

# Making functional assessment functional

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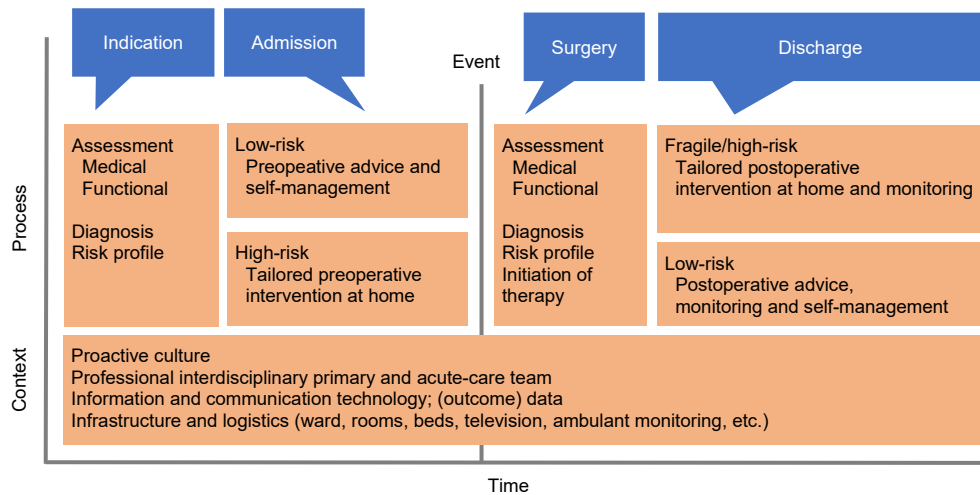
The predicted global life expectancy will increase another ten years, from 75 to 85 years, in the next century due to, among other things, medical treatments converting fatal diseases into chronic conditions [1]. Therefore, the definition of health has shifted from the absence of disease to adaption and managing the physical, mental, and social challenges throughout life [2]. To keep health and healthcare financially affordable for societies and their economy with steadily aging populations, these societies need to gradually accommodate their macro budgets on the one hand and their economy on the other hand. A clear focus on the forecasts of the increase of life expectancy of their total population is crucial. In line with these insights, the Dutch government has set out a national strategy for the coming 20 years. This strategy demands a clear cut change in society and the healthcare system for the coming ten years, with the perspective to create its optimal impact in 2040. An impact that should almost completely solve the immense economic and healthcare problems when the current care-demand and its parallel budget-rise will be left untouched. To do so, the Dutch government's central mission states that in 2040 all residents in the Netherlands live at least five years longer in *good health* and that health inequalities between the low and high socioeconomic groups will decrease by 30%. Innovations are needed to improve citizens' lifestyle and the living context, healthcare should mitigate for at the least 50% towards home, and people with chronic disease(s) should be able to increase their participation in society by 25% in 2030 [3]. A common ingredient in these central and underlying missions is the P4-medicine approach of Leroy Hood, in which health and healthcare need a personalized, preventive, predictive, and participatory approach to assist vital functioning citizens in the Netherlands. New knowledge, ideas, assumptions, processes, treatments, and products are needed, resulting in essential validated innovations. Alas, adoption and implementation are still seen as the missing links in the uptake of innovations in society. Consequently valorization is seen nowadays as pivotal in closing the gap between science/theory and healthcare practice and the collective strive for their societal and economic impact [4].

In general, universities have three main strategic tasks; education, research, and valorization of new knowledge in society and everyday practice [5], thereby assisting the economy to grow. This valorization chapter aims to discuss the social and economic relevance of the reported research and its outcomes, as presented in this thesis, to improve health and healthcare for people who opt for a total hip arthroplasty (THA).

## SOCIAL AND ECONOMIC RELEVANCE

For people in general and patients in particular, optimal physical performance is essential to function independently and participate in society. However, during the preoperative period, patients with end-stage osteoarthritis awaiting THA experience an extra gradient decline in function and activities due to the effects of their disease and will challenge them even more. Their ability to function and participate will be further tested, during the direct postoperative period, due to the physical stress response related to hospitalization and surgery [6], [7]. If a patient cannot adapt to this stress response, they will likely have a prolonged recovery of activities, and a patient with a poor preoperative function might have a higher risk for such prolonged recovery.

**Figure 8.1.** The continuum of care for elective total hip arthroplasty [9].



Clinical (allied) healthcare treatment, in general, is standardized using (local) guidelines according to theoretical recovery for standard patients. These guidelines are in place to reduce unwanted treatment variance. However, these protocols can also cause a reduction in wanted treatment variance [8]. Standardizations that are overly strict could be potentially harmful mentally, physically, and/or economically, especially for patients at both ends of the normal distribution of the “standard patient” [most fragile and very fit]. Both patients groups, fragile and fit, might not receive the optimal care they need based on the standardized recommendations; the fragile patient may need extra care to recuperate from surgery while the very fit patients get more care than need. In this thesis, we have strived to personalize these recommendations by

introducing prediction models and clinical innovations (assessing and monitoring recovery) throughout the continuum of care (see **Figure 8.1**).

Insight into the predicted recovery of individual patients could help to allocate the available care resources better. So the patient receives the right amount of care they need, and the workload of healthcare professionals can allocate more efficiently, at best resulting in the most efficient patient mix per hospital ward and/or healthcare professional. This coordination of the demand for and availability of care is critical in the decreasing healthcare professionals' resources in the Netherlands.

### **SHARING AND IMPLEMENTING KNOWLEDGE**

The products within this thesis are a co-creation between patients, healthcare professionals, and researchers, all intending to improve healthcare for patients after THA. A learning community grew gradually alongside the conception of this thesis; first on a micro-level (physical therapy department of the Diakonessenhuis), secondly on a meso-level (interdisciplinary teams within the Diakonessenhuis), and eventually on a macro-level (national community of practice (CoP)). For the local implementation, input from the micro and meso-levels were collected focusing on the usability of the newly developed tools combined with local communication and coordination to enhance efficiency and quality of care. The board of the Diakonessenhuis supported our innovation of care by awarding a grant of €30k for the implementation of preoperative exercise (the "Better in - Better out" network) for outpatient physical therapists in the catchment area of the hospital. Committed inpatient and community physical therapists jointly developed a guideline for preoperative exercise for patients awaiting THA with a high risk for prolonged recovery of activities assessed with the risk assessment tool (Chapter 6). This guideline was developed by consensus to reduce the implementation burdens within the different working fields.

### **LOCAL AND NATIONAL IMPLEMENTATION OF OUR RESULTS**

During the preoperative phase, patients are preferably treated according to a stepped-care approach [10], starting with life-style recommendations and drug treatment from their general practitioner. Some patients end with a THA surgery performed by an orthopedic surgeon. Ideally, throughout this stepped-care process the healthcare professionals, in co-creation with the patient, his family, and other (in)formal caregivers, discuss the available treatment options during

the shared decision making (SDM) processes throughout the total treatment period. As soon as the decision for THA is made and less invasive treatment options have been tried, then the innovations described in this thesis come into play to further facilitate the SDM process. All innovations in this thesis, comprising prediction models and assessment of the recovery of activities of patients undergoing THA surgery, have been sustainably integrated into the continuum of care during indication, admission, and postoperative outpatient periods for patients awaiting and recovering from THA at the Diaconessenhuis. Moreover, some innovations have been disseminated on a national level.

## INDICATION & ADMISSION

Although THA is widely accepted as an effective treatment for end-stage osteoarthritis of the hip, about 15-50% of the patients [11], [12] are not satisfied with the results after surgery. More accurate predictions of the functional outcome after THA, based on characteristics of the individual patient, can facilitate the SDM process in which the patient, together with his team, makes an informed decision whether THA is the best option at this specific point in time. Based on new knowledge regarding patient-related factors associated with the recovery of activities and/or length of hospital stay (LoS) (Chapter 2), patient profiles (Chapter 3), and the risk assessment tool (Chapter 4), the screening was optimized. These three studies showed that, next to the conventional patient-related factors (age, BMI, gender, ASA-score, and Charnley score), the functional status of the patient significantly contributes to the explained variance of the predicted inpatient functional recovery of activities resulting in the addition of the Timed up and Go (TUG) during the preoperative screening. Thereby, the outcome of the risk assessment tool – which includes the TUG – gives the patient and the physical therapist essential information about the predicted inpatient recovery of activities and if preoperative exercise might enhance the postoperative recovery of the patient. Nowadays, the preoperative physical therapy screening in the Diaconessenhuis has three pillars: 1) prediction of inpatient recovery of activities; 2) determine if the patient can be discharged home based on their predicted recovery of activities and; 3) determine and discuss if preoperative exercises (supervised or unsupervised) are beneficial for the individual patient to improve their functional status [7].

On a national level, this approach to prediction-based care has been integrated into the Royal Dutch Physical Therapy Association (KNGF) guideline. The KNGF guideline states that "*preoperative exercise can indeed be considered in case a patient is at risk for delayed functional*

*recovery after THA*" [13]. Our risk assessment model (Chapter 4) has been presented as one of the instruments that clinicians can use to determine which high-risk patient for prolonged recovery of activities might benefit from such preoperative interventions.

### **INPATIENT RECOVERY AFTER SURGERY**

Our research has shifted the perspective on how to objectify the inpatient recovery after THA surgery in the Diaconessenhuis. Initially, LoS was considered one of the critical process indicators. LoS comprises 1) medical recovery, 2) functional recovery, and 3) logistics. However, in theory, patients can be discharged if they meet items 1 and 2, in other words, if they are medically stable and capable of performing basic functional tasks (like making transfers, walking, and, if necessary, stairclimbing).

We showed that physical therapists could use the mLAS to monitor the functional recovery of patients after THA on a daily basis, using five functional activities – transfers in and out of bed, transfer sit to stand, walking, and if necessary stairclimbing – as part of the routine physical therapy care during hospital admission. For the mLAS to be useful in clinical practice, structural use by all colleagues is essential. Therefore, the mLAS was integrated into the hospital information system, and the scores were made accessible for all healthcare professionals.

After implementing the mLAS (Chapter 6) in the Diaconessenhuis, we gathered new information about the patients' functional recovery of activities after THA surgery. Evaluation of these postoperative data revealed a difference of two days between the theoretical LoS (items 1 and 2) and the actual LoS (items 1, 2, and 3); thus, hospital logistics delayed discharge substantially. To close this gap between the theoretical and actual LoS, the functional recovery of activities is the main topic nowadays during the multidisciplinary consultations of patients after THA. To date, in the Diaconessenhuis, objective day-to-day recovery of patients' activities provides healthcare professionals essential information to determine if and when the patient is ready to be discharged so logistical issues can be addressed on time, resulting in a lower actual LoS.

As the risk assessment tool, the use of the mLAS was recommended through the KNGF guideline 'Osteoarthritis of the hip and knee' [13].

## RECOVERY AFTER DISCHARGE

All patients discharged from the Diakonessenhuis receive a transfer letter detailing their recovery after the THA surgery. Previously, this transfer letter included only medical items, like LoS, wound healing status, pain levels, etcetera. To date, the transfer letter also includes details about the functional recovery of patients, including the preoperative level of functioning and level of functioning at discharge. This information about the patient's functioning helps both the patient and the primary care physical therapist better estimate the potential speed and (maximum) level of recovery. For patients recovering from TKA, we now also include the recovery curve for active flexion after TKA (Chapter 7) in the transfer letter. The patient and physical therapist can use this curve as a reference tool to monitor the recovery of flexion. Besides, researchers in the US have developed a mobile application to enhance the daily use of such recovery curves (see **Figure 8.2**). With this application, both patients and healthcare professionals gain easy access and visual insight into the (expected) recovery speed. The app provides two curves: A) curve generated with data from patients similar to the index-patient [14] and; B) curve generated with data from all patients [15]. Attempts are made to translate and incorporate this app into the Dutch care setting.

Finally, this thesis's results were disseminated through guest lectures at applied universities, the professional master physical therapy, the Better In - Better Out community of practice meetings, and other hospitals.

## POTENTIAL VALORIZATION OF OUR RESULTS

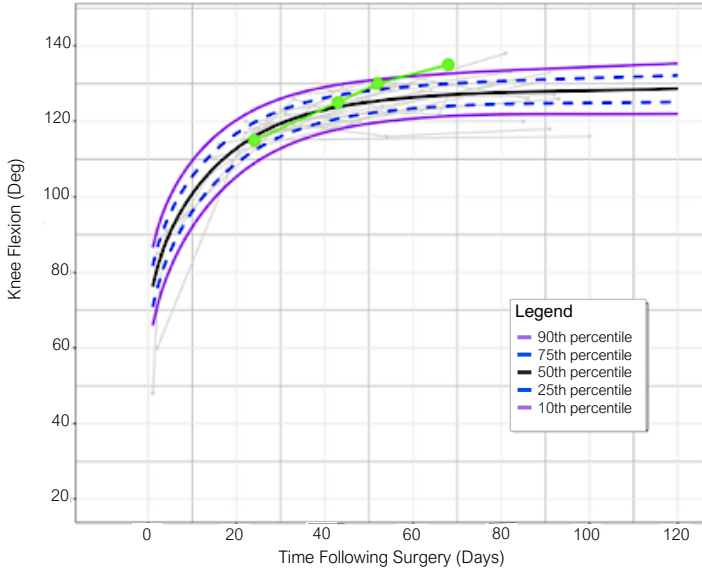
Besides the relevance of our work to the quality of care for patients awaiting and recovering from THA, our work might also have economic potential.

First, using preoperative prediction models. As stated before, by identifying patients with a high risk for prolonged recovery before surgery, preoperative interventions might be useful to enhance their functional status yielding a faster recovery of functions resulting in a lower LoS and fewer post clinical physical therapy sessions [13]. During the 8 weeks of "waiting time" before surgery, a preoperative exercise intervention with 2 supervised sessions of 30 minutes, at €40 per session, costs approximately €640. The potential reduction in hospital costs is €600 for each day the patient is discharged earlier than he or she was without the preoperative exercise intervention,



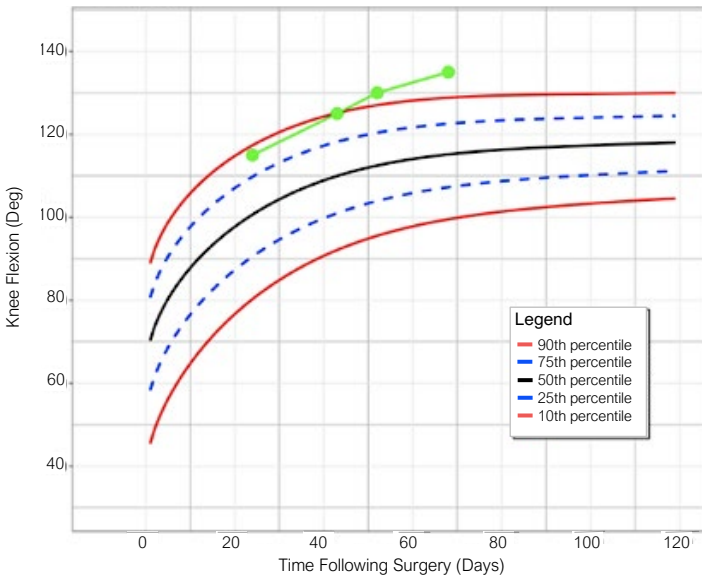
**Figure 8.2.** Knee Recovery App in use.

**A. Patients like me**



Knee flexion ROM recovery is faster than expected; only 3 percent of similar patients have more flexion ROM at this time point.

**B. All patients**



Of all patients with TKA, 97 percent have less flexion ROM and 3 percent have more flexion ROM at this time point.

without the possibility that the post clinical physical therapy treatment might be shortened due to the better direct postoperative functions and level of activity. Moreover, if the postoperative functional status of a patient is sufficient to be discharged home, instead of a skilled nursing home, the potential cost reduction rises to ~€7.5k per patient (€254 per day [16] with a mean total stay of 30 days [17]). Finally, some patients even reconsider THA surgery after a 6-week conservative treatment intervention to reduce symptoms and improve functioning [18], [19]. Each of the three scenarios mentioned above are cost-effective.

Second, using inpatient outcome monitoring of recovery. If the outcomes on the mLAS are actually in the lead to determine whether an individual patient can or cannot be discharged (assuming that the patient is medically stable after one night and logistical issues are addressed), the LoS could be lowered by 2 days according to our data of 2015. The reduction of the LoS by 2 days equals an estimated reduction of hospital costs of €1.200 per patient. Annually, 500 THA are performed at the Diakonessenhuis hospital; with the 2-day reduction, the total revenue would be  $500 \times \text{€}1.200 = \text{€}600\text{k}$ . Moreover, 1000 admission days (500 patients with 2-day lower admission days) are available for other patients.

Third and final, using recovery curves during rehabilitation. We believe that the use of recovery curves during the peri-operative period may reduce healthcare costs even further. Fifteen to fifty percent of the patients after THA are not completely satisfied with surgery outcomes [11], [12]. Recovery curves provide essential information about the predicted improvement of functions and activities overtime during the postoperative phase. Some patients' expectations might not likely to be achieved after THA surgery, despite that they are willing to undergo surgery and invest in (p)rehabilitation interventions. If patients, together with their support team, are provided with personalized predictions of their most likely outcome after THA, they can make a more informed decision regarding THA surgery. If their expectations are too high concerning the outcome provided by the recovery curves, they might reconsider THA surgery or accept the end result of their recovery sooner, resulting in earlier termination of their postoperative physical therapy treatment.

## **CONCLUSION AND AMBITION**

The population of patients awaiting THA surgery is heterogeneous in terms of preoperative function and level of activities and their postoperative recovery of activities and opts for more personalization of care. The P4-Medicine indices *prediction*, *prevention*, *personalize*, and *participatory* help optimize the perioperative quality of THA surgery further and might even have an economic benefit for society. Therefore, we recommend that proper identification, monitoring, and titration of care should be implemented in daily healthcare routines for THA surgery care pathways.

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