

Preoperative optimization of physical functioning in patients with colorectal cancer

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Valorization

By law, Dutch universities have three main tasks; to educate at an academic level, to conduct scholarly research, and to ensure that research findings impact society. The latter is called *valorization*, with the following commonly used definition: “knowledge valorization is the process of creating value from knowledge, by making knowledge suitable and/or available for social and/or economic use, as well as by making knowledge suitable for translation into competitive products, services, processes, and new commercial activities” (adapted definition based on the National Valorization Committee 2011:8). This valorization chapter describes the possible value of the knowledge, products, and services developed and validated in this thesis, in which the author, as an “embedded scientist”, combined daily clinical practice with the scientific evaluation and interpretation of clinical practice using usual care data for its analysis and the *embedded research*.

BACKGROUND

Nationwide, people are getting older, and the incidence of colorectal cancer will increase accordingly. With the advances in health care, more personalized treatment options are available, which lead to improvements in survival rate. Consequently, the amount of people living with (the consequences of) cancer and its corresponding treatment is increasing [1]. This thesis, as part of a nationwide program on perioperative care, aimed to examine the complete people’s journey and treatment course of patients with colorectal cancer scheduled for elective surgery. Finally, the aim was to develop and implement optimal evidence-based physical therapy management, during the pre- and postoperative care pathway for patients with colorectal cancer, based upon the study findings. In order to support personalized health care, in which the appropriate individual physical therapy treatment is executed in joint coalition with the patient and his/her social relatives, at the right time, and in the right context.

This thesis provided innovative ingredients as; an overview of (the variation in) pre- and postoperative physical therapy management for patients opting for major elective abdominal surgery (2016-2017) and the associations between preoperative performance parameters of physical fitness and postoperative outcomes (time to recovery of physical functioning, incidence and type of postoperative complications, length of hospital stay). Furthermore, it gave insight in changes in performance-based physical fitness and skeletal muscle measurements, before and after neoadjuvant chemoradiotherapy in single subjects with locally advanced rectal cancer, and in preoperative physical exercise training (prehabilitation) during neoadjuvant treatment for the same patient population. Finally, preparations for the evaluation of a personalized supervised home-based prehabilitation program were made by

constructing a study protocol for the evaluation of the feasibility of the program and the monitoring of relevant parameters during the program. These ingredients cover the whole patient journey and provide insight in specific elements of performance-based physical functioning throughout this journey and the treatment course of patients with colorectal cancer.

SOCIETAL RELEVANCE

With the aging population, the incidence of diseases, including (colorectal) cancer is increasing [2,3]. Consequently, these changes challenge health care systems with increasing demands and the associated costs. For example, there is more need for long-term care and chronic disease management [4]. Moreover, elective surgery, the main treatment modality for colorectal cancer, has relatively high rates of morbidity and mortality [5,6]. A complicated postoperative course and/or suboptimal postoperative outcomes influence a patient's recovery of physical functioning and perceived health-related quality of life. Moreover, complications following colorectal cancer surgery are associated with a substantial increase in health care costs [7]. Hence, without a complicated postoperative period, patients can still experience a decrease in (independent) physical functioning and/or health-related quality of life due to the pathology, its treatment and the (function related) consequences of both. Optimizing the patient care pathway by targeting the right patients for preventive interventions may positively influence the treatment course and patient outcomes, as well as the corresponding health care profits and costs.

Inadequate levels of preoperative physical fitness are known to be associated with worse postoperative outcomes (e.g., higher risk for morbidity and mortality, higher risk for a prolonged length of hospital stay) after major abdominal surgery [8-10]. Preoperative interventions as physical exercise training and nutritional support can contribute to improving the level of preoperative physical fitness [11], which is likely to benefit postoperative (short-term) outcomes and (long-term) recovery of physical functioning and health-related quality of life [12], especially in high-risk patients. This latter will probably also improve health care values and at the same time lower the corresponding health care costs.

With adequate preoperative risk stratification, discrimination between the preoperative physical fitness levels of groups and - more relevant - probably also individual patients can be accomplished. Consequently, health care can be better adapted to the individual patient's needs (patient-tailored care). For example, patients with inadequate levels of physical fitness (high-risk patients) can be suggested to take part in supportive preoperative interventions. This will lead to a more efficient use of resources through the delivery of effective preventive interventions in the right patients, thereby of value in avoiding less effective high-cost interventions [13].

One aspect of this thesis was the implementation and execution of a preoperative screening of physical fitness followed by a personalized tailored advice on physical activity and physical fitness during the pre- and postoperative treatment course. Consequently, patients with colorectal cancer are more properly guided throughout their treatment course, focusing on reducing the loss of physical functioning associated with major surgery and facilitating a swift return to (vital) physical functioning in society during the pre- and postoperative phase. This can positively contribute to independent physical functioning and a better quality of life in patients with colorectal cancer. So, this preoperative screening of physical fitness can be of relevance to the patients.

TARGET GROUPS

The overall findings of this thesis are of value to patients and their social relatives, physical therapists, anesthesiologists, surgeons, other health care professionals, and (embedded) scientists.

Individual patients

In this thesis, (small) groups of individual patients were studied in the real-life context of our hospital with multiple measurements (e.g., pre- and postoperative, before and after neoadjuvant treatment). Results can be applied to individual patients and can contribute to personalized physical therapy care. Studies with small sample sizes or n=1 studies contribute to evaluating interventions among specific patients with different characteristics in their specific context. Moreover, results from multiple n=1 studies, gathered in a standardized way, can generate results applicable to a wider population [14]. By combining data from n=1 studies, common characteristics among patients who respond best to a specific intervention can be identified, at least that is the conviction that we would want to underline. For example, patients who respond best to a certain intervention may share genotypic, biomarker, clinical, or demographic characteristics [14]. Knowledge of these common aspects helps health care professionals by choosing a particular intervention for future patients with comparable characteristics. For the profession of physical therapy, such kind of research efforts may be helpful to enter the approach of personalized physical therapy, in parallel with the shift to personalized health. Future studies have to demonstrate the advantage of this approach, especially in the context of preoperative physical therapy as part of the prehabilitation concept.

(Inter)national colleagues and students

The research findings were shared with direct colleagues at the department of physical therapy (Maastricht UMC+) and colleagues from other Dutch hospitals (community of practice) on a regular basis. Moreover, during this thesis project, there was a collaboration between the department of physical therapy of the Maastricht UMC+ and the physical therapists working in outpatient physical therapy practices (n=20) within the catchment area of the hospital. One goal of this collaboration was to strengthen the link between outpatient physical therapy care and in-hospital physical therapy care, covering the complete patient journey. Hereto, physical therapy colleagues within and outside the hospital could learn from each other and benefit from the findings gathered during this thesis project. Besides, the colleagues in this collaboration were trained and educated in exercise physiology, preoperative home-based exercise training, motivational interviewing, monitoring progression during therapy sessions, and nutritional support during training. Furthermore, knowledge was shared with students from several educational levels (bachelor physical therapy, master physical therapy, master human movement sciences) with practical skill lessons, lectures, and thesis projects. Finally, knowledge gathered during this thesis was shared in (inter)national conferences concerning prehabilitation, physical therapy, nursing, and health sciences.

Healthcare professionals

This research project stimulated interdisciplinary teamwork, along the journey of each specific patient and his or her social relatives (e.g., partner, family), as several health care professionals worked together in this project. Surgeons, anesthesiologists, nurses, case managers (often a colorectal care nurse), dieticians, and physical therapists worked together during the whole journey per patient and during the research project period. Furthermore, findings and knowledge were presented several times during the project at hospital gatherings at the department of physical therapy, anesthesiology, surgery, and the nursing wards.

Other scientists

The (embedded) research procedures performed in this thesis might be of value for other (embedded) scientists. Data was collected during daily routines, which stimulates the direct translation from study results to daily practice and the people of interest [15]. However, research in a usual care setting has its limitations in terms of methodological quality (e.g., statistical power, bias and confounders, lack of a control group) and study results could also be biased by usual care protocols of the concerned hospital or by the people working in it. Another possible advantage of working as an embedded scientist is the direct connection between the health care professional

(here the physical therapist) and academia (researchers). This connection ensures that embedded scientists stay up to date and remain a critical perspective towards the content and context of health care procedures [16]. It has been recommended that embedded scientists engage with other researchers doing similar work and share their knowledge [17]. During the whole research period of this thesis, gained knowledge was shared with several hospitals and colleagues in (inter)national communities of practice in order to learn from each other and exchange experiences.

ACTIVITIES AND PRODUCTS

The research and activities during this thesis project, as part of a nationwide program on perioperative care, contributed to the start of (sustainable) changes and implementations in a proactive care pathway for colorectal cancer in the Maastricht UMC+ concerning the preoperative phase, the postoperative phase, data collection, and the transfer of knowledge.

Preoperative guidance for individual patients

Currently, all patients diagnosed with colorectal cancer and opting for abdominal resection of the tumor can participate in a preoperative screening of physical fitness as part of risk stratification. Afterwards, patients receive an individualized advice concerning physical activity during the preoperative period with a referral for supervised home-based physical therapy when necessary (high-risk patients). This personal advice with guidance through the preoperative phase was a new aspect in the current care pathway in the Maastricht UMC+ and resulted from this embedded research project.

Postoperative physical therapy management

During the postoperative phase, recovery of physical functioning of patients is monitored more consistently and in more detail than before the start of this project. Recovery of physical functioning is measured on a daily base with the modified Iowa level of assistance scale (mILAS) and other clinimetric measurements applicable to the specific patient (e.g., timed up-and-go test, 2-minute walk test). These measurements are used to guide postoperative physical therapy treatment, in order to contribute to patient-tailored care.

Contributions to data collection and infrastructure

Data on clinical outcomes can be useful to measure the effects and value of the implementation of a certain advice, intervention, and/or treatment. Furthermore, it

can contribute to a more detailed patient profile, and thereupon can be helpful in identifying both high- and low-risk patients. This thesis contributed to gathering and collecting relevant pre- and postoperative data, which can be used for evaluating daily clinical practice and guide pre- and postoperative physical therapy care.

Furthermore, the (usual care) data gathered in this thesis project is available for (larger) studies and for the build up of core sets of data in a national database. With this national database, usual care data can be evaluated faster and more accurate. Currently, the establishment of a connection between these core sets of data on physical functioning and the already existing medical databases (here, the Dutch Colorectal Audit of the Dutch Institute for Clinical Auditing) [18] is in progress. This will contribute to the evaluation of perioperative interventions and postoperative outcomes on a national level and provide better benchmark and mirror information for hospitals concerning the quality of care. Furthermore, data is used to educate physical therapists and other health care professionals at the Maastricht UMC+ with the main aim to deliver patient-tailored physical therapy treatment.

Knowledge exchange between the research field and outpatient practices

In the catchment area of the Maastricht UMC+, a network of trained, competent, and dedicated physical therapists working in outpatient physical therapy practices was developed, with the prospect of continuously optimizing this network for optimal pre- and postoperative physical therapy care over time. The physical therapists in this network were specifically trained in performing personalized preoperative physical therapy interventions for high-risk patients with colorectal cancer scheduled for elective resection. Moreover, they were, and are still being educated to guide these patients with functional task exercises and several monitoring methods at the patient's home. This education was based on previous scientific knowledge, previous research, and the nowadays practice-based experiences. Additionally, a decision-support guideline was developed for these physical therapists concerning preoperative physical exercise training. Within this (p)rehabilitation network, the aim is to establish a continuous exchange of (scientific) knowledge. The broader goal of this network is to make sure that patients are optimally prepared during the preoperative period in the right context, aiming to minimize the treatment-related loss of physical functioning and facilitation a complete and fast recovery. Furthermore, in cooperation with the colleagues of this network, the objective is to establish a long-term connection between hospital care and care in the outpatient physical therapy practices, to provide optimal care for patients throughout the complete continuum of care.

INNOVATION

This thesis project was executed by embedded scientists. Embedded scientists continuously gather new insights and knowledge by collecting, analyzing, and interpreting data from patients and their dynamic contexts during daily practical and clinical routines [15,19]. This is in line with (continuous) comparative effectiveness research, which provides information needed by patients and health care professionals to make decisions and choose among alternative approaches in clinical care [20]. Continuous comparative effectiveness research includes the direct comparison of existing (health care) interventions, in order to determine which treatment and context works best, for which patient population, and under what circumstances [21]. Embedded research contributes to the transfer of new research knowledge into daily clinical practice, and vice versa.

Embedded research: studying real-life practice, reducing research waste

The transfer of knowledge from research into (changes in) clinical practice remains challenging [22-24], which can also be seen in chapter 2 of this thesis. Research waste arises when (large, expensive) studies with initially promising findings do not lead to improvements or changes in health care, which is an often-seen phenomenon in biomedical research [25]. Recently, this became the most worry of the entire life sciences and health scientific community. The gap between new knowledge from research and daily clinical practice cannot easily be explained [26], let alone how to overcome this gap. Hence, embedded research in the real-life context of the to be evaluated context may be able to contribute to reducing this gap, as research findings can probably enter the context of practice easier and faster, which may assist to reduce research waste. Moreover, with embedded research, the insight in exact issues affecting patients and caregivers increases [27]. Study aims and questions of embedded research arise from the local, mostly rather dynamic context, which probably makes them more relevant to daily clinical practice [28]. Final results might also be more easily incorporated into (changes in) daily practice. Embedding the research into daily clinical practice can be called innovative in the field of physical therapy and contributed to real-life data concerning the patients of our interest, and may therefore provide more context-valid outcomes than when investigated in a highly controlled research context [28]. All in all, the research in this thesis gave more insight in the people's journey for patients with colorectal cancer, contributing to more patient-tailored physical therapy care, focused on the P4 principles (predictive, preventive, personalized, and participatory) [29].

SCHEDULE & IMPLEMENTATION

Several findings have already been incorporated into local daily practice. The work during this thesis project contributed to several adaptations in the care pathway for patients with colorectal cancer at the Maastricht UMC+. A preoperative screening of physical fitness with patient-tailored advice on preoperative physical activity and/or prehabilitation is a new component of the current care pathway. Furthermore, close and frequent postoperative monitoring of a patient's recovery of physical functioning by the physical therapist with help of the modified Iowa levels of assistance scale (mILAS) is rather new. The active approach of the patient and his/her support system and the proactive involvement of the physical therapist in the preoperative phase contributes to a more optimal preparation of patients and his/her support system before surgery. Patients and physical therapists can provide, evaluate and discuss information about the upcoming period, base their decisions and interventions upon these pieces of information, which is often appreciated by patients. Furthermore, preoperative performance of physical fitness can provide reference points for postoperative recovery of physical functioning for both patients and the physical therapist, which can help to manage optimal physical therapy preventive interventions and care.

Future challenges

An important future challenge is to perform adequately powered research in the real-life practice. This thesis showed that it is difficult to perform real-life practice research with the adequate power to strengthen the research conclusions. In order to accomplish this in the future, researchers should try to join national research developments. For example the development of personalized health. Personalized health aims to identify which approaches or interventions will be effective for specific patients. This requires the integration of diverse collections of data, generated in different hospitals and research centers [30]. For example the health research infrastructure (Health-RI), with the common goal to connect several data resources, thereby empowering researchers to develop better personalized medicine and health solutions [30]. When research institutes and hospitals work together in an (inter)national research infrastructure, this can contribute to adequately powered continuous comparative effectiveness research projects, which includes the comparison of existing interventions, in order to determine which treatment and context works best, for which individual patient and the patient's context [21].

A second challenge for the future is to maintain the changes made in the care pathway in joint coalition with patients with colorectal cancer, as well as with the structure of the care settings – peripheral and in the hospital – involved in this trajectory. The future will have to demonstrate whether the changes made are

sustainable and will be further optimized, even though this thesis project has come to an end. The embedded scientist will continue working at the hospital aiming to further improve pre- and postoperative physical therapy care for patients undergoing colorectal resection. Furthermore, this project originated mainly from the Maastricht University side of the university complex, in coalition with the department of physical therapy of the Maastricht UMC+. When other health care professionals, besides the physical therapy, are also motivated for this topic and are able to encourage other professionals, this will positively contribute to maintaining the changes and expand the development concerning this topic. If not, the risk that the changes made during this project will fade out of the current system will be plausible. Besides, working together with people guiding the implementation, preferably during the complete project, may help to reach and keep (sustainable) changes present in daily practice [18]. Finally, it is challenging to continue with the work provided in this thesis, besides normal daily routines. There are still many questions left and the challenge is to stay critical towards work in daily practice and to be open for change, despite busy day schedules and routines of normal daily practice.

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