

# Towards Cancer Rehabilitation at Home.

## Design of a Telerehabilitation Service for Lung Cancer Patients

J.G. Timmerman<sup>1,2</sup>, T.M. Tönis<sup>1,2</sup>, M.W.J.M. Wouters<sup>3</sup>, M.G.H. Dekker-van Weering<sup>1</sup>, H. J. Hermens<sup>1,2</sup>,  
M.M.R. Vollenbroek-Hutten<sup>1,2</sup>

<sup>1</sup>Roessingh Research and Development, Telemedicine Research Group, Enschede, The Netherlands

<sup>2</sup>University Twente, Faculty of Electrical Engineering, Biomedical Signals and Systems, Telemedicine group, Enschede, The Netherlands

<sup>3</sup>Nederlands Kanker Instituut-Antoni van Leeuwenhoek, Amsterdam, The Netherlands

### Background

Although lung resection still provides the best long-term outcome for lung cancer, it is also associated with a considerable decay in physical and psychosocial health status<sup>1,2</sup>. If not controlled, these symptoms can hamper postsurgical recovery, and lead to unscheduled healthcare use<sup>3</sup>. This study aimed to determine the clinical relevance of and functional requirements for a telerehabilitation (TR) service to support recovery following lung resection.

### Methods

A sociotechnical scenario-based design approach was used, characterized by early and systematically involvement of patients and healthcare providers during an iterative design process (figure 1). First, end users' requirements for the TR service were explored by means of semi-structured interviews. Subsequently a small focus group with healthcare providers from the Netherlands Cancer Institute – Antoni van Leeuwenhoek hospital (NKI-AVL) in Amsterdam was organised to establish requirements for the TR service in more detail. The findings from the interviews and focus group were summarized in a scenario and validated by healthcare professionals from the NKI-AVL.

### Results

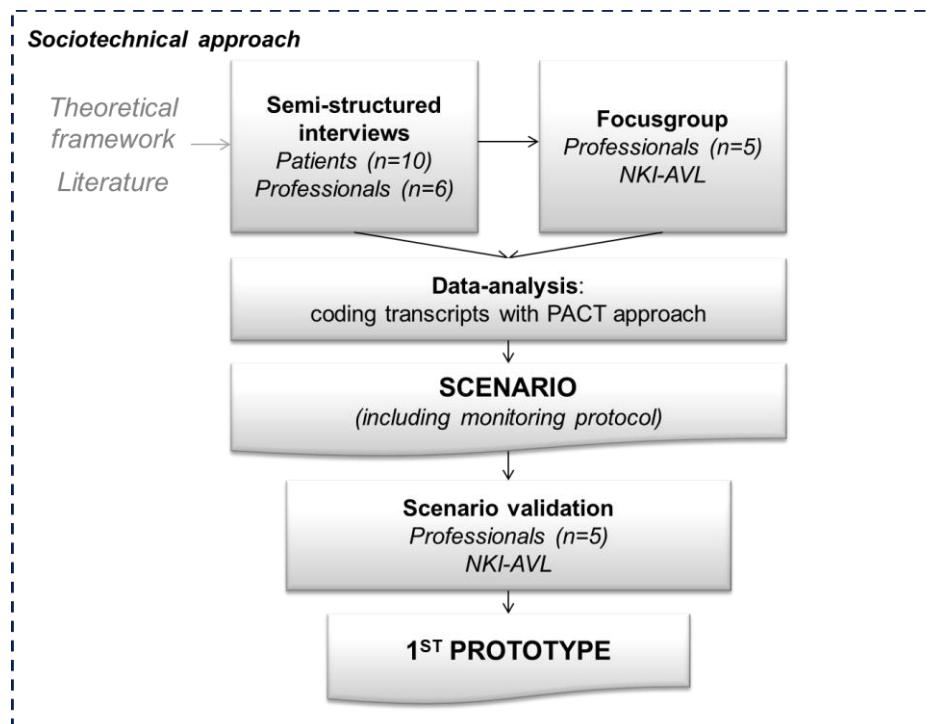
Survivors and professionals expected a TR service to be beneficial for improving quality of current care, and identified three modules that should be included in the TR service: ambulant monitoring of recovery and symptoms, home exercise programs and patient-provider contact. The functional requirements for these three modules and general requirements as reported by the patients and professionals are presented in table 1. The results also indicated that successful implementation of the service will be promoted by structurally embedding the service in existing healthcare processes, and record clearly the specific roles and responsibilities of all involved healthcare professionals.

### Conclusion

End-users showed positive intention to use a TR service for home-based symptom monitoring and rehabilitation. At this moment, a prototype of the TR service is designed, which will be evaluated this summer in patients and healthcare providers to improve end-users' acceptance.

- 1 Brunelli, A. *et al.* Quality of life before and after major lung resection for lung cancer: a prospective follow-up analysis. *The Annals of thoracic surgery* **84**, 410-416, doi:S0003-4975(07)00747-3 [pii]  
10.1016/j.athoracsur.2007.04.019 (2007).
- 2 Brunelli, A. *et al.* Evaluation of expiratory volume, diffusion capacity, and exercise tolerance following major lung resection: a prospective follow-up analysis. *Chest* **131**, 141-147, doi:131/1/141 [pii]  
10.1378/chest.06-1345 (2007).
- 3 Wang, K. Y. *et al.* Post-discharge health care needs of patients after lung cancer resection. *J Clin Nurs* **19**, 2471-2480, doi:10.1111/j.1365-2702.2010.03298.x (2010).

**Figure 1** Flowchart of methods used for end users' requirements elicitation and analysis.



**Table 1 Functional requirements for the telerehabilitation service**

 <p><b>MONITORING</b></p>	<p><i>Monitoring of recovery, perceived symptoms and physical activity.</i></p> <ul style="list-style-type: none"><li>• Ambulant monitoring for multiple days per week at:<ul style="list-style-type: none"><li>• 2 weeks pre-surgery (baseline) and at 1, 3 and 6 months post-surgery</li></ul></li><li>• Connect and disconnect sensors (e.g. HR, O<sub>2</sub>) on patients' demand</li><li>• Parameters: heart rate, O<sub>2</sub> saturation, physical activity, weight, symptoms (pain, fatigue, dyspnea), pain medication use, experienced of QoL and daily disability.</li></ul>
 <p><b>EXERCISE</b></p>	<p><i>Promote physical activity and improve physical fitness pre- and post-surgery.</i></p> <ul style="list-style-type: none"><li>• Minimally once face-to-face contact with healthcare professional</li><li>• Supervised and supported by healthcare professional (from distance)</li><li>• Individually tailored when needed</li><li>• Exercises illustrated in video and text</li></ul>
 <p><b>CONSULTATION</b></p>	<p><i>Enable flexible, efficient and timely patient-provider consultation.</i></p> <ul style="list-style-type: none"><li>• Additional service; no replacement of regular consultation</li><li>• Chat-appointment: short questions or reassurance</li><li>• Clear responsibility for email/message handling</li></ul>
 <p><b>DATA ACCESS</b></p>	<p><i>Enable adequate data access and interpretation</i></p> <ul style="list-style-type: none"><li>• Integration of outcome parameters to enable interpretation</li><li>• Summary of relevant data</li><li>• Data accessible by clinicians/professionals prior to planned consults</li><li>• Post-surgery recovery compared to pre-surgery results</li></ul>
 <p><b>GENERAL</b></p>	<p><i>General requirements for TR service</i></p> <ul style="list-style-type: none"><li>• Flexible system for individual tailoring</li><li>• User-friendly and high mobility to enable independent and home-based use by an elderly population without restricting daily activities</li><li>• Integration with existing (hospital) electronic patient records</li></ul>