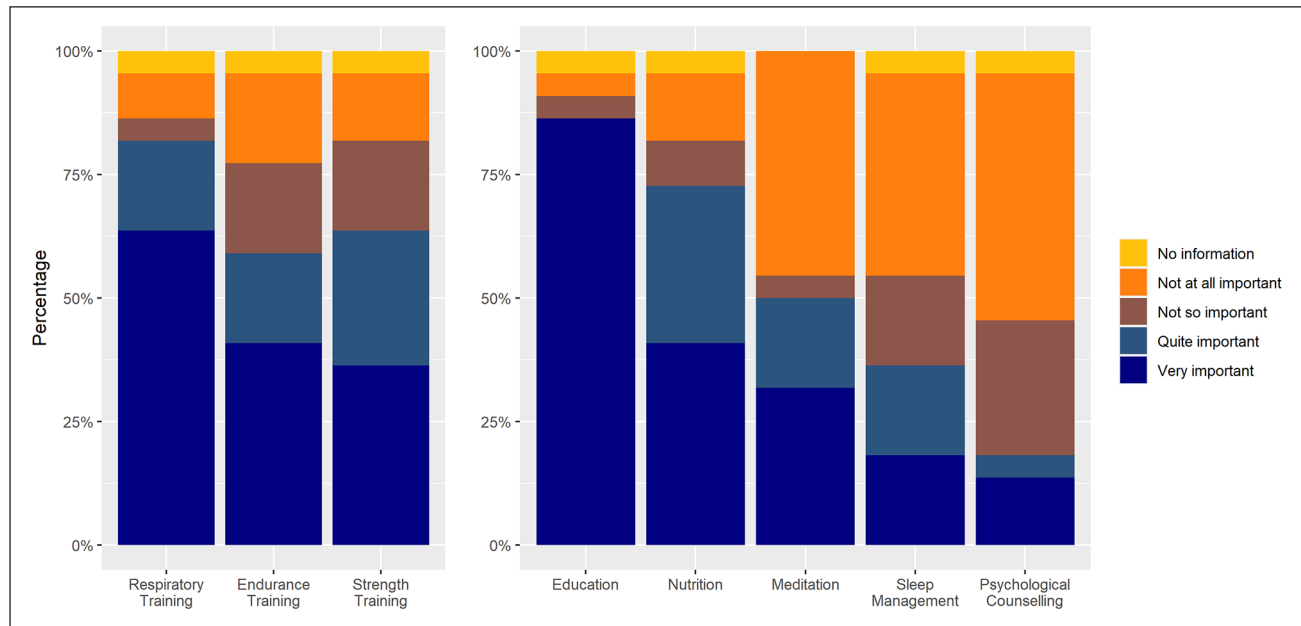
Only 6 out of 22 patients said that they did not have sleeping problems awaiting surgery. Seven patients said that they had difficulties sleeping because of worries and disturbing thoughts. Three patients said they used sleep medication occasionally, two patients used sleep medication permanently and one patient used plant-based sleep medication occasionally.



**Figure 1.** Patient willingness to participate in a prehabilitation programme. Shown are the themed answers to the Question: Would you be/have been willing to participate in an individualised surgery preparation programme?

### Willingness to participate and content of a prehabilitation programme

Only 1 patient had heard about the concept of prehabilitation before. After patients received verbal information about the purpose and content of a prehabilitation programme, 13 patients said that they would /would have very gladly participated in a prehabilitation programme, 4 patients may have participated, 3 may rather not have participated, 1 patient would certainly not have participated and 1 person did not respond to this question (Figure 1). Endurance and strength training was rated very important by 9 and 8 patients, respectively, quite important by 4 and 6, respectively, and not so important and not important at all by 4 and 3 patients, respectively (Figure 2). Of note, most patients gave a consistent rating for these two training modalities. Respiratory training was rated very important by 14 patients, important by 4, not so important by 1 and not important at all by 2 patients (Figure 2). Training in meditation techniques was rated very important by 7, quite important by 4, not so important by 1 and not at all important by 10 patients (Figure 2). Addressing sleep improvement was rated very important by 4, quite important by 4, not so important by 4 and not at all important by 9 patients. Psychological counselling was rated very important by 3, quite important by 1, not so important by 6 and not at all important by 11 patients (Figure 2). Education on risk factor management was rated



**Figure 2.** Patients' rating of the content of a prehabilitation programme. Shown are the themed answers to the Question: What would a prehabilitation programme need to include for you to benefit from it? Training of the respiratory muscles; Increase in physical activity/endurance; Increase in muscle strength; Education on risk factor management; Optimisation of nutrition/supplements; Meditation/relaxation techniques and/or breathing exercises; Sleep management; Psychological counselling.

very important by 19, not so important by 1 and not at all important by 1 patient (Figure 2). Nutrition counselling and supplementation was rated very important by 9, quite important by 7, not so important by 2 and not at all important by 3 patients (Figure 2). All of the above questions except meditation training had one missing answer.

Out of 17 patients who were asked the question about shared decision-making (because we added this question after the method evaluation after the first 5 patients), 11 patients rated shared decision-making with regard to the content of the programme very important, 2 quite important, 3 not so important and 1 patient not important at all.

### *Time and place of prehabilitation programme*

Eight patients would have clearly preferred a centre-based prehabilitation programme, 4 would have clearly preferred a home-based programme, 2 patients would have preferred the programme to have taken place in their home town and 6 patients said that they welcomed either, depending on what would make most sense (e.g. a group fitness training would be better centre-based, but respiratory training could easily be performed at home), and 2 patients did not answer this question. Four patients preferred training in a group, seven patients preferred training independently on their own, two patients would have wanted individual training sessions with a health professional and one patient was not interested in a prehabilitation training. Seventeen patients welcomed a digital delivery of home training, while five patients would have

wanted all instructional and educational material in paper format and to be contacted by phone.

Type of physical activities that patients were interested in were walking (18 patients), gymnastics and strength training (12), cycling (8) and swimming (3).

Nineteen patients gave an answer with regard to the amount of time they would be willing to spend on a prehabilitation programme. Patients were prepared to spend a mean 2.6 sessions per week with a mean duration of 78 min/session, equating to 2 h 42 min per week.

Remote monitoring of daily steps and sleep would have been welcomed by 2/3 of the patients, answers with regard to monitoring of steps and sleep were congruent.

Seventeen patients could imagine receiving education and training instructions digitally (some would need help but could organise help from friends or family), while five patients would only communicate via phone and would want instructions on paper.

### *Smoking cessation*

Of the 6 (27.3%) active smokers, 4 (66.7%) were not at all interested in a smoking cessation programme including nicotine replacement products. One active smoker may have been interested and one patient would definitely have been interested in a smoking cessation programme.

Of the 11 former smokers, 8 stopped smoking without a smoking cessation programme and without any nicotine replacement products. Only one patient stopped smoking

with a smoking cessation programme before receiving the diagnosis of NSCLC. One patient gave no information to how the smoke stop was performed and one patient was a passive smoker working in a restaurant where smoking was allowed until its ban in 2009. Three patients stopped smoking before their lung cancer diagnosis following the advice of their general practitioners, and of one past smoker information on the circumstances leading to smoking cessation was missing.

### *Involvement of family or with peers*

Five patients would very much welcome the integration of a family member as a facilitator and supporter of a prehabilitation programme, 7 may welcome the integration of family, 1 patient would rather not integrate family and 8 patients would not integrate family into a prehabilitation programme.

Three patients would be interested in an involvement with a peer group, two patients may be interested in an involvement with a peer group, two patients rather declined and 13 patients definitely declined an involvement with a peer group.

One patient said that his spouse would definitely be interested in getting involved in a peer group, two patients thought that their family would rather not and 15 said that their family would definitely not be interested in getting involved in a peer group.

### *Unexpected answers leading to formulation of hypotheses*

The following points were raised outside the predefined questions (Table 3). We rated these comments as important for future design of prehabilitation programmes.

## **Discussion**

This is the first study in Switzerland assessing the demand for and the expectations from a prehabilitation programme in patients awaiting lung resection. In line with the findings of the only previous study in lung resection patients conducted in the U.K.,<sup>14</sup> we found that patients were overall interested (81%) in such a programme. They were most interested in receiving education on how they would benefit from the components of the programme, and they would have been happy to perform approximately 2.7h/week of physical exercise consisting of respiratory, strength and endurance training. They were also interested in nutrition counselling and supplementation, but less interested in psychological counselling, meditation or a peer group, despite the fact that almost all patients were feeling anxious and worried awaiting surgery. Most patients preferred conducting exercise training at the hospital in group sessions; however, they were open to perform respiratory or walking training at home. Most of them would have been happy to digitally receive information or be contacted.

Further, our patients were (very) interested in shared decision-making regarding the content of the programme, which was also found in patients awaiting major abdominal cancer surgery.<sup>25</sup>

With regard to the content of the programme, patients were mainly interested in respiratory training (82%), endurance (62%) and strength (67%) training, as well as education (90%) on risk factor management. Education on how patients may benefit from a prehabilitation programme was rated very important by nearly all of our patients, congruent to what was found in an elderly population with colorectal cancer awaiting or having undergone surgery.<sup>22</sup>

Surprisingly, patients were interested in prehabilitation programme content that would help improving their physical fitness despite the fact that more than half of the patients felt physically fit. The perception of being already fit enough was also found by the U.K. study on cancer patients awaiting lung resection and identified as a barrier to exercise.<sup>14</sup> This raises the question whether physical tests such as maximal inspiratory pressure, grip strength, time-up-and-go or 6-min-walking tests may be helpful to objectively quantify patients' physical fitness to point out potential room for improvement.

Nutrition counselling was rated as (quite) important component by 76%, while only 50% rated meditation and only 38% sleep management as at least quite important. Previous studies on patients' needs with regard to prehabilitation content have addressed the content in a much less detailed form,<sup>14,26</sup> making a comparison with our results difficult. However, these studies found that patients prefer exercise that is not too intensive.<sup>22,26</sup>

Despite the fact that most patients felt tense and/or anxious, only 19% of our patients were open for psychological counselling. However, we did not ask patients whether they think that an involvement in a prehabilitation programme would (have) improve(d) their mental state. Namely, a study by Gillis and colleagues found that in patients who had undergone colorectal surgery, patients perceived passively awaiting surgery as stressful and thought that involvement in a prehabilitation programme would have ameliorated their situation by making the waiting period busier and allowing them to meet and exchange with peers.<sup>23</sup> Patients in their study welcomed a peer group (as long as peers with very bad outcomes of surgery were excluded), which is in contrast to our study where only 25% of our patients were interested in participating in a peer group. Disparities between their and our findings may be due to cultural differences. Less than half of our patients would have welcomed the involvement of family. It is possible that answers would have been different had we asked the question less ambiguously as to whether patients would have wished the involvement of family rather than whether they thought their family would have liked to be involved.

Most patients preferred an in-hospital delivery of the programme, whereby most patients said that it depended on the type of activity. For example, they felt it made more

**Table 3.** Patients comments outside the predefined questions and themes with importance to content and conduction of a prehabilitation programme.

Feedback	Supporting data	Consequence for design of prehabilitation programme
Need for a single point of contact with whom patients can address questions regarding diagnosis, planned surgery and hospital stay	P21: "I felt that I did not receive coordinated interdisciplinary information. I trust the specialists and was hoping for more information. I think that a single point of contact would have helped."; P19 «I would have appreciated further exchange with health professionals because I still had questions with regard to diagnosis and hospital stay." P11: "After the consultation I still didn't know what to expect. I would have liked to first digest the diagnosis but then have a health professional with whom to discuss my diagnosis and further procedures."	Recruitment of an Advanced Practitioner Nurse as single point of contact who will be available to prehabilitation patients at certain times on a weekly basis
Concerns about data security/privacy collected by wearable devices	P9: "I do not want to wear a device that monitors my sleep and my physical activities. I feel policed and I don't know who can look at my data."; P3: "I am apprehensive toward these technical things. I don't know exactly where my data will end up."	Provision of detailed information on storage and use of data collected by wearable devices. Provision of options that exclusively allow patients to see their own data without monitoring by health professionals
Critique on design of flyer for prehabilitation programme	P9: "On the prehabilitation flyer I can see very well the content of the prehabilitation programme. However, I still can't see how I can benefit from the programme."; P19: "After reading the flyer I don't see how I can benefit from the single components of the programme and whether there is evidence for these components to help with regard to the surgery."	Design of the flyer should convey the benefits (with reference to evidence) of the prehabilitation programme to the patients more than the content

sense to perform a respiratory training session at home, but endurance or strength training at the hospital or a fitness centre/physiotherapy rooms near their residence. This is in line to what was found in a study using questionnaires in cancer patients performing prehabilitation before surgery where they opted that prehabilitation training should mainly take place at home but one session per week should be offered at the hospital,<sup>27</sup> or another study in oncologic gynaecologic surgery patients in the Netherlands which found that patients preferred a supervised exercise programme in a fitness centre close to their home.<sup>21</sup> Long travelling distance may deter patients from attending exercise sessions at the hospital; however, it seems that at least some interaction with other patients and/or health professionals is desired.

From points raised by patients that were not part of our predefined themes, we learnt that some patients would welcome the presence of a nurse who could give information on the programme, but also answer clinical questions the patients may have with regard to their diagnosis and planned surgery. To have a nurse as a single point of contact in a prehabilitation programme was also found important in a study with oncologic gynaecologic surgery patients.<sup>21</sup>

Strengths of the present study were the inclusion of patients both before and after surgery, reflecting, on the one hand, the situation of the target population and, on the other hand, a more informed view of a population who already

underwent surgery. Based on the 79% participation rate, we could gather information of a representative sample of our lung resection population. We utilised the state-of-the-art methodology of semi-structured interviews that has been recommended for patient involvement in many reviews and guidelines.<sup>28–30</sup> Retrospectively, data saturation was reached after 11 patients; nevertheless, we considered it valuable to be certain that no new information was received amongst the 10 successive interviews.

The limitations were that only four of our patients were pre-surgery, while more than 80% were post-surgery. The reason for this was that due to staff shortage in the operation theatre not many lung resections were planned during the time window within which we performed the interviews. Patients who had just been scheduled for surgery were also less willing to participate in the interviews, implying that they may also be less interested in prehabilitation. Whether patients will take up prehabilitation in the short time period before lung resection will have to be assessed when a prehabilitation programme will be offered. While patients post-surgery have a good understanding of what may have benefitted them pre-surgery, it does not mean that patients who have just received a cancer diagnosis and have many appointments to attend and provisions to make in the limited time period before surgery also regard prehabilitation as beneficial. Further, whether patients would physically engage in the programme content that they deem important verbally



will have to be assessed in future studies. Last but not least, we did not have data on socioeconomic status available and could not compare study participants to non-participants.

## Conclusions

We will design a prehabilitation programme for patients awaiting lung resection based on the preferences patients outlined in this study. This programme will give high priority to education, which we will co-create and provide online. Next to providing instructions for daily home training during one 90-min weekly physical therapy group session with regard to respiratory training, endurance and strength training, patients will have one session with an advanced practitioner nurse who will be their single point of contact, who will answer questions the patients may have with regard to their diagnosis, their surgery, and their prognosis. Psychological counselling and smoking cessation will be addressed by the nurse if applicable and guided smoke-stop initiated if desired. These priority components have been suggested by lung resection patients of whom 81% were post-surgery; therefore, whether the suggested content will also be attractive to pre-surgery patients and whether pre-surgery patients will be willing and able to participate in such a programme will have to be assessed once the programme has been set up.

Further, in collaboration with the Behavioural Psychology Department of the University of Berne, we will conduct a qualitative study with surgical patients (other than lung resection) who have just participated in a multimodal prehabilitation program to specifically identify facilitators and barriers to participation in such a program.

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## Authors' contributions

DE, PE, TV and CK designed the study. CK conducted the interviews. CK, PE, and DE conducted the thematic analysis. PE and CK drafted the manuscript. RE created the graphical representation of data. DE, TV and RE critically read and revised the manuscript. All authors read and accepted the final version of the manuscript.

## Data availability statement

Coded data can be made available upon request from the corresponding author.

## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## Ethical approval

Ethical approval was not sought for the present study because this study was performed as clinical quality management control and did not require approval by our ethics committee. No identifiable patient data was collected for these semi-structured interviews.

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## Supplemental material

Supplemental material for this article is available online.

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