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Faculteit Revalidatiewetenschappen

master in de revalidatiewetenschappen en de kinesitherapie

Masterthesis

Do preoperative contextual predictors influence the postoperative performance based outomes in patients that have undergone a total knee arthroplasty: a systematic review

Gilles Filippini
Nick Schoeters

Eerste deel van het scriptie ingediend tot het behalen van de graad van master in de revalidatiewetenschappen en de kinesitherapie

PROMOTOR :

Prof. dr. Annick TIMMERMANS

BEGELEIDER :

De heer Abner SERGOORIS

2020
2021

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‘Do contextual predictors influence the postoperative performance based outcomes in patients that have undergone a total knee arthroplasty: a systematic review’

Research Question: Which contextual predictors influence the postoperative performance based measures in patients with osteoarthritis (OA) that have undergone a total knee arthroplasty (TKA).

Nick Schoeters (1643317)
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Promotor
Prof. Dr. Annick Timmermans

Begeleider
Drs. Abner Sergooris

- Older age, female sex predicts worse physical outcomes after total knee arthroplasty.
- More research is needed to estimate the influence of psychological variables on physical outcomes.
- More research is needed to estimate the influence of marital status and academic qualification on physical outcomes.

Context of the master thesis

In this review paper, we investigated the influence of contextual preoperative predictors on the gait-related performance based outcome measures (PBM's). Numerous predictors exist that can influence the PBM's. These predictors can be grouped in the different domains of the international classification of functioning, disability and health (ICF). This study will focus on the predictors situated within the contextual domain of the ICF.

Prognostic research is important for determining whether particular characteristics of individuals, their environment or other factors, are associated with changes in individual outcomes. Prognostic factors could help to identify subgroups of individuals at risk for worse recovery. This may influence the way these individuals are treated pre- or post-surgery, causing their prognosis to improve.

This review is situated within the Master of Rehabilitation Sciences and Physiotherapy. Our thesis does not necessarily situate itself within a current research project, but it takes its roots from an active research project of Prof. dr. Annick Timmermans & drs. Abner Sergooris. The title of the research project is called "Clinical phenotypes in persons with hip osteoarthritis and prognostic factors of outcome following total hip arthroplasty".

For the second part of our Master thesis, we will join our supervisors in their ongoing research project. We will be conducting preoperative and postoperative tests/screenings of patients in the UHasselt REVAL research centre and in Ziekenhuis Oost-Limburg (ZOL).

For our study we chose to use the central format. The research question of our study was chosen by our supervisors. We (Nick and Gilles) then started researching this topic and eventually made our search strategy together. From this point forward we independently performed every screening. We then cooperated to make the entirety of the literature study together. We both reviewed each other's work constantly and discussed our findings when we viewed things differently.

Table of Contents

Part 1: Literature study

1. Abstract

Background: Postoperative physical functioning is a large predictor or satisfaction after TKA. Contextual factors may play a role in predicting postoperative physical outcomes. **Methods:** A systematic review will be conducted as per the PRISMA guidelines. The databases PubMed and WebofScience will be searched for articles published from 2000 to February 2021. This study focuses on studies examining the relationship between contextual preoperative predictors and gait-related performance based outcomes (PBM's).

Results: Older age, female sex and better mental health are preoperative predictors for worse gait-related performance based outcome measures.

Discussion & conclusion: There is moderate quality of evidence that older age, female sex and worse mental health are prognostic factors for worse outcomes on the gait-related PBMs. Additionally there is low quality of evidence that marital status, education level, pain catastrophizing, depression and anxiety are not prognostic factors for postoperative gait-related PBM's in patients with osteoarthritis (OA) that have undergone a total knee arthroplasty (TKA).

Aim of this research: In the future study we will research the influence of preoperative contextual predictors on performance based outcomes in patients with knee OA that have undergone a TKA.

Operationalization of the research question: patients will be recruited out of Ziekenhuis Oost-Limburg (ZOL) and the performance tests will be taken in the UHasselt REVAL centre. A multivariate regression model will be used to analyze the results.

Important keywords: knee osteoarthritis; total knee arthroplasty; predictors; contextual; performance based outcome measures

2. Introduction

Osteoarthritis (OA) of the knee is one of the most common joint disorders in the world and a major cause of pain and disability (Wallace et al., 2017). With obesity becoming more widespread and the increasing life expectancy, OA will only become more prevalent (Cross et al., 2014). It's estimated that the lifetime risk for knee osteoarthritis is 40% in men and 47% in women (Giwnewer, Rubin, Orbach, & Rozen, 2016). In a study in 2010, Cross et al. (2014) found that hip and knee osteoarthritis was ranked as the eleventh highest contributor to global disability and thirty-eighth in disability-adjusted life years (DALYs). Patients with knee OA experience pain and other impairments which can be classified into different domains of the international classification of functioning, disability and health (ICF), which leads to functional limitation during daily activities (Charlesworth, Fitzpatrick, Perera, & Orchard, 2019).

Conservative treatment is the first course of action when treating OA. When conservative treatment fails to improve the impairments, they will change to surgical treatment (Indelli & Giuntoli, 2018).

Manen, Nace & Mont (2012) found that OA accounts for 94% to 97% of TKA operations. The majority of studies report a satisfaction rate of approximately 80% after TKA (Kahlenberg et al., 2018). They also found that postoperative functional outcome and relief of pain were the main determinants of satisfaction after TKA (Kahlenberg et al., 2018). Preoperative predictors could aid in identifying patients at risk for worse functional outcomes after TKA. Such knowledge would help determine the need for preoperative rehabilitation (Lee et al., 2017) and postoperative locomotor rehabilitation (Parent & Moffet, 2003).

In the study of Parent & Moffet (2003) they describe that only a few studies focus on preoperative predictors of functional outcomes after TKA.

In the PROGRESS framework of Moons, Royston, Vergouwe, Grobbee & Altman (2009) it's mentioned that when doing prognostic research, it's best to identify predictors that are readily available in clinical practice. Predictors should be clearly defined, standardized and reproducible to generalize results to clinical practice (Simon & Altman, 1994). Contextual predictors in particular, fit this description because they include demographic factors such as

age and sex, and other factors such as mental health, anxiety, … that have standardized means of measurement.

There are several ways to measure functional outcomes, of which subjective patient-reported outcome measures (PROMS) and objective performance based outcome measures (PBMs) are the most commonly used (Neviditha et al., 2019). Previous studies indicated that PROMs fail to measure objective changes in functional outcomes (Gabr, Tansey, & Haddad, 2015). Mizner et al. (2011) found that when exclusively using patients' perceptions of change, they tend to overestimate the actual changes in physical function after TKA. PBMs have several advantages over PROMs (Devasenapathy et al., 2019). PBMs are easier to interpret across varying contexts and are less susceptible to reporting bias (Singh, Sloan, & Johanson, 2010).

A systematic review that evaluates the influence of preoperative predictors on PBMs hasn't been made. The aim of this systematic review is to identify preoperative contextual factors that predict performance based outcomes in patients after TKA.

3. Methods

3.1. Eligibility criteria:

Studies were eligible for this study if (1) it was a prospective or retrospective longitudinal cohort study, or case control study, (2) it was a study that focused on the contextual preoperative predictors, (3) it was a study that measured preoperative and postoperative gait-related performance based outcomes (PBM's), (4) it was a study that included participants suffering from knee OA, treated with their first unilateral TKA, and (5) it was a study written in English or Dutch.

3.2. Dependent variables:

Gait-related performance based measures that were studied preoperatively and postoperatively. These gait-related PBM's included any measure that measured gait speed, gait endurance, balance, etc.

3.3. Independent variables:

Contextual predictors were identified using domains of the ICF. Predictors were considered to be contextual if they could be included in either the personal factor domain or the external factor domain. Demographic factors such as age and sex were considered as personal factors in this study.

3.4. Information sources:

Pubmed and Web of Science were used to identify studies. Studies that were written between the years 2001 (inception ICF) and February 2021 were included.

3.5. Search strategy:

The search strategy used in Pubmed and WebofScience can be found in the appendix in Table 1.

3.6. Selection process

Two independent reviewers (S. N. and F. G.) screened the articles on title/abstract, and subsequently on full text. The reviewers compared their findings after both screenings. In case

of a disagreement, a consensus has been made. When a consensus couldn't be reached, a third independent reviewer was consulted. Rayyan was used to conduct the screening process. Additional studies were searched in the references of systematic reviews and in the references of the included studies identified by our search strategy.

3.7. Data collection process

Two independent, blinded reviewers (S. N. and F. G.) collected data from the included studies. Relevant information of each study (Author, year, study population, predictors, PBM's, study design, statistical analysis, results, and time points) were extracted and subsequently displayed in Microsoft excel. After data extraction, the data were compared.

3.8. Data items

A summary table in the appendix has been made in Microsoft Excel to tabulate the following information: Author and year, sample size, study population, PBMs, preoperative predictors, study design, statistical analysis, results, and timing of measurements.

Data were sought for gait-related performance based outcome measures (PBM's). These had to be measured preoperatively and postoperatively.

Other variables for which data were sought were contextual predictors such as age, sex, mental health,...

The level of evidence is scored by the Oxford's Centre for Evidence-Based Medicine (CEBM) guidelines.

3.9. Study risk of bias assessment

All studies that met the inclusion criteria were assessed for methodological quality using the Quality In Prognosis Studies (QUIPS) tool developed by Hayden, van der Windt, Cartwright, Côté & Bombardier (2013). The QUIPS tool consists of six domains of potential biases: (1) study participation; (2) study attrition; (3) prognostic factor measurement; (4) outcome measurement; (5) study confounding and (6) statistical analysis and reporting. The six domains are each individually scored with high, moderate, or low risk of bias. Two independent reviewers scored each of the seven included studies using the QUIPS. They discussed their findings and came to an agreement when there were discrepancies.

For any study to score an overall rating of low risk of bias, it had to score low risk of bias on each of the six domains of the QUIPS. A study was qualified as having a moderate risk of bias if it scored a moderate risk of bias on any of the six domains. If the domains ‘outcome measurements’, ‘prognostic factor measurement’ or ‘study confounding' had a high risk of bias, the overall rating of the study would be high risk of bias. However if these three domains had a low risk of bias score, the overall rating would be low risk of bias, regardless of the other domains.

4. Results

4.1. Results of study selection

Results of the study selection are shown in figure 1.

A total of 1502 articles were found: 819 on Pubmed, 683 on Web of Science. After removing the duplicates 1160 articles were left. After screening on title and abstract a total of nineteen articles remained for full text screening. Thirteen articles were excluded based on full text, leaving six articles for data extraction. One additional hand searched article was then included out of the references of the six studies.

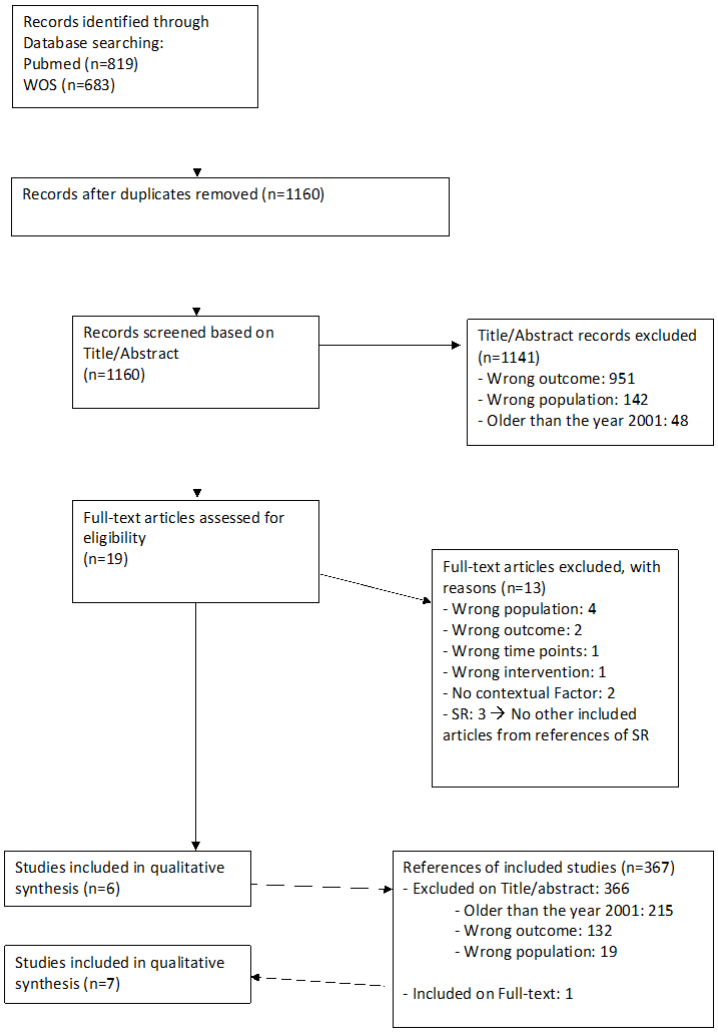


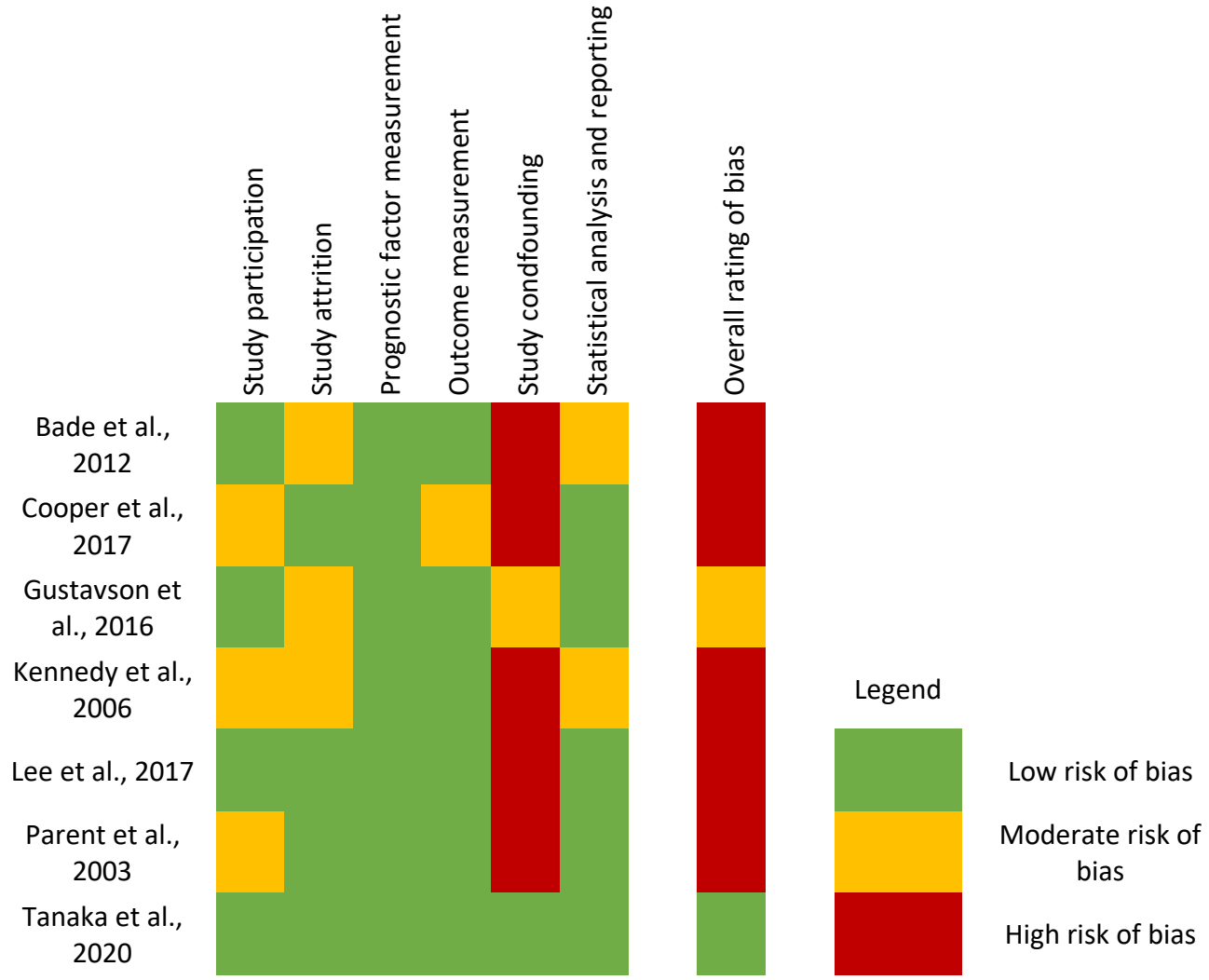
Figure 1. Flowchart of the systematic search

Reasons for exclusion can be found in table 4 in the appendix.

4.2. Results of quality assessment

five studies had an overall rating of a high risk of bias (Bade et al., 2012; Cooper et al., 2017; Kennedy et al., 2006; Lee et al., 2017; Parent & Moffet, 2003). These studies didn't account for study confounding, and thus scored a high risk of bias on this domain. One study had an overall score of a moderate risk of bias (Gustavson et al., 2016). This study mentioned confounding factors as a limitation in their study. Tanaka et al. (2020) was the only study to score an overall rating of low risk of bias, and was the only study to include confounding factors.

Table 1.
Quality in Prognosis Studies (QUIPS)



4.3. Results of data extraction

Results of the data extraction are presented in Table 2.

Age

Six studies looked at “age” as a possible preoperative predictor shown in table 2 in the appendix (Parent & Moffet, 2003; Lee et al., 2017; Kennedy et al., 2006; Cooper et al., 2017; Bade et al., 2012; Tanaka et al., 2020).

15 seconds Gait speed test

The 15 seconds gait speed test was used as a PBM in Cooper et al. (2017). They described that older age was a significant predictor for lower postoperative gait speed.

The Timed Up and Go test (TUG)

The TUG test was used in three studies. (Bade et al., 2012; Kennedy et al., 2006; Tanaka et al., 2020).

Two of these studies mentioned that older age was a preoperative predictor for longer TUG times (Bade et al., 2012; Tanaka et al., 2020). One study concluded that age wasn’t a preoperative predictor for the TUG test (Kennedy et al., 2006: Lee et al. 2017).

The six-minute walking test (6MWT)

The 6MWT was used as a PBM in Bade et al. (2012); Kennedy et al. (2006); Lee et al. (2017); Parent & Moffet (2003). All four studies described that age wasn’t a preoperative predictor for the 6MWT.

Gait speed

Lee et al. (2017) used a validated wireless inertial sensing device for the measurement of gait speed along a distance of 8 meters. They concluded that older age was a preoperative predictor for lower postoperative gait speed.

Stair climbing test (SCT)

The SCT was used as a PBM in Bade et al. (2012). They found that age wasn’t a preoperative predictor for the SCT.

Sex

Six studies have looked at “sex” as a possible preoperative predictor shown in table 2 (Cooper et al., 2017; Gustavson et al., 2016; Kennedy et al., 2006; Parent & Moffet, 2003; Tanaka et al., 2020).

15 SGST

The 15 seconds gait speed test was used as PBM in Cooper et al. (2017). They concluded that female sex had a significant effect on lower postoperative gait speed.

TUG

The TUG has been used in Gustavson et al. (2016); Kennedy et al. (2006); Tanaka et al. (2020). These studies concluded that female sex was a predictor for slower TUG times.

6MWT

The 6MWT has been used as PBM in Gustavson et al. (2016); Kennedy et al. (2006); Parent & Moffet (2003). These studies concluded that female sex was a predictor for shorter 6MWT distances.

SCT

The SCT has been used as PBM in Gustavson et al. (2016). They mentioned that female sex was a predictor for longer SCT times.

Marital Status

In the regression analysis from Tanaka et al. (2020) marital status was not a significant predictor for TUG.

Academic qualification

In the regression analysis from Tanaka et al. (2020) academic qualification was not a significant predictor for postoperative TUG.

Mental health

In Bade et al. (2012) they found that mental health is a predictor for worse SCT times. A score of <42 on the mental component score (MCS) of the Short Form-36 (SF-36) was indicative of a depressive disorder. Thus, depression may play a role in poor SCT performance.

Anxiety

In Cooper et al. (2017) they found that anxiety isn't a predictor for the 15s gait speed test.

Depression

In Cooper et al. (2017) they found that depression wasn't a predictor for the 15s gait speed test.

Pain catastrophizing

In Cooper et al. (2017) they found that pain catastrophizing wasn't a predictor for the 15s gait speed test.

Table 2:
Data-extraction

Author, Year	Sample size	Study-population	PBM	Preoperative predictors	Study design	Statistical analyis	Results	Timing of measurement
Bade et al., 2012	119 patients, who underwent TKA with knee OA	Age: 64,8 (SD:9,2) sex: 54M/65F SF-36 MCS: 55,9 (SD:8,9)	TUG, 6MWT and SCT	Sex, age, 6MWT, SCT, TUG MCS SF-36	Prospective cohort study	Classification and Regression Trees	Individuals taking >=10,1 s on the TUG and aged >= 72 before surgery demonstrated the poorest performance on the TUG 6 months after surgery. MCS SF-36 was a predictor of poorer performance on the SCT.	2 weeks before TKA & 6 months after TKA
Cooper et al., 2017	62 patients with knee OA after TKA	Age: 60,5 (SD:10,3); sex: 36F/36M	15 s gait speed test	Sex, age Depression (GDS), State and Trait Anxiety (STAI), Pain Catastrophizing (PCS)	Case-control study	Bivariate correlation - Pearson correlation & T-test	At six-week follow-up: age (r=-0,195; p=0,002) with the gait speed. At six-month follow-up: age (r=-0,229; p=0,001) with the gait speed. At six-week follow-up: female sex (p<0,001) predicts slower gait speed. At six-month follow-up: female sex (p=0,187) doesn't predict slower gait speed Negative GDS was at six-week (p=0,004) & six-month (p=0,063) follow-up a predictor for slower gait speed.	Assessment on the day of recruitment at the time of their preoperative work-up & at 6 weeks and 6 months

		At six-week follow-up: trait anxiety (r=-0,175; p=0,008) & state anxiety (r= -0,172; p=0,010) anxiety with gait speed. At six-month follow-up trait anxiety (r=-0,180; p=0,016) & state anxiety (r=-0,178; p=0,018) with gait speed. At six-week follow-up: pain catastrophizing (r=-0,172; p=0,008) with gait speed, but not at six-month follow-up (r=-0,108; p=0,147).
	Multiple regression analysis	At 6 week follow up: younger age (p<0,001) & male sex (female sex p=0,116) were significant predictor for faster gait speed. At 6 month follow up: younger age (p<0,001) was the only significant predictor for a faster gait speed. In the regression analysis psychological factors were not significant predictors on the gait speed.

Gustavson et al., 2016	301 patients who underwent unilateral TKA for OA	Age: 64,2 (SD:7,8) sex: 166F/135M	TUG, SCT & 6MWT	Sex	Retrospective cohort study	Likelihood model	For adjusted change in TUG from prior to surgery to 1 month, women demonstrated a greater decline (p=0,001) in TUG time than men. At 3 months (p=0,83) and 6 months (p=0,64), there were no significant differences For adjusted change in SCT: At 1 month: women demonstrated greater decline (p=0,004) in SCT times than men. At 3 months (p=0,22) and 6 months (p=0,08), there were no significant differences For adjusted change in 6MWT: At 1 month: women demonstrated greater decline (p=0,001) in 6MWT than men. At 3 months (p=0,18) and 6 months (p=0,44), there were no significant differences.	1-2 weeks before TKA & at 1, 3 and 6 months after TKA

Kennedy et al., 2006	152 patients with end stage OA	Age: F: 66,4 (SD:7,9) and M: 67,2 (SD/8,64); sex: 75F/77M	6MWT & TUG	Sex, age	Longitudinal observational study	Hierarchical linear modeling	Preoperative 6MWT score, female sex, and site of arthroplasty were all significant predictors of less 6MWT distances at one week after surgery. Gender, site of arthroplasty, baseline TUG function, and an interaction between time and arthroplasty site are predictors for the TUG model. One week after surgery, women have worse TUG function than men, and patients post-THA are slower than those post-TKA. Comorbidities and age were not predictive variables for any of the models.	Assessment 1 to 2 weeks before surgery & at least one assessment during the 4 months postoperative
Lee et al., 2017	84 patients with end-stage primary OA of the knee scheduled for primary TKA	Age: 72,0 (SD:6,0); sex: 76F/8M	6MWT, TUG, SCT, Gait analysis	Age, gait variables, 6MWT, TUG & SCT.	Prospective cohort study	Pearson correlation Multivariate regression analysis	Gait speed (r=-0,33; p<0,010) with age Gait endurance (r=-0,10) with age Older age (p=0,010) was a predictor for slower postoperative gait speed.	Assessment before the surgery and at 1 month after surgery

Parent & Moffet, 2003	65 patients scheduled for a first TKA with primary knee OA	Age: 68,6 (SD:8,8); sex: 40F/25M	6MWT	Age, sex, BMI	Prospective cohort study	Pearson's correlation coefficient	The distance covered in 6 minutes 2 months after TKA was significantly correlated with sex (r=0,53) and BMI (r=-0,44), and not significant correlated to age (r=-0,12) and the duration since symptoms onset (r=-0,02).	before & 2 months after TKA
						Multiple regression analysis	The combining of Sex (p<0,001), BMI (p=0,005), and comorbidities (p=0,006) were the only significant predictors in the personal category (together, these predict 42,3% of the variance in the dependent variable). Female sex with higher BMI and many comorbidities predicts worse outcomes measured by the 6MWT.	

Tanaka et al., 2020	388 participants, who underwent TKA with knee OA	Age, mean: 74,4 (SD:7,4); sex: 303F/85M; academic qualification, compulsory education: 89, post-compulsory education: 299; marital status, with a spouse: 261, without a spouse: 127	TUG	Sex, age, academic qualification, and marital status, Confounding factors: Kellgren and Lawrence grade & type of surgery	Prospective cohort study	Spearman correlation analysis Mann-Whitney U test Hierarchical multiple regression analysis	Age (r = 0,38; p<0,01) with TUG time, such that older participants took longer to complete the TUG. There were significant differences in TUG times between men and women (p<0,05), between participants with and without compulsory education (p<0,05), and between participants with and without a spouse (p<0,05), such that women, participants without a spouse, and participants with low education level took longer to complete the TUG. In the regression analysis without the confounding factors: older age (p<0,01) and female sex (p<0,05) were significant factors for longer TUG times. With confounding factors: older age (p<0,01) and female sex (p<0,05) were significant factors for longer TUG times. Marital status and academic qualification were not significant factors in the regression analyses.	Assessment 1 day prior to TKA & walking ability was measured again 2 weeks after TKA

5. Discussion

5.1. Reflection of study quality

The level of evidence is scored by the Oxford's Centre for Evidence-Based Medicine (CEBM) guidelines shown in the appendix (Figure 1).

The overall level of evidence of the included articles varied from level 1b prospective cohort studies to level 2b retrospective cohort studies and level 3b case-control studies. Out of the seven studies only two didn't have an overall score of high risk of bias. These two studies either included (Tanaka et al., 2020) or at the very least mentioned (Gustavson et al., 2016) confounding factors in their study. With five studies not accounting for confounding factors, their results must be interpreted with caution.

5.2. Reflection of findings in function of research question

5.2.1. Included studies and patients

Overall the patient characteristics between the included studies were not entirely comparable. The sample sizes of the studies varied from 62-388, with five of the seven studies having an equal distribution of women and men (mean 54% female) (Bade et al., 2012; Cooper et al., 2017; Gustavson et al., 2016; Kennedy et al., 2006; Parent & Moffet, 2003). Tanaka et al. (2020) and Lee et al. (2017) had respectively 78% and 90% women in their population, meaning their findings can't be generalized to all men. The mean ages of the different study populations ranged from 60,5-74,4 years old, meaning the results should be interpreted with caution. This is mainly because in Milanovic et al. (2013), they found that physical functioning varied greatly between different age groups (60-69 and 70-79). When combined with the finding that preoperative physical functioning is an important predictor for recovery after TKA (Bade, Kittelson, Kohrt, & Stevens-Lapsley, 2015), we can hypothesize that this could be a reason for possible differences in outcomes between the studies.

5.2.2. Study findings

Three studies discussed age as a possible preoperative predictor for postoperative TUG performance (Bade et al., 2012; Kennedy et al., 2006; Tanaka et al., 2020). However, there was a discrepancy between these studies when discussing the results, as one study found that age wasn't a predictor of TUG performance (Kennedy et al., 2006).

When comparing Kennedy et al. (2006) with Bade et al. (2012), the main difference would be their choice of statistical measure. Kennedy et al. (2006) used hierarchical linear modeling (HLM) and Bade et al. (2012) used Classification and Regression Trees (CART). CART uses a splitting model that 'splits' the Sample in two homogeneous groups, causing the sample size to be split in half (Speybroeck, 2012). This could be a cause for predictors to be found significant more easily.

When comparing Tanaka et al. (2020) and Kennedy et al. (2006) two factors stood out, the difference in their mean ages and the difference in the amount of women in their study.. Tanaka et al. (2020) had a mean age of 74,4 years old with a population consisting of 78% women, and Kennedy et al. (2006) had a mean age of 66,5 years old with a population consisting of 49% women. De Vroey et al. (2020) found that female sex and older age were risk factors for kinesiophobia, and that this had a significant effect on postoperative functioning following a TKA. This could explain why Tanaka et al. (2020) found a significant effect of age on TUG times.

Kennedy et al. (2006) described in their study that when age and baseline scores were added to the regression model, age wasn't a significant predictor for TUG performance. They hypothesized that the effect of age on performance would have most likely been captured in their preoperative performance scores. Following this theory, we assumed that gender would not be a significant predictor for the TUG after baseline scores were added. However, Kennedy et al. (2006) found that female gender was a significant predictor for slower TUG times. We surmised that there might have been other factors related to gender that were not accounted for in the regression analysis in Kennedy et al. (2006). A factor that could have been a significant factor between men and women is pain. Nandi et al. (2019) described that women reported significantly greater levels of pain than men at 48 hours and two weeks after surgery. Kennedy et al. (2006) centered their analysis around a one week follow up, so pain could have been a significant factor influencing their results.

Two studies described age as a predictor for postoperative 6MWT performance (Kennedy et al., 2006; Parent & Moffet., 2003). Both studies found that age wasn't a predictor of postoperative 6MWT. Both of these studies used preoperative performance as predictors for postoperative performance. Which means that most likely the effect of age was captured in the preoperative performance scores (Kennedy et al., 2016). Parent & Moffet (2003)

described that age-related decline in function was also related to changes in other variables, which were retained in regression models independently of age. This is comparable with the reason described in Kennedy et al. (2006).

Other predictors discussed in the studies were: mental health, depression, anxiety, pain catastrophizing, marital status and academic qualification. Only mental health was found to be a significant predictor for PBM's (Bade et al., 2012). This was consistent with other studies such as (Vissers et al., 2012). They found that lower mental health (measured with the SF-36) was a predictor for worse physical outcome after TKA. They also found that preoperative depression and pain catastrophizing didn't have a significant effect on postoperative physical function. In Tanaka et al. (2020), marital status and academic qualifications were significant in the univariate analysis, but were lost in the regression analyses. One reason for this discrepancy is that individuals who undergo TKA usually remain hospitalized for 2 weeks after surgery for intensive rehabilitation under close supervision by physical therapists in Japan and TUG times were measured near the end of this rehabilitation. Therefore, health behaviors and self management capacity associated with education level may not play a role in hospital rehabilitation (Tanaka et al., 2020).

5.3. Reflections of strong and limitations of the literature study

There were several limitations in this review. The first limitation being the small number of included studies, due to this we can't generalize our findings to a larger population.
One reason for this could be that we had a relatively limited search strategy. We only included studies that explicitly stated in their protocol that they recruited patients suffering from OA treated with elective unilateral TKA. Because of this we might have missed some studies that had similar populations, but didn't mention OA. Another reason was because there weren't many studies that researched preoperative predictors for postoperative performance based outcomes. There were significantly more studies that researched PROMs.
Another limitation is that we only included studies written in english or dutch, which could cause a language bias. A third limitation was that we only searched the database Pubmed and Web of Science for this review. Lastly we only found age and sex as recurring predictors, the

other predictors were only discussed in one study, making it difficult to generalize their findings.

5.4. Recommendations for other studies

In future studies it would be interesting to research the effect of contextual predictors on PROMs, and to compare this to our study. To our knowledge, a study specifically researching preoperative contextual predictors for postoperative gait-related PBM's hasn't been made yet.

6. Conclusion

This study suggests that some contextual factors may have an influence on postoperative PBM's. Ultimately it can be assumed that people with the risk factors discussed in this study, have a higher risk of worse gait-related physical functioning post-surgery.

7. Reference list

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8. Appendix

Table 1. Search strategy

Search strategy PubMed:

(("arthroplasty, replacement, knee"[MeSH Terms]) OR ("knee prosthesis"[MeSH Terms]) OR ("total knee replacement"[Title/Abstract]) OR ("total knee arthroplasty"[Title/Abstract])) AND (("osteoarthritis"[MeSH Terms]) OR ("osteoarthritis"[All Fields])) AND (("predict*") OR ("prognos*") OR ("causal*") OR ("associat*") OR (“Risk Factors”[MeSH Terms])) AND (("Walking"[Title/Abstract]) OR ("ambulation"[Title/Abstract]) OR ("gait"[Title/Abstract]) OR ("locomotion"[Title/Abstract]) OR ("locomotor activity"[Title/Abstract]) OR ("performance"[Title/Abstract]) OR ("walk test"[Title/Abstract]) OR ("walking test"[Title/Abstract]) OR ("timed up and go test"[Title/Abstract]) OR ("chair test"[Title/Abstract]) OR ("functional outcome"[Title/Abstract]) OR ("Assessment"[Title/Abstract]) OR ("balance"[Title/Abstract]))	816

Search strategy WebofScience:

((TS=("total knee arthroplasty*") OR TS=("Total knee prosthesis") OR TS=("knee arthroplasty*")) AND (TS=("osteoarthritis") OR TS=("arthrosis")) AND (TS=("predict*") OR TS=("prognos*") OR TS=("causal*") OR TS=("associat*") OR TS=("risk factors")) AND (TS=("walking") OR TS=("ambulation") OR TS=("gait") OR TS=("locomotion") OR TS=("locomotor activity") OR TS=("performance") OR TS=("walk test") OR TS=("walking test") OR TS=("timed up and go test") OR TS=("chair test") OR TS=("functional outcome") OR TS=("assessment") OR TS=("balance")))	677

Table 2:
Summarize table: preoperative predictors (n=7)

		Author, year						
		Bade et al., 2012	Cooper et al., 2017	Gustavson et al., 2016	Kennedy et al., 2006	Lee et al., 2017	Parent et al., 2003	Tanaka et al., 2020
Preoperative predictors	Age	X	X	/	X	X	X	X
	Sex	X	X	X	X	/	X	X
	Marital Stage	/	/	/	/	/	/	X
	Academic Qualification	/	/	/	/	/	/	X
	Mental Health	X	/	/	/	/	/	/
	Depression	/	X	/	/	/	/	/
	State-trait anxiety	/	X	/	/	/	/	/
	Pain catastrophizing	/	X	/	/	/	/	/

Table 3:
Summarize table: performance based outcome measures (n=7)

		Author, year						
		Bade et al., 2012	Cooper et al., 2017	Gustavson et al., 2016	Kennedy et al., 2006	Lee et al., 2017	Parent et al., 2003	Tanaka et al., 2020
PBM	15s gait test	/	X	/	/	/	/	/
	TUG	X	/	X	X	/	/	X
	6MWT	X	/	X	X	X	X	/
	SCT	X	/	X	/	/	/	/
	Gait analysis	/	/	/	/	X	X	/

Table 4:
Characteristics of the excluded articles

Author, Year	Study-population	Performance Based Outcome Measures	Pre-operative predictors	Reasons for exclusion
Doury-Panchout et al., 2015	89 patients all patients hospitalized for early rehabilitation after TKA for primary osteoarthritis of the knee; age: 72,6 (SD:8,9); sex: 37M/52F	6MWT	Kinesiophobia (TSK)	No contextual predictor
Güney-Deniz et al., 2017	46 patients with the diagnosis of primary knee OA who were candidates for unilateral TKA; sex: 31F/15M;	2MWT & TUG	Kinesiophobia (TSK)	No contextual predictor
Halket et al., 2010	147 patients undergoing unilateral primary hip or knee arthroplasty	/	Sex, age	Wrong outcome
Harmelink et al., 2017	18 articles has included	/	Age, Sex, K-L Grade, Preoperative status	SR

Hayashi et al., 2017	46 participants underwent TKA or THA; sex: 13M/33F	TUG & 10-m gait time	/	No prediction
Magklara et al., 2014	8 articles included	/	Self-efficacy	SR
Ritter et al., 2008	7890 Primary TKA, sex: 1947M/4379F	/	Sex	PROM & Wrong population
Oka et al., 2019	115 adults with knee osteoarthritis (OA) planning to undergo TKA; age; 72,1 (SD:5,9); Sex: 67F/48M	TUG	Sedentary behaviour	No contextual predictor
van den Akker-Scheek et al., 2006	124 patients with a THA or TKA; age: 63,8; Sex: 28M/75F	20-m walk test	Self-efficacy	Wrong population

Pua et al., 2015	1025 patients undergoing primary TKA; sex: 763F/262M; age: 66,7 (SD: 7,5)	10MWT (Habitual & Fast)	Age	Wrong population
Pua et al., 2016	1765 patients who underwent primary TKA; age: 67,1 (SD:7,5); sex: 1313W/452M	10MWT (Habitual & Fast)	Age, sex, height, weight, BMI	Wrong population
Vissers et al., 2012	35 articles included	/	Depression, anxiety, mental health, patient expectations, physiological stress, self-efficacy, coping, vitality, emotion, personality	SR
Robbins et al., 2013	72 patients underwent a primary TKA for knee OA; age: 67 (SD:9); sex: 40F/32M	TUG	Age, gender, and BMI,	Wrong time points

Level	Therapy / Prevention, Aetiology / Harm	Prognosis	Diagnosis	Differential diagnosis / symptom prevalence study	Economic and decision analyses
1a	SR (with homogeneity*) of RCTs	SR (with homogeneity*) of inception cohort studies; CDR" validated in different populations	SR (with homogeneity*) of Level 1 diagnostic studies; CDR" with 1b studies from different clinical centres	SR (with homogeneity*) of prospective cohort studies	SR (with homogeneity*) of Level 1 economic studies
1b	Individual RCT (with narrow Confidence Interval"¡)	Individual inception cohort study with > 80% follow-up; CDR" validated in a single population	Validating** cohort study with good" " " reference standards; or CDR" tested within one clinical centre	Prospective cohort study with good follow-up****	Analysis based on clinically sensible costs or alternatives; systematic review(s) of the evidence; and including multi-way sensitivity analyses
1c	All or none§	All or none case-series	Absolute SpPins and SnNouts" "	All or none case-series	Absolute better-value or worse-value analyses " " " "
2a	SR (with homogeneity*) of cohort studies	SR (with homogeneity*) of either retrospective cohort studies or untreated control groups in RCTs	SR (with homogeneity*) of Level >2 diagnostic studies	SR (with homogeneity*) of 2b and better studies	SR (with homogeneity*) of Level >2 economic studies
2b	Individual cohort study (including low quality RCT; e.g., <80% follow-up)	Retrospective cohort study or follow-up of untreated control patients in an RCT; Derivation of CDR" or validated on split-sample§§§ only	Exploratory** cohort study with good" " " reference standards; CDR" after derivation, or validated only on split-sample§§§ or databases	Retrospective cohort study, or poor follow-up	Analysis based on clinically sensible costs or alternatives; limited review(s) of the evidence, or single studies; and including multi-way sensitivity analyses
2c	"Outcomes" Research; Ecological studies	"Outcomes" Research		Ecological studies	Audit or outcomes research
3a	SR (with homogeneity*) of case-control studies		SR (with homogeneity*) of 3b and better studies	SR (with homogeneity*) of 3b and better studies	SR (with homogeneity*) of 3b and better studies
3b	Individual Case-Control Study		Non-consecutive study; or without consistently applied reference standards	Non-consecutive cohort study, or very limited population	Analysis based on limited alternatives or costs, poor quality estimates of data, but including sensitivity analyses incorporating clinically sensible variations.
4	Case-series (and poor quality cohort and case-control studies§§)	Case-series (and poor quality prognostic cohort studies***)	Case-control study, poor or non-independent reference standard	Case-series or superseded reference standards	Analysis with no sensitivity analysis
5	Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles"	Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles"	Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles"	Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles"	Expert opinion without explicit critical appraisal, or based on economic theory or "first principles"

Produced by Bob Phillips, Chris Ball, Dave Sackett, Doug Badenoch, Sharon Straus, Brian Haynes, Martin Dawes since November 1998. Updated by Jeremy Howick March 2009.

Figure 1: Oxford's Centre for Evidence-Based Medicine Scale

Part 2: Protocol

1. Introduction

Osteoarthritis (OA) of the knee is one of the most common joint disorders in the world and a major cause of pain and disability (Wallace et al., 2017). With obesity becoming more widespread and the increasing life expectancy, OA will only become more prevalent (Cross et al., 2014). It's estimated that the lifetime risk for knee osteoarthritis is 40% in men and 47% in women (Giwnewer, Rubin, Orbach, & Rozen, 2016). In a study in 2010, Cross et al. (2014) found that hip and knee osteoarthritis was ranked as the eleventh highest contributor to global disability and thirty-eighth in disability-adjusted life years (DALYs).

Preoperative predictors could aid in identifying patients at risk for worse functional outcomes after TKA. Lee et al. (2017) recommended that patients with a poor prognosis in terms of gait-related PBMs after TKA should undergo more intensive rehabilitation to improve gait function.
Such knowledge would help determine the need for preoperative rehabilitation (Lee et al., 2017) and postoperative locomotor rehabilitation (Parent & Moffet, 2003).

2. Purpose of the investigation

1.1. Research question

Which contextual predictors influence the postoperative performance based measures in patients with osteoarthritis (OA) that have undergone a total knee arthroplasty (TKA).

1.2. Hypotheses

- Age, gender, marital status and education level are prognostic factors that could influence the gait-related PBMs. (Hypothesis 1)
- People with higher age, female sex, without a spouse and lower education predict worse outcomes on the PBMs for gait capabilities. (Hypothesis 2)
- Psychological factors such as mental health are a predictor for worse performance based outcomes after TKA. (Hypothesis 3)

3. Method

1.3. Study design

This study will be a prospective cohort study.

1.4. Participants

1.4.1. Inclusion criteria

1.4.1.1. Participants with primary knee osteoarthritis treated with unilateral TKA
1.4.1.2. Participants who are receiving their first TKA
1.4.1.3. Participants have to understand the Dutch language

1.4.2. Exclusion criteria

1.4.2.1. Participants with revisional TKA
1.4.2.2. Participants with bilateral TKA
1.4.2.3. Participants with unicompartmental TKA
1.4.2.4. Participants with neurological diseases
1.4.2.5. Participants with cognitive or mental diseases

1.4.3. Recruitment

All patients who were diagnosed with primary knee OA, that were scheduled to undergo a unilateral primary TKA at the Ziekenhuis Oost-Limburg (ZOL) were contacted to participate in the study. Our aim is to include a high number of participants (n=100), to limit the possibility of overestimating the influence of the predictors the PBM's. A larger sample size may make it easier to generalize our findings to a larger population.

1.5. Medical ethics

All participating participants were informed about the nature of the study, and will read and sign a written informed consent before taking part in this study. The study protocol was approved by the College of UHasselt.

1.6. Outcome measurements

1.6.1. Primary outcome measures

TUG

The TUG test measures the time an individual needs to perform a task that consists of standing up from a chair, walking a distance of three meters towards a marker, turning around, walking back to the chair and sitting down again (Podsiadlo & Richardson, 1991). The seat has to be standardized for the whole population and for every time point the test is taken. We chose a seating height of 46 cm, because Siggeirsdóttir, Jónsson, Jónssen & Iwarsson (2002) concluded that a seating height between 44 – 47 cm should be used to assure the best possible performance when performing the TUG test.

Siggeirsdóttir et al. (2002) described the protocol from the TUG:

Starting Position is described as the patient sitting with his back against the chair, his arms resting on the chair's arms.

When the Physiotherapist says the word go, the individual has to get up from the chair, walk at a comfortable and safe pace to the mark at three meters from the chair, turn, return to chair, and sit down with his back against the chair.

The time the patient took to complete the task is measured with a stopwatch. (1/100 of a second)

Extra:

1. The subject wears comfortable footwear and if needed uses his walking aid.
2. The TUG is measured twice to exclude impossible or wrong times.
3. The subject completes the task once before measurement to become familiar with the test.

The ICC for test re-test reliability of the TUG was 0,75 with a SEM of 1,76s in patients following a total hip or knee arthroplasty measured in Kennedy, Stratford, Wessel, Gollish & Penney (2005).

6MWT

The 6-Minute Walk Test (6MWT) measures the functional walk capacity and gait endurance (Enright et al., 2003).

American Thoracic Society Journal (2002) describes the protocol of the 6MWT:

The walking course must be 30m in length. The turnaround point has to be marked with a cone. Every three meters have to be marked and a starting line should be marked on the floor, which marks the beginning and the end of each 60m lap.

The individual had to attempt to cover as much distance as possible in 6 minutes.

The individual had the permission to stop and rest when needed but was instructed to resume the task when able.

After each minute the supervisors will inform the patients of the remaining time left. The supervisor isn't allowed to encourage the participants, because Guyat et al. (1984) concluded in their study that when encouraged during walking, the walk distance significantly increased.

After 6 minutes the individual was instructed to stop walking and this point was marked. The total distance the individual has covered was measured by multiplying the numbers of laps with 60m and adding the distance that was covered during the last lap.

1. The patient wears comfortable clothing and appropriate shoes for walking.
2. Patients should use their walking aids during the test if necessary.

The ICC for test re-test reliability of the 6MWT was 0,94 with a SEM of 43,37m in patients following a total hip or knee arthroplasty measured in Kennedy et al. (2005).

Rejetski et al. (1995) described a test re-test reliability (2 weeks) of the 6MWT with ICC 0,87 in patients with knee osteoarthritis. If we look to test re-test reliability after 3 months an ICC was found of 0,86.

1.6.2. Secondary outcome measures

SCT

The SCT measures the patient's capability of ascending and descending a set of stairs (Dobson et al., 2013). The protocol is described in Kennedy, Stratford, Wessel, Gollish & Penney (2005), the patient was instructed to normally ascend and descend 9 stairs. A step height of 20cm and handrail were recommended for this test (Dobson et al., 2013).

The Time the patient took to complete the task is measured with a stopwatch. (1/100 of a second)

The ICC for test re-test reliability of the 9-SCT was 0,90 with a SEM of 2,35s in patients following a total hip or knee arthroplasty measured in Kennedy et al. (2005).

Rejetski et al. (1995) descrided an excellent test re-test reliability (2 weeks) of a similar SCT with ICC 0,93 in patients with knee osteoarthritis. If we look to test re-test reliability after 3 months a ICC was found of 0,75.

1.6.3. Confounding variable

Kellgrenn and Lawrance grade

The severity of osteoarthritis (OA) is described by the Kellgren and Lawrence classification tool. This tool defined OA in five grades (0, normal to 4, severe) (Schiphof, Boers, & Bierma-Zeinstra, 2008). A previous study found that K-L grade significantly predicted walking speed recovery and the duration of hospitalization after TKA (Amano et al., 2016).

1.6.4. Predictors

Demographic variables

Demographic data like age, sex, marital status, education level. These factors were extracted from the medical charts of the patients.

Tampa scale for kinesiophobia

In De Vroey et al. (2020) they found that patients undergoing TKA had more fear of movement. In order to measure patients' fear of movement, we will use the Dutch version of the Tampa scale for kinesiophobia. This version has been validated in Goubert et al. (2000).

STAI Dutch:

The Dutch version of the state-trait anxiety index (STAI) is a reliable and validated method of measuring patients' anxiety (Van der Ploeg, 1980).

SF-36 Dutch version: MCS:

The SF-36 is a standardized self-report questionnaire. It can be divided into two subscales: the physical component score (PCS) and the mental component score (MCS). In our study the MCS will be evaluated. We will use the Dutch version of the SF-36, this version has been validated by Aaronson et al. (1998).

1.7. Data analysis

Depending on the variables we choose the Pearson correlation or Spearman correlation to determine the relationship between the predictors and gait-related performance based outcome measures.

A p-value of < 0,05 is described as a significant correlation. Variables with near-significant correlations (p-value < 0,10) will also be included in the multivariable regression model.

A p-value of <0,05 will be considered to indicate statistical significance.

4. Time planning

The recruiting and testing of the participants will start in September 2021 and will be finished around December 2021. After we summarize all the results, the statistical analysis will start in January 2022 and will be finished around April 2022. The conclusion based on the results and statistics will be formulated between April and May 2022.

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Attachment 1: Contract Master Thesis part 1

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KNOWLEDGE IN ACTION

CONTRACT WETENSCHAPPELIJKE STAGE DEEL 1

Datum: 8/11/2020

Student(e)1: Nick Schoeters

Student(e) 2: Gilles Filippini

Promotor: Annick Timmermans

Copromotor: Abner Sergooris

Situering masterproef:

☐ Vormt onderdeel van lopend onderzoeksproject, nl. .....

☐ Vormt onderdeel van opstartend onderzoeksproject, nl. .....

☐ Individuele studie

☐ Andere, nl. .....

Nederlandstalige werktitel masterproef:

Contextuele factoren binnen het ICF-raamwerk geassocieerd met activiteitsbeperkingen en participatiebeperkingen na totale knieprothese (TKA)

Engelstalige werktitel masterproef (indien van toepassing)

Contextual factors within the ICF framework associated with activity limitations and participation restrictions following total knee arthroplasty (TKA)

Voorlopige onderzoeksvraag literatuurstudie (indien gekend)

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Formatkeuze van format MP1

☐ Centrale format (conform met masterproefrichtlijnen)

☐ Alternatieve format (zie richtlijnen alternatieve format), nl.

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Uitsluitend van toepassing indien CENTRAL FORMATKEUZE

Doelstelling	Akkoord	Niet akkoord	NVT
1. De student(e) formuleert (in samenspraak met de promotor) een duidelijke vraag in functie van de literatuurstudie. Duid NVT aan indien de vraagstelling voor de literatuurstudie volledig door de promotor wordt aangereikt en formuleer een doelstelling voor de student(e):	☐	☐	☐
2. De student(e) voert een literatuurstudie uit conform de richtlijnen MP deel 1.	☐	☐	
3. De student(e) schrijft de literatuurstudie uit in academische taal conform met de richtlijnen MP deel 1.	☐	☐	
4. De student(e) formuleert, op grond van de gerealiseerde literatuurstudie een onderzoeksvraag voor het eigenlijke wetenschappelijke onderzoek (MP 2). Duid NVT aan indien de student(e) deelneemt aan een lopend onderzoeksproject en de onderzoeksvraag al geformuleerd is en formuleer een doelstelling voor de student(e):	☐	☐	☐
5. De student(e) kiest een onderzoeksdesign en maakt een kritische keuze van de te hanteren methodologie en materialen. Duid NVT aan indien de student(e) gebruik maakt van een uitgewerkt onderzoeksdesign (lopend onderzoeksproject) en formuleer een doelstelling voor de student(e)	☐	☐	☐
6. De student(e) schrijft de methodologiesectie van zijn/haar onderzoek uit conform de richtlijnen MP deel 1. Duid NVT aan indien de student(e) gebruik maakt van een uitgewerkt onderzoeksprotocol (lopend onderzoeksproject) en formuleer een doelstelling voor de student(e)	☐	☐	☐
7. De student(e) schrijft het onderzoeksprotocol uit in academische taal conform met de richtlijnen MP1.	☐	☐	
8. De student(e) voert reeds in deze fase (een deel van) de data acquisitie uit. Duid NVT aan indien de data-acquisitie voltooid wordt/werd zonder inbreng van de student(e) en formuleer een doelstelling voor de student(e).....	☐	☐	☐
9. De student(e) voert reeds in deze fase (een deel van) de data verwerking uit. Duid NVT aan indien de dataverwerking voltooid wordt/werd zonder inbreng van de student(e) en formuleer een doelstelling voor de student(e).....	☐	☐	☐
10. Bijkomende afspraken: ✔ ✔	☐	☐	☐

Datum 8/11/2020 & handtekening student(e)

Datum & handtekening promotor

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CONTRACT WETENSCHAPPELIJKE STAGE DEEL 1

Datum: 9/11/2020

Student(e)1: Nick Schoeters

Student(e) 2: Gilles Filippini

Promotor: Annick Timmermans

Copromotor: Abner Sergooris

Situering masterproef:

☐ Vormt onderdeel van lopend onderzoeksproject, nl. .....

☐ Vormt onderdeel van opstartend onderzoeksproject, nl. .....

☐ Individuele studie

☐ Andere, nl. .....

Nederlandstalige werktitel masterproef:

"Contextuele factoren binnen het ICF-raamwerk geassocieerd met activiteitsbeperkingen en participatiebeperkingen na totale knieprothese (TKA)"

Engelstalige werktitel masterproef (indien van toepassing)

"Contextual factors within the ICF framework associated with activity limitations and participation restrictions following total knee arthroplasty (TKA)"

Voorlopige onderzoeksvraag literatuurstudie (indien gekend)

/

Formatkeuze van format MP1

☐ Centrale format (conform met masterproefrichtlijnen)

☐ Alternatieve format (zie richtlijnen alternatieve format), nl.

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Uitsluitend van toepassing indien CENTRAL FORMATKEUZE

Doelstelling	Akkoord	Niet akkoord	NVT
1. De student(e) formuleert (in samenspraak met de promotor) een duidelijke vraag in functie van de literatuurstudie. Duid NVT aan indien de vraagstelling voor de literatuurstudie volledig door de promotor wordt aangereikt en formuleer een doelstelling voor de student(e):	☐	☐	☐
2. De student(e) voert een literatuurstudie uit conform de richtlijnen MP deel 1.	☐	☐	
3. De student(e) schrijft de literatuurstudie uit in academische taal conform met de richtlijnen MP deel 1.	☐	☐	
4. De student(e) formuleert, op grond van de gerealiseerde literatuurstudie een onderzoeksvraag voor het eigenlijke wetenschappelijke onderzoek (MP 2). Duid NVT aan indien de student(e) deelneemt aan een lopend onderzoeksproject en de onderzoeksvraag al geformuleerd is en formuleer een doelstelling voor de student(e):	☐	☐	☐
5. De student(e) kiest een onderzoeksdesign en maakt een kritische keuze van de te hanteren methodologie en materialen. Duid NVT aan indien de student(e) gebruik maakt van een uitgewerkt onderzoeksdesign (lopend onderzoeksproject) en formuleer een doelstelling voor de student(e)	☐	☐	☐
6. De student(e) schrijft de methodologiesectie van zijn/haar onderzoek uit conform de richtlijnen MP deel 1. Duid NVT aan indien de student(e) gebruik maakt van een uitgewerkt onderzoeksprotocol (lopend onderzoeksproject) en formuleer een doelstelling voor de student(e)	☐	☐	☐
7. De student(e) schrijft het onderzoeksprotocol uit in academische taal conform met de richtlijnen MP1.	☐	☐	
8. De student(e) voert reeds in deze fase (een deel van) de data acquisitie uit. Duid NVT aan indien de data-acquisitie voltooid wordt/werd zonder inbreng van de student(e) en formuleer een doelstelling voor de student(e).....	☐	☐	☐
9. De student(e) voert reeds in deze fase (een deel van) de data verwerking uit. Duid NVT aan indien de dataverwerking voltooid wordt/werd zonder inbreng van de student(e) en formuleer een doelstelling voor de student(e).....	☐	☐	☐
10. Bijkomende afspraken: ✓ ✓	☐	☐	☐

Datum & handtekening student(e)(

8/11/2020

Datum & handtekening promotor

Maak een kopie van het ondertekende contract voor de student(e), de promotor en het studentensecretariaat.

Attachment 2: Mail Reply - Contract

Abner SERGOORIS <abner.sergooris@uhasselt.be> 9 nov. 2020 10:27
aan mij

Beste Gilles

Bij deze hebt u mijn akkoord voor uw contract van wetenschappelijke stage deel 1.

Mvg

Abner

Op zo 8 nov. 2020 om 12:35 schreef Gilles Filippini <gilles.filippini@student.uhasselt.be>:

•••

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Abner Sergooris
Doctoraatsbursaal
REVAL

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UHASSELT
KNOWLEDGE IN ACTION

De kopie voor het studentesecretariaat wordt ter attentie van mevrouw Vicky Vanhille (gebouw D) ingediend.

Re: Contract MP

AS **Abner SERGOORIS <abner.sergooris@uhasselt.be>**
10:27

Aan: Nick Schoeters

Beste Nick

Bij deze hebt u mijn akkoord voor uw contract van wetenschappelijke stage deel 1.

Mvg

Abner

Op ma 9 nov. 2020 om 10:09 schreef <nick.schoeters@student.uhasselt.be>:

Attachment 3: Declaration of honour – GF

Verklaring op Eer

Ondergetekende, student aan de Universiteit Hasselt (UHasselt), faculteit Revalidatiewetenschappen aanvaardt de volgende voorwaarden en bepalingen van deze verklaring:

1. Ik ben ingeschreven als student aan de UHasselt in de opleiding Revalidatiewetenschappen en kinesitherapie, waarbij ik de kans krijg om in het kader van mijn opleiding mee te werken aan onderzoek van de faculteit Revalidatiewetenschappen aan de UHasselt. Dit onderzoek wordt beleid door Prof. dr. Annick Timmermans & drs. Abner Sergooris en kadert binnen het opleidingsonderdeel Wetenschappelijke stage/masterproef deel 1. Ik zal in het kader van dit onderzoek creaties, schetsen, ontwerpen, prototypes en/of onderzoeksresultaten tot stand brengen in het domein van totale knie arthroplasty (hierna: "De Onderzoeksresultaten").

2. Bij de creatie van De Onderzoeksresultaten doe ik beroep op de achtergrondkennis, vertrouwelijke informatie[1], universitaire middelen en faciliteiten van UHasselt (hierna: de "Expertise").

3. Ik zal de Expertise, met inbegrip van vertrouwelijke informatie, uitsluitend aanwenden voor het uitvoeren van hogergenoemd onderzoek binnen UHasselt. Ik zal hierbij steeds de toepasselijke regelgeving, in het bijzonder de Algemene Verordening Gegevensbescherming (EU 2016-679), in acht nemen.

4. Ik zal de Expertise (i) voor geen enkele andere doelstelling gebruiken, en (ii) niet zonder voorafgaande schriftelijke toestemming van UHasselt op directe of indirecte wijze publiek maken.

5. Aangezien ik in het kader van mijn onderzoek beroep doe op de Expertise van de UHasselt, draag ik hierbij alle bestaande en toekomstige intellectuele eigendomsrechten op De Onderzoeksresultaten over aan de UHasselt. Deze overdracht omvat alle vormen van intellectuele eigendomsrechten, zoals onder meer – zonder daartoe beperkt te zijn – het auteursrecht, octrooirecht, merkenrecht, modellenrecht en knowhow. De overdracht geschiedt in de meest volledige omvang, voor de gehele wereld en voor de gehele beschermingsduur van de betrokken rechten.

6. In zoverre De Onderzoeksresultaten auteursrechtelijk beschermd zijn, omvat bovenstaande overdracht onder meer de volgende exploitatiewijzen, en dit steeds voor de hele beschermingsduur, voor de gehele wereld en zonder vergoeding:

   - het recht om De Onderzoeksresultaten vast te (laten) leggen door alle technieken en op alle dragers;
   - het recht om De Onderzoeksresultaten geheel of gedeeltelijk te (laten) reproduceren, openbaar te (laten) maken, uit te (laten) geven, te (laten) exploiteren en te (laten) verspreiden in eender welke vorm, in een onbeperkt aantal exemplaren;

[1] Vertrouwelijke informatie betekent alle informatie en data door de UHasselt meegedeeld aan de student voor de uitvoering van deze overeenkomst, inclusief alle persoonsgegevens in de zin van de Algemene Verordening Gegevensbescherming (EU 2016/679), met uitzondering van de informatie die (a) reeds algemeen bekend is; (b) reeds in het bezit was van de student voor de mededeling ervan door de UHasselt; (c) de student verkregen heeft van een derde zonder enige geheimhoudingsplicht; (d) de student onafhankelijk heeft ontwikkeld zonder gebruik te maken van de vertrouwelijke informatie van de UHasselt; (e) wettelijk of als gevolg van een rechterlijke beslissing moet worden bekendgemaakt, op voorwaarde dat de student de UHasselt hiervan schriftelijk en zo snel mogelijk op de hoogte brengt.

- het recht om De Onderzoeksresultaten te (laten) verspreiden en mee te (laten) delen aan het publiek door alle technieken met inbegrip van de kabel, de satelliet, het internet en alle vormen van computernetwerken;
- het recht De Onderzoeksresultaten geheel of gedeeltelijk te (laten) bewerken of te (laten) vertalen en het (laten) reproduceren van die bewerkingen of vertalingen;
- het recht De Onderzoeksresultaten te (laten) bewerken of (laten) wijzigen, onder meer door het reproduceren van bepaalde elementen door alle technieken en/of door het wijzigen van bepaalde parameters (zoals de kleuren en de afmetingen).

De overdracht van rechten voor deze exploitatiewijzen heeft ook betrekking op toekomstige onderzoeksresultaten tot stand gekomen tijdens het onderzoek aan UHasselt, eveneens voor de hele beschermingsduur, voor de gehele wereld en zonder vergoeding.

Ik behoud daarbij steeds het recht op naamvermelding als (mede)auteur van de betreffende Onderzoeksresultaten.

7. Ik zal alle onderzoeksdata, ideeën en uitvoeringen neerschrijven in een "laboratory notebook" en deze gegevens niet vrijgeven, tenzij met uitdrukkelijke toestemming van mijn UHasseltbegeleider Prof. dr. Annick Timmermans & drs. Abner Sergooris.

8. Na de eindevaluatie van mijn onderzoek aan de UHasselt zal ik alle verkregen vertrouwelijke informatie, materialen, en kopieën daarvan, die nog in mijn bezit zouden zijn, aan UHasselt terugbezorgen.

Gelezen voor akkoord en goedgekeurd,

Naam: Gilles Filippini

Adres: Burgemeester Vinckenlaan 17, 3630 Maasmechelen

Geboortedatum en –plaats : 07/12/1998, Genk

Datum: 09/11/2020

Handtekening:

Attachment 4: Declaration of honour – NS

Verklaring op Eer

Ondergetekende, student aan de Universiteit Hasselt (UHasselt), faculteit [RWS] aanvaardt de volgende voorwaarden en bepalingen van deze verklaring:

1. Ik ben ingeschreven als student aan de UHasselt in de opleiding [revalidatiewetenschappen en kinesitherapie], waarbij ik de kans krijg om in het kader van mijn opleiding mee te werken aan onderzoek van de faculteit [RWS] aan de UHasselt. Dit onderzoek wordt beleid door [Annick Timmermans] en kadert binnen het opleidingsonderdeel masterproef deel 1. Ik zal in het kader van dit onderzoek creaties, schetsen, ontwerpen, prototypes en/of onderzoeksresultaten tot stand brengen in het domein van [MSK] (hierna: "De Onderzoeksresultaten").

2. Bij de creatie van De Onderzoeksresultaten doe ik beroep op de achtergrondkennis, vertrouwelijke informatie[1], universitaire middelen en faciliteiten van UHasselt (hierna: de "Expertise").

3. Ik zal de Expertise, met inbegrip van vertrouwelijke informatie, uitsluitend aanwenden voor het uitvoeren van hogergenoemd onderzoek binnen UHasselt. Ik zal hierbij steeds de toepasselijke regelgeving, in het bijzonder de Algemene Verordening Gegevensbescherming (EU 2016-679), in acht nemen.

4. Ik zal de Expertise (i) voor geen enkele andere doelstelling gebruiken, en (ii) niet zonder voorafgaande schriftelijke toestemming van UHasselt op directe of indirecte wijze publiek maken.

5. Aangezien ik in het kader van mijn onderzoek beroep doe op de Expertise van de UHasselt, draag ik hierbij alle bestaande en toekomstige intellectuele eigendomsrechten op De Onderzoeksresultaten over aan de UHasselt. Deze overdracht omvat alle vormen van intellectuele eigendomsrechten, zoals onder meer – zonder daartoe beperkt te zijn – het auteursrecht, octrooirecht, merkenrecht, modellenrecht en knowhow. De overdracht geschiedt in de meest volledige omvang, voor de gehele wereld en voor de gehele beschermingsduur van de betrokken rechten.

6. In zoverre De Onderzoeksresultaten auteursrechtelijk beschermd zijn, omvat bovenstaande overdracht onder meer de volgende exploitatiewijzen, en dit steeds voor de hele beschermingsduur, voor de gehele wereld en zonder vergoeding:

   - het recht om De Onderzoeksresultaten vast te (laten) leggen door alle technieken en op alle dragers;
   - het recht om De Onderzoeksresultaten geheel of gedeeltelijk te (laten) reproduceren, openbaar te (laten) maken, uit te (laten) geven, te (laten) exploiteren en te (laten) verspreiden in eender welke vorm, in een onbeperkt aantal exemplaren;

[1] Vertrouwelijke informatie betekent alle informatie en data door de UHasselt meegedeeld aan de student voor de uitvoering van deze overeenkomst, inclusief alle persoonsgegevens in de zin van de Algemene Verordening Gegevensbescherming (EU 2016/679), met uitzondering van de informatie die (a) reeds algemeen bekend is; (b) reeds in het bezit was van de student voor de mededeling ervan door de UHasselt; (c) de student verkregen heeft van een derde zonder enige geheimhoudingsplicht; (d) de student onafhankelijk heeft ontwikkeld zonder gebruik te maken van de vertrouwelijke informatie van de UHasselt; (e) wettelijk of als gevolg van een rechterlijke beslissing moet worden bekendgemaakt, op voorwaarde dat de student de UHasselt hiervan schriftelijk en zo snel mogelijk op de hoogte brengt.

- het recht om De Onderzoeksresultaten te (laten) verspreiden en mee te (laten) delen aan het publiek door alle technieken met inbegrip van de kabel, de satelliet, het internet en alle vormen van computernetwerken;
- het recht De Onderzoeksresultaten geheel of gedeeltelijk te (laten) bewerken of te (laten) vertalen en het (laten) reproduceren van die bewerkingen of vertalingen;
- het recht De Onderzoeksresultaten te (laten) bewerken of (laten) wijzigen, onder meer door het reproduceren van bepaalde elementen door alle technieken en/of door het wijzigen van bepaalde parameters (zoals de kleuren en de afmetingen).

De overdracht van rechten voor deze exploitatiewijzen heeft ook betrekking op toekomstige onderzoeksresultaten tot stand gekomen tijdens het onderzoek aan UHasselt, eveneens voor de hele beschermingsduur, voor de gehele wereld en zonder vergoeding.

Ik behoud daarbij steeds het recht op naamvermelding als (mede)auteur van de betreffende Onderzoeksresultaten.

7. Ik zal alle onderzoeksdata, ideeën en uitvoeringen neerschrijven in een "laboratory notebook" en deze gegevens niet vrijgeven, tenzij met uitdrukkelijke toestemming van mijn UHasseltbegeleider [Annick Timmermans].

8. Na de eindevaluatie van mijn onderzoek aan de UHasselt zal ik alle verkregen vertrouwelijke informatie, materialen, en kopieën daarvan, die nog in mijn bezit zouden zijn, aan UHasselt terugbezorgen.

Gelezen voor akkoord en goedgekeurd,

Naam: Nick Schoeters

Adres: Romeinskampstraat 1, 3630 Maasmechelen

Geboortedatum en –plaats : 30/07/98, Genk

Datum: 8/11/2020

Handtekening:

Attachment 5: Progress form

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VOORTGANGSFORMULIER WETENSCHAPPELIJKE STAGE DEEL 1

DATUM	INHOUD OVERLEG	HANDTEKENINGEN
28/10/2020	Opstartvergadering MP 1	Promotor: Annick Timmermans Copromotor/begeleider: Abner Sergooris Student(e): Nick Schoeters Student(e): Gilles Filippini
2/11/2020	Verdere uitleg MP 1 Uitleg Onderzoeksvraag Uitleg start MP 1	Promotor: Annick Timmermans Copromotor/begeleider: Abner Sergooris Student(e): Nick Schoeters Student(e): Gilles Filippini
22/12/2020	Masterproefoverleg Korte ppt presentatie over gedeeltelijke onderzoeksvraag, PICO, zoekstrategie. Verder advies i.v.m. uitwerking zoekstrategie	Promotor: Annick Timmermans Copromotor/begeleider: Abner Sergooris Student(e): Nick schoeters Student(e): Gilles Filippini
22/02/2021	Werkpunten zoekstrategie aangehaald Uitleg over inleiding, screening en methode	Promotor: Annick Timmermans Copromotor/begeleider: Abner Sergooris Student(e): Nick Schoeters Student(e): Gilles Filippini
1/04/2021	Bespreking voortgang masterproef Bespreking i.v.m. vragen	Promotor: Annick Timmermans Copromotor/begeleider: Abner Sergooris Student(e): Nick Schoeters Student(e): Gilles Filippini
27/05/2021	Bespreking voortgang masterproef Verder advies i.v.m. methode, resultaten en discussie Bespreking i.v.m. vragen	Promotor: Annick Timmermans Copromotor/begeleider: Abner Sergooris Student(e): Nick schoeters Student(e): Gilles Filippini
7/06/2021	Bespreking feedback inleiding, methode, resultaten Bespreking i.v.m. vragen	Promotor: Annick Timmermans Copromotor/begeleider: Abner Sergooris Student(e): Nick Shoeters Student(e): Gilles Filippini
7/06/2021	**Niet-bindend advies:** De promotor verleent hierbij het advies om de masterproef WEL/~~NIET~~ te verdedigen.	Promotor: Annick Timmermans Copromotor/begeleider: Abner Sergooris Student(e): Nick Schoeters Student(e): Gilles Filippini

Attachment 6: self-evaluation form

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UHASSELT
KNOWLEDGE IN ACTION

BEOORDELING VAN DE WETENSCHAPPELIJKE STAGE-DEEL 1

Wetenschappelijke stage deel 1 (Masterproef deel 1- MP1) van de Master of Science in de revalidatiewetenschappen en de kinesitherapie bestaat uit **twee delen**:

1) De literatuurstudie volgens een welomschreven methodiek.
2) Het opstellen van het onderzoeksprotocol ter voorbereiding van masterproef deel 2.

Omschrijving van de **evaluatie**:

1) 80% van het eindcijfer wordt door de promotor in samenspraak met de copromotor gegeven op grond het product en van het proces dat de student doorliep om de MP1 te realiseren, met name het zelfstandig uitvoeren van de literatuurstudie en het zelfstandig opstellen van het onderzoeksprotocol, alsook de kwaliteit van academisch schrijven.
2) 20% van het eindcijfer wordt door de interne jury gegeven op grond van het ingeleverde product en de mondelinge presentatie waarin de student zijn/haar proces toelicht.

In de beoordeling dient onderscheid gemaakt te worden tussen studenten die, in samenspraak met de promotor, een nieuw onderzoek uitwerkten en studenten die instapten in een lopend onderzoek of zich baseren op voorgaande masterproeven of onderzoeksprojecten. Van deze laatste worden bijkomende inspanningen verwacht zoals bv. het bijsturen van de eerder geformuleerde onderzoeksvraag, de kritische reflectie over het onderzoeksdesign, het uitvoeren van een pilotexperiment.

Beoordelingskader:

Beoordelingskader: criteria op 20	
18-20	Excellente modelmasterproef
16-17	Zeer goede masterproef
14-15	Goede masterproef
12-13	Voldoende masterproef
10-11	Zwakke masterproef
≤ 9	Onvoldoende masterproef die niet aan de minimumnormen voldoet

ZELFEVALUATIERAPPORT

Onderstaand zelfevaluatierapport is een hulpmiddel om je wetenschappelijke stage -deel 1 zelfstandig te organiseren. Bepaal zelf je deadlines, evalueer en reflecteer over je werkwijze en over de diepgang van je werk. Check de deadlines regelmatig. Toets ze eventueel af bij je (co)promotor. Succes!

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LITERATUURSTUDIE	Gestelde deadline	Behaald op	Reflectie
De belangrijkste concepten en conceptuele kaders van het onderzoekdomein uitdiepen en verwerken	1/12/2021	1/12/2021	*soft-deadlines
De belangrijkste informatie opzoeken als inleiding op de onderzoeksvraag van de literatuurstudie	15/1/2021	15/2/2021	
De opzoekbare onderzoeksvraag identificeren en helder formuleren in functie van de literatuurstudie	30/1/2021	30/1/2021	
De zoekstrategie op systematische wijze uitvoeren in relevante databanken	5/03/2021	30/03/2021	
De kwaliteitsbeoordeling van de artikels diepgaand uitvoeren	10/05/2021	20/05/2021	
De data-extractie grondig uitvoeren	1/05/2021	15/05/2021	
De bevindingen integreren tot een synthese	30/05/2021	1/06/2021	

ONDERZOEKSPROTOCOL	Gestelde deadline	Behaald op	Reflectie
De onderzoeksvraag in functie van het onderzoeksprotocol identificeren	15/05/2021	30/05/2021	
Het onderzoeksdesign bepalen en/of kritisch reflecteren over bestaande onderzoeksdesign	15/05/2021	5/06/2021	
De methodesectie (participanten, interventie, uitkomstmaten, data-analyse) uitwerken	25/05/2021	5/06/2021	

ACADEMISCHE SCHRIJVEN	Gestelde deadline	Behaald op	Reflectie
Het abstract to the point schrijven	3/06/2020	6/06/2020	
De inleiding van de literatuurstudie logisch opbouwen	15/04/2020	28/05/2020	
De methodesectie van de literatuurstudie transparant weergegeven	15/05/2020	25/05/2020	
De resultatensectie afstemmen op de onderzoeksvragen	30/05/2020	8/06/2020	
In de discussiesectie de bekomen resultaten in een wetenschappelijke tekst integreren en synthetiseren	1/06/2020	8/06/2020	
Het onderzoeksprotocol deskundig technisch uitschrijven	6/06/2020	10/06/2020	
Referenties correct en volledig weergeven	20/05/2020	15/05/2020	

ZELFSTUREND EN WETENSCHAPPELIJK DENLEN EN HANDELEN	Aanvangsfase	Tussentijdse fase	Eindfase
Een realistische planning opmaken, deadlines stellen en opvolgen	Voldoende	Goed	Goed
Initiatief en verantwoordelijkheid opnemen ten aanzien van de realisatie van de wetenschappelijke stage	Voldoende	Voldoende	Goed
Kritisch wetenschappelijk denken	Voldoende	Goed	Zeer goed
De contacten met de promotor voorbereiden en efficiënt benutten	Goed	Zeer goed	Zeer goed
De richtlijnen van de wetenschappelijke stage autonoom opvolgen en toepassen	Goed	Goed	Zeer goed
De communicatie met de medestudent helder en transparant voeren	Goed	Goed	Goed
De communicatie met de promotor/copromotor helder en transparant voeren	Goed	Voldoende	Goed
Andere verdiensten:	/	/	/