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A NEW PRACTICE MODEL TO ORGANIZE PERIOPERATIVE NURSING CARE

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'Never be afraid of trying something new, because life gets boring when you stay within the limits of what you already knew'

- *Jaya Maheswari*

This thesis is dedicated to all patients undergoing perioperative care and the nurses caring for them

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ABSTRACT

The aim of this research was to investigate the effects of a new perioperative practice model (NPPM) on patient outcomes (anxiety, health-related quality of life, satisfaction), nursing outcomes (organizational engagement), and organizational outcomes (the timeline of the surgical care process). In the NPPM one designated anesthesia nurse cares for the patient throughout the entire perioperative process, visiting the patient on the first postoperative day. In contemporary perioperative care the patients are cared for by different nurses in the operating room and in the Post Anesthesia Care Unit, and do not receive postoperative visits. The feasibility test of the NPPM was performed using a qualitative method in a pilot study between 2013 and 2014. After piloting, a randomized clinical trial with a two-group parallel design was conducted. The randomized patient sample comprised voluntary adult patients receiving total hip arthroplasty or total knee arthroplasty under spinal anesthesia (n = 453). The intervention group (n = 231) received NPPM care and the control group (n = 222) received contemporary perioperative care. All participants of the two groups answered two self-reported questionnaires: the 15D health-related quality of life questionnaire and the State-Trait Anxiety Inventory (STAI) to measure anxiety two to three weeks prior to a planned operation, and at three months postoperatively. Additionally, the two groups responded to the Good Perioperative Nursing Care Scale questionnaire at discharge from hospital. The surgical time points for all participants were collected from the operating room management software and hospital information system, from hospital admission until discharge. The nurses at the study setting responded to the Nurse Engagement Survey (NES) before the start of the study and after the last study participant had been discharged from hospital. In data analysis qualitative content analysis, descriptive statistics, one- and multifactor ANOVAs and nonparametric tests were used. The NPPM care was as good as the contemporary perioperative care, when examining the changes in HRQoL and anxiety levels, from baseline to follow-up. Both patient groups rated their perioperative care as particularly good. Minor differences in time points of the surgical care process were found between groups, but none of statistical significance. Nurse engagement was higher prior to the study than after the study.

KEYWORDS: nursing, perioperative practice model, anxiety, health-related quality of life, arthroplasty, continuity, patient satisfaction, nurse engagement, surgical care process, randomized clinical trial

TIIVISTELMÄ

Tämän tutkimuksen tarkoituksena oli selvittää, mikä aiemmin kehittämämme uuden perioperatiivisen hoitotyön toimintamallin vaikutus oli potilaan kokemaan ahdistuneisuuteen, terveyteen liittyvään elämänlatuun ja potilastyytyväisyyteen, hoitajien sitoutumiseen työhönsä sekä leikkausprosessin ajalliseen sujuvuuteen. Uudessa perioperatiivisen hoitotyön toimintamallissa sama anestesiahoitaja hoitaa potilasta sekä leikkaussalissa että heräämössä sekä tekee postoperatiivisen käynnin leikkauksen jälkeisenä päivänä. Tavanomaisessa perioperatiivisen hoidon toimintamallissa potilaan hoitaja vaihtuu hoitopistekohtaisesti. Tämä tutkimus on jatkoa laadulliselle pilottitutkimukselle, joka suoritettiin vuosina, 2013–2014. Kyseessä on kahden ryhmän, yhteensä 453 polven ja lonkan tekonivel-leikkauspotilaan satunnaistettu kontrolloitu pitkittäistutkimus, jossa tutkimus-ryhmän potilaita (n = 231) hoidettiin uuden perioperatiivisen hoitotyön toiminta-mallin mukaisesti ja verrokkiryhmän potilaita (n = 222) tavanomaisen mallin mukaisesti. Molemmat ryhmät täyttivät terveyteen liittyvän elämänlaatukyselyn 15 D ja ahdistuneisuuskyselyn STAI kaksi-kolme viikkoa ennen leikkausta ja kolme kuukautta leikkauksen jälkeen, sekä sairaalasta kotiutuessaan leikkaukseen liittyvää hoitoa arvioivan kyselyn Hyvä Perioperatiivinen Hoito-mittarin. Kaikkien tutki-mukseen osallistuneiden potilaiden hoidonkulkua kuvaavat aikamerkinnät kerättiin leikkausosaston toiminnanohjausjärjestelmästä. Tutkimuskohteen sairaanhoitajat täyttivät organisaatioon sitoutumista ja siihen vaikuttavia tekijöitä tarkastelevan kyselyn Nurse Engagement Survey (NES) ennen tutkimuksen alkua sekä viimeisen tutkimuspotilaan kotiuduttaa sairaalasta. Aineiston analyysissä käytettiin laadullista sisällön analyysiä, kuvailevia tilastomenetelmiä, yksi- ja monimuuttujaista varianssianalyysiä sekä ei-parametrisiä testejä. Uuden perioperatiivisen hoitotyön toimintamallin mukainen hoito oli yhtä hyvää kuin tavanomainen hoito, kun tarkasteltiin muutoksia terveyteen liittyvän elämänlaadun ja ahdistuneisuuden tasoja ennen ja jälkeen leikkauksen. Kummankin ryhmän potilaat arvioivat saaneensa erittäin hyvää perioperatiivista hoitoa. Pieniä eroja oli havaittavissa hoidonkulkua kuvaavissa aikamerkinnöissä ryhmien välillä, nämä eivät kuitenkaan olleet tilastollisesti merkitseviä. Hoitajat olivat sitoutuneempia ennen tutkimuksen alkamista kuin tutkimuksen jälkeisessä mittauksessa.

AVAINSANAT: perioperatiivisen hoitotyön toimintamalli, ahdistuneisuus, ter-veyteen liittyvä elämänlaatu, tekonivelleikkaus, jatkuvuus, potilastyytyväisyys, hoitajien sitoutuneisuus, leikkausprosessin ajallinen sujuvuus, satunnaistettu pitkittäistutkimus

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Abbreviations

AN	Anesthesia nurse
ANOVA	Analysis of variance
AORN	Association of periOperative Registered Nurses
ASA	Physical Status Classification System of the American Society of Anesthesiologists
CI	Confidence interval
ERAS	Enhanced recovery after surgery
FORNA	Finnish Operating Room Nurses Association
GEE	Generalized estimating equations
GPNCS	Good Perioperative Nursing Care Scale
HRQoL	Health Related Quality of Life
LOS	Length of hospital stay
MRC	Medical Research Council
NES	Nurse Engagement Survey
NPPM	New Perioperative Practice Model
NS	Not statistically significant
OA	Osteoarthritis
OR	Operating room
PACU	Post-anesthesia care unit
PI	Primary investigator
RCT	Randomized clinical trial
RN	Registered nurse
SAS	Statistical analysis system
SD	Standard deviation
SPSS	Statistical Package for Social Sciences
STAI	The Spielberger State-Trait Anxiety Inventory
TENK	Finnish Advisory Board on Research Integrity
THA	Total hip arthroplasty
TKA	Total knee arthroplasty
WHO	World Health Organization

List of Original Publications

This dissertation is based on the following original publications, which are referred to in the text by their Roman numerals:

I Pulkkinen M, Junttila K, Lindwall L. 2016. The perioperative dialogue – a model of caring for the patient undergoing a hip or a knee replacement surgery under spinal anesthesia. Scandinavian Journal of Caring Sciences, 30(1), 145–153. https://doi.org/10.1111/scs.12233

II Pulkkinen M, Jousela I, Sintonen H, Engblom J, Salanterä S, Junttila K. 2021. A randomized clinical trial of a new perioperative practice model on anxiety and health-related quality of life in arthroplasty patients. Nursing Open, 8(4), 1593–1605. https://doi.org/10.10021/nop2.776

III Pulkkinen M, Jousela I, Engblom J, Salanterä S, Junttila K. 2020.The effect of a new perioperative practice model on length of hospital stay and on the surgical care process in patients undergoing hip and knee arthroplasty under spinal anesthesia: a randomized clinical trial. BMC Nursing, 19(73), 1–9. https://doi.org/10.1186/s12912-020-00465-3

IV Pulkkinen M, Lindwall L, Jousela I, Salanterä S, Junttila K. 2021. A randomized clinical trial of a new perioperative practice model on patient satisfaction and nurse engagement. Manuscript.

The original publications have been reproduced with the permission of the copyright holders. This thesis also contains unpublished material about Phase III.

1   Introduction

The current state of healthcare is struggling with a threatening lack of nurses and economic constraints and savings being made all over the world. There is a demand for effectiveness and efficiency in healthcare services to be of high quality and rewarding both for patients, nurses, and the healthcare organizations. In other words, more should be accomplished with less economic and personnel resources (Peltokorpi 2011). At the same time, the world's population is aging, with extended care needs for disabling diseases. One of the most common disabling disease is osteoarthritis (OA), which has increased all over the world (World Health Organization 2001). OA causes joint deformity, pain, anxiety, fatigue, and a reduction of both physical and mental wellbeing and functioning. The health-related quality of life (HRQoL) in patients suffering from OA is influenced by these symptoms. Often patients suffering from OA also suffer from anxiety due to restricted physical functioning, and constant use of painkillers followed by dizziness. Hip and knee arthroplasties can be effective treatments resulting in pain relief, improved mobility, and enhanced quality of life (Hustedt et al. 2008, 2011,2018, Malviya et al. 2011, Specht et al. 2015, Miettinen et al. 2020).

The rapid medical development in recent decades has improved surgical outcomes for patients receiving total hip arthroplasty (THA) and total knee arthroplasty (TKA), including standardized care protocols. The length of hospital stay (LOS) has decreased due to the advanced surgical and anesthetic techniques together with increasing outpatient surgery activity.

A surgical procedure is always a unique event for the patient, with an unpredictable outcome causing uncertainty, nervousness, anxiety, and a sense of losing control over one's life. These mental factors might increase anxiety and may result in delayed recovery caused by pain and prolonged wound healing (Ali et al. 2014, Pritchard 2009, Kagan & Bar Tal 2007, Vaugh 2007).

Despite the standardization of care protocols, there are still patients who might not fit into these protocols, because people are individuals with different care needs, different personal traits, health status, age, gender, and personal resources to cope. Patients having fewer comorbidities and a lower age might recover quickly, while

patients who are older and with severe comorbidities might recover more slowly (Gong & Dong, 2014, Sillero Sillero & Zabalegui, 2018).

These latter-mentioned patients in particular could gain from extra emotional support and encouragement, individual education, pain management, and support for self-management for recovery, which is required for timely discharge (Strickland et al. 2018). Patient participation is of importance regarding the shortened LOS, so that the patients have enough knowledge to self-manage (Gröndahl et al. 2019, Karaca & Durna, 2019, Kao et al. 2016). Earlier studies have found that individual and person-centered interventions are valuable in meeting patients' various care needs and in supporting patients' recovery and self-management (Berg et al. 2019, Olsson et al. 2016, Olsson et al. 2014, Tekin & Findik 2015).

The median LOS following THA and TKA procedures has decreased from being five days in 2009 to only one to three days nowadays (Hustedt et al. 2011, 2018). Short hospital stays nowadays can be demanding for both patients and nurses in perioperative settings, due to restricted time for the patient-nurse relationship. The main focus of perioperative nursing is on supporting patients to recover safely and timely, and on encouraging patients to find their own strengths to self-manage.

Although surgical and anesthetic techniques have undergone huge development, the way of delivering perioperative care to patients in practice by perioperative nurses has remained the same over the years. In contemporary perioperative nursing practice, the patient is cared for by different nurses in the operating department, for example in the operating room (OR) and in the post-anesthesia care unit (PACU). In the contemporary model of perioperative nursing practice, the continuity in patient care is lacking and might mainly rely on handovers and patient documents (Leino-Kilpi et al. 2015). The information provided to the patient can also be fragmented when given by several different nurses. This may cause insecurity and confusion in patients (Sibbern et al. 2016).

In meeting the current demands of nurse-delivered perioperative care, there might be a need for new interventions with a focus on continuity of patient care (World Health Organization 2018). Continuity-creating nursing interventions have been reported as being efficient in several contexts (Bazemore et al., 2018, McInnes, Martin, & MacArthur, 2018, Perriman, Davis, & Ferguson, 2018, Suominen et al. 2014) but have been sparely reported in perioperative nursing care, and not at all in perioperative nursing among arthroplasty patients. Continuity-creating perioperative nursing interventions could diminish anxiety, improve HRQoL, and patient satisfaction. Patients need confidence and trust in their own abilities to recover safely. Such interventions might also have an impact on the job satisfaction and engagement of perioperative nurses in a rewarding way and may even gain organizational outcomes. In this study we developed a new perioperative practice model (NPPM), which could be a model of choice for vulnerable patients in need of

extra support and encouragement in perioperative settings. This new practice model could also be used as a supplement to standardized surgical care protocols.

This doctoral thesis belongs to the field of clinical nursing science and contributes new knowledge on a continuity-creating perioperative practice model.

2 Background of the Study

Theoretical background of the study

This study represents nursing science, thus its metaparadigm includes the basic concepts: the human being, health, illness, nursing, and the environment (Fawcett 1984). Nursing as a profession includes the ontological basic assumptions of the person, seen as a unique human being, as a whole of body, soul, and spirit. The epistemological concepts of interest in nursing science are the human being, their health, illness, and the environment, and the relationships between these concepts.

Holistic nursing encompasses the mind, body, and spirt, in a culture that supports a caring relationship, which results in wholeness and healing, instead of caring for the person in fragmented parts. The holistic view of care is person-focused, with the aim of providing individualized care for the patient (McEvoy & Duffy 2008).

This is in accordance with the standards of the Association of periOperative Registered Nurses (AORN 2015) and the Core Curriculum for Perioperative Nursing of the European Operating Room Nurses Association (EORNA 2019), which both state that the foundation of perioperative nursing practice is a holistic, individual caring relationship, including an ethical attitude, promoted by working together with other healthcare professionals in accordance with the patient's needs in coordinating the care (AORN 2015, EORNA 2019).

In this study the focus of interest is on the patient suffering from OA who is in need of surgical treatment on the hip or knee, the perioperative nurse, and a nurse-delivered perioperative care intervention (caring relationship). The environment is the perioperative context, more precisely in the operating department, during the phases of perioperative care. The focus of interest in this study is to explore the effect of the NPPM from the patient's perspective (patient-reported outcomes; anxiety, HRQoL, and patient satisfaction), from the perioperative nurse's perspective (nurse engagement) and from the perspective of the organization (LOS and the different time points of the surgical care process).

Patients have different (physiological, emotional, and spiritual) needs; the need to be recognized as an individual, the need to feel safe and in good hands, to be able to trust in the nurse, the need in the nurse to find their own resources, the need for encouragement and support to be able to cope with surgery, and the safe recovery to

self-manage their care at early discharge. The nurses have a need to find meaning in their work, to be engaged, and to be able to deliver high-quality care to the patients. The organization has needs to deliver high-quality care to all patients, the safe and timely discharge from hospital for all patients, efficient processes of surgical care, and for this the organization needs professional, engaged nurses who are able to provide high-quality care for all patients. The background of this study is presented in Figure. 1.

In the next section (2.1) a description of what OA causes the patient is given, followed by a definition of the concepts related to suffering from OA.

2.1 Patients suffering from osteoarthritis

Osteoarthritis (OA) is a disabling disease which is known to cause a variety of symptoms, both physical and psychological. OA causes deformity of the joints, severe pain, fatigue, anxiety, and reduction of both physical and psychological functioning. Due to the restricted physical functioning caused by the aforementioned symptoms, patients suffering from OA might need help from others to cope in daily life, and this might cause anxiety and decrease HRQoL (Bachrach-Lindström et al. 2008, Mandzuk et al. 2015). The concepts related to patients suffering from OA and of interest to this study are HRQoL and anxiety, which will be defined and described in the next two sections.

Quality of life and health-related quality of life

Quality of life is a widespread and complex concept that has been difficult to define. Quality of life can have different meanings for individuals and might depend on their beliefs, values, goals, and expectations in life. There are several elements in an individual's life that influence the perceived quality of life such as health, social relations, satisfaction with living conditions, and satisfaction with work (Barofsky 2012). Quality of life comprises both subjective and objective aspects, meaning that an individual can live in poor circumstances, but still be satisfied with their quality of life. Such a life can be considered by another individual as a life of poor quality, although the individual them self is content with their life (Meeberg 1993). The concept of health-related quality of life (HRQoL) can be defined as the influence of health on how well an individual is able to function in their life and their subjective experience of their wellbeing in physical, emotional, and social fields of life (Karimi & Brazier 2016).

Anxiety

Earlier studies report that these patients suffer from anxiety, especially during the waiting time prior to a scheduled operation, due to pain and the use of painkillers which cause dizziness and fatigue (Bachrach-Lindström et al. 2008, Marks, 2016).

Anxiety is an important matter to assess prior to surgery (Arakelian et al. 2018, Arakelian et al. 2019). It has been reported that patients with a poorer state of emotional wellbeing prior to arthroplasty might have poorer outcomes after arthroplasty due to pain and low physical function, which in turn might influence patient satisfaction (Montin et al. 2007, Duivenvoorden et al. 2013, Hanusch et al. 2014, Johansson Stark et al. 2016, Alattas et al. 2017, Allsop et al. 2019). According to Spielberger (1972), two types of anxiety exist: state anxiety and trait anxiety. State anxiety can be described as an emotional state that occurs at a given moment with a special level of intensity and is characterized by subjective feelings such as an unpleasant feeling causing nervousness, tension, and an inability to concentrate, which can influence the ability to comprehend information. The aforementioned symptoms are initiated by activation of the autonomous nervous system (Spielberger 1972). State anxiety scores are known to rise immediately prior to surgical treatments and decrease after surgery. Trait anxiety refers to "relatively stable individual differences in anxiety proneness" (Spielberger et al. 1983, p.5). Trait anxiety differs from one person to another in terms of how stressful events are perceived as dangerous or threatening by a person in general (Spielberger 1972).

A clear correlation has been found with anxiety and the experience of pain, which can impact short-term recovery after THA and TKA (Marks 2016, Kennedy et al. 2017). Preoperative anxiety has been rated as the most common risk factor for pain in patients undergoing surgery (Ip et al. 2009, Sobol-Kwapinska et al. 2016, Yang et al. 2019). There seems to be a need for education and information provided to patients on how to manage their pain preoperatively (Sweinsdottir et al. 2020), in order to avoid postoperative pain from getting worse or even pain catastrophizing during short-term recovery, which might essentially influence long-term recovery (Schwenkglenks et al. 2014).

End-stage OA of hip and knee arthroplasty operations, where a damaged joint is replaced with an artificial joint, have been reported to be successful treatments in terms of pain relief, improved physical functioning and improved HRQoL (Djukanovic et al. 2011, Hørdam et al. 2011, Miettinen et al. 2020, Sveinsdottir 2021). In the next sections, shortened LOS and patient satisfaction together with influencing factors will be described.

Shortened length of hospital stay

The length of hospital stay has shortened remarkably for THA and TKA patients. This is due to the implementation of standardized care protocols such as fast-track and early recovery programs (ERAS). These programs require multi-professional cooperation in order to be successful. It requires involvement from the patient and all healthcare professionals to have a mutual goal for recovery and considering patients essential care needs (Drew et al. 2019, Hustedt et al. 2010, 2011, 2018). Reductions in the average length of hospital stay have been gained with ERAS programs, resulting in high grades of patient satisfaction and no increase in the rate of complications (Drew et al. 2019, Gwynne-Jones 2017). Nowadays, THA and TKA are procedures that are conducted to a large extent as out-patient procedures (same day surgery) in selected cases, which have decreased hospital costs, cut readmission rates, and have made it possible for the patients involved to return to their job and everyday life much quicker than before (Malviya et al. 2011, Hustedt et al. 2018).

Patient satisfaction

Patients have different needs concerning the operation and anesthesia: the need to be recognized as a person, the need to feel and be safe, the need for information, and the need for knowledge on how to cope during the operation and during recovery. If these needs are not fulfilled, they can influence patient satisfaction in a negative way (Allvin et al. 2019).

In quality improvement of care, the patients' experiences of care are valuable (World Health Organization 2015). Patient satisfaction is considered one of the key indicators for high-quality care. There are several variables influencing patient satisfaction through care, such as the patient's age, gender, and comorbidities. Each patient has their own values in life and these values impact their subjective experiences of the care they receive. How the nurse meets the patient with empathy, is present for the patient with a supportive attitude, and shows interest in the patient are realized forms of the nurses' respect for the patient (Charalambous et al. 2010, Olsson et al. 2016, Koskenniemi et al. 2019, Krupic 2019).

Communication has been reported to influence patient satisfaction. Both verbal and non-verbal communication always occurs when people communicate. There should be congruence between verbal and non-verbal messages. Non-verbal communication occurs through gestures, eye contact and body language. Self-awareness of non-verbal communication is important, especially with older patients or those with hearing disabilities, so that the meaning of the messages cannot be misinterpreted by the patient (Wanko Keutchafo et al. 2020). When good communication appears in the patient-nurse relationship and among all involved in the care of the patient, it seems to improve patient satisfaction (Domnez et al. 2011,

Findik et al. 2010, Garret 2016, Lane et al. 2016). Poor communication might lead to insecurity in the patient and increase the risk of critical events among healthcare professionals participating in the patients' care (Wilson 2019).

In the next section, perioperative nurses' work and factors related to their organizational engagement will be described, together with a description of how patients can be supported by the nurse in perioperative nursing practice.

2.2 Perioperative nursing practice

A perioperative nurse is a registered nurse (RN), who works in perioperative settings, including operating departments, outpatient surgery departments (day surgery), and ambulatory surgery departments (Junttila et al. 2005). The job description of a perioperative nurse can vary depending on the country they work in. In Finland, perioperative nurses can work either as a scrub nurse, a circulating nurse, a recovery room nurse, or an anesthesia nurse (AN) (EORNA 2019). In this study, the term perioperative nurse refers to an RN who functions as an AN in an operating department. An AN is not the same as a nurse anesthetist. The difference is that an AN is not allowed to administer local or general anesthesia to patients. An AN is permitted to maintain anesthesia according to given prescriptions from an anesthesiologist. An AN is present with the patient throughout the entire operation.

The aim of perioperative nursing practice is to support patients and their families to gain a level of wellness that is the same or even better than the level prior to a surgical or invasive procedure (AORN 2015). Perioperative nurses make patient assessments about the physical and psychological state of the patient and address individualized care plans together with the patient, including the provision of patient education and information to those undergoing surgical procedures (AORN 2015). For this, perioperative nurses require knowledge that is based on scientific research to respond to patients' physical and emotional needs in delivering high quality care (AORN 2015). Perioperative nursing practice encompasses patient advocacy, safe anesthetic and surgical techniques and treatment, as well as information and patient education (Lindwall & von Post 2009). Patient advocacy is a key element in the role of professional nursing in enhancing patients' wellbeing, supporting them emotionally, and preserving their dignity (Munday et al. 2015, Lindwall & von Post, 2003, 2009, Heijkenskjo Bredenhof et al. 2010, Vaartio & Leino-Kilpi 2005).

The perioperative care process is divided into pre-, intra-, and postoperative phases. For elective patients, the preoperative phase begins when the patient gets the information that a surgical procedure is needed. Sometimes a surgical procedure has to be performed as an emergency operation and comes unexpectedly both for the patient and the healthcare professionals. In such emergency cases, the preoperative

phase begins with the surgeon's decision that an urgent operation is needed. The preoperative phase ends when the patient enters the operating room, which is the beginning of the intraoperative phase. The intraoperative phase comes to a close when the patient is transferred to the PACU, which is the beginning of the postoperative phase, and ends when the patient is discharged from hospital.

Contemporary perioperative nursing practice in Finland is organized so that the patient is cared for by several different nurses during the perioperative care process. The contemporary perioperative practice model lacks relational continuity of patient care in perioperative settings.

Usually the perioperative nursing practice is organized in an operating department, so that each OR has its own team of nurses, consisting of one circulating nurse, one scrub nurse and one AN (AORN 2015). In the contemporary perioperative practice model, the nurse team is assigned to one and the same OR during their working shift, for one day. Usually the AN does not continue to care for the patient in the PACU; instead, they hand the patient over to another nurse who will care for the patient in the PACU. Sometimes the patient arrives in the operating department in advance, to be anesthetized in the holding area, where a holding nurse cares for the patient and hands the patient over to the AN who will care for the patient in the OR.

The following section describes what the different phases of the perioperative care process include from the ANs' and the patients' perspective in a contemporary perioperative nursing practice.

Preoperative phase

In the preoperative phase, the patient and AN meet and get to know each other. The AN makes an assessment concerning the physiological, medical, and emotional state of the patient to provide safe care for the patient during the operation (Malley et al. 2015). The arthroplasty procedure is an unfamiliar situation, with an unidentified outcome, which might make the patients highly vulnerable and in need of emotional support (Raghavan et al. 2019, Munday et al. 2015, Tristaino et al. 2016). A good communication between the AN and the patient is crucial in establishing a caring relationship where the patient can feel safe (Weldon et al. 2013, McCann-Spry et al. 2016, Arakelian et al. 2017). A caring attitude from the AN toward the patient can help the patient feel invited to participate in their own care, by providing a calm and empathic atmosphere in the operating department (Charalambous et al. 2010, Bengtsson et al. 2016, Olsson et al. 2016). In such an atmosphere the patient can feel confident about sharing their emotions¬—both positive and negative—which are important for the AN to know in order to be able to help the patient prior to anesthesia (Liebenhagen & Forsberg 2013, Pritchard, 2009).

Intraoperative phase

The intraoperative phase takes place in the operating room, which as an environment can be anxiety-arousing, with its strong lighting and a variety of noises from different kinds of surgical and anesthetic equipment (Mitchell 2008, Haugen et al. 2009). Earlier studies found anxiety to be experienced to some degree in all patients (Kühlmann et al. 2018, Mitchell 2012, Montin et al. 2007). During the intraoperative phase, adequate information provided by the AN can alleviate anxiety in patients undergoing surgery (Mitchell 2012, Lane et al. 2016, Tekin & Findik 2015). In the intraoperative phase the patient might be comforted and supported by simply talking with the AN or listening to music on headphones in cases where the operation is performed under regional anesthesia, or a light sleep if the patient so wishes. When the patient knows that the AN is present during the operation it can help them to relax, knowing that the AN is there as a safeguard (Arakelian et al. 2018, Sundqvist et al. 2016). It has been reported that the prevalence of anxiety is statistically significantly higher prior to general anesthesia than it is prior to local anesthesia. Continuous information from the AN about what is going to happen next can help patients cope better and cooperate in given situations. It is also important to explain why sometimes even painful interventions are necessary, so that the patient understands the reason for these (Bengtsson 2016, Mitchell 2008). The AN monitors the patient's body temperature by covering the patient with warm blankets, monitoring their vital signs (blood pressure, heart rate, fluid balance, excretion, and bleeding), and being ready to act as soon as something unpredictable happens. The AN makes a variety of assessments of the patient during the operation concerning pain, nausea, body temperature, anxiousness, and need for oxygen supply, if necessary. If the patient is under regional anesthesia, the AN and the patient can plan the postoperative phase together. It is important that the patient is aware of postoperative pain and how it can be measured and treated, so as to self-manage pain later (Mavridou et al. 2017, Bruckenthal & Simpson 2016).

Postoperative phase

In the postoperative phase the patient is transferred to the PACU, where they are cared for by a PACU nurse. A thorough handover is given to the PACU nurse about the operation and its procedure, together with detailed data about the patient's health status during the intraoperative phase. Safety is one major issue in perioperative patient care, and for that reason the handovers are of importance as well as good documentation (Braaf et al. 2011, Søndergaard et al. 2017). The postoperative phase includes the early recovery phase, which refers to immediate postoperative care after the operation in the PACU, by close monitoring of the patient, such as already happened intraoperatively. The provision of information and education of the

patients continues, which already started in the operating room. The patient is advised to anticipate a sense of pain, so that it can be managed in a timely manner. The patient can perform light exercise by moving their legs and talk with the nurse. The next phase of recovery is called intermediate recovery. When all the vital signs are stable and the patient's criteria for discharge from PACU are achieved, the patient can be transferred to the surgical ward, and at this stage the PACU nurse provides a thorough report and hands the patient over to the ward nurse. The late recovery phase is when the patient has recovered to their preoperative physiological state (McGrath & Chung, 2003).

The prerequisites for nurses to be able to deliver high quality care to their patients are that they are experiencing wellbeing and satisfaction with their work (Garcia-Sierra et al. 2016). Engaged nurses sense they are valued, and they find positive meaning in the work they perform (DiNapoli et al. 2016). Engaged nurses are more satisfied and accomplish more and they also seem to be healthier and experience more wellbeing than nurses who are less satisfied (Kuykendall & Marshburn 2014). Nurse managers have a crucial role in promoting staff empowerment and creating positive working environments, resulting in job satisfaction and less turnover (Dempsey & Assi 2018). Nurse engagement has been reported to correlate directly with patient safety, as well as patients' experiences of quality of care (Dempsey & Reilly 2016, Spence Laschinger & Leiter 2006). Nurse managers can improve nurses' engagement by encouraging nurses to participate more in the decision-making process. This could also increase nurse satisfaction and enhance commitment to work and thereby to the organization (Asiri et al. 2016, Rivera et al. 2011).

The perioperative dialogue, which will be presented in the next section, is one approach to establishing a caring relationship.

2.3   The perioperative dialogue

The perioperative dialogue (Lindwall & von Post 2009, Lindwall, von Post, & Bergbom, 2003) was developed as an ideal model for organizing perioperative care from a caring science perspective (Eriksson 2002). Von Post (1999) was the first to describe the perioperative dialogue and emphasized that it should be regarded as a new interpretation of the perioperative nursing process, which includes nursing care, primary care, and specialized care of the patient. Initially von Post defined the perioperative dialogue as follows: "Perioperative nursing consists of those nursing actions and nursing activities which are performed by a nurse anesthetist or operating-room nurse in preoperative, intraoperative and postoperative phases of a patient's operation" (von Post 1999, p. 84). Since that definition, a new definition

was developed by Lindwall & von Post, (2009) which is defined as follows: "The perioperative dialogue is the perioperative nurse's pre-, intra- and postoperative dialogue with the patient she is caring for at the time of a surgical procedure and aims to alleviate the patient's suffering, safe-guard the patient's dignity, create well-being and become a life-giving event that the patient will remember as good. The purpose is also to make the perioperative dialogue useful as a guide for the operating theatre nurse's future caring work and a guide for the nursing managers as they plan and organize the perioperative caring work" (Lindwall & von Post 2009, p. 396).

The model of perioperative dialogue has been experienced as providing continuity of care by those involved. The organizing of perioperative nursing care is important regarding patient safety and the job satisfaction of perioperative nurses (Lindwall & von Post 2009). To be beneficial for both patients and nurses, organizations must allow new habits rather than old traditions to create continuity in delivering perioperative nursing care to patients undergoing surgery (Lindwall et al. 2004). The patient-to-nurse relationship forms a continuous whole. This can enhance both patient satisfaction and recovery from surgery, and job satisfaction of the nurses, while the patient and the nurse can plan, implement, and evaluate the care together without fragmenting the care process. The perioperative dialogue has been studied in surgical patients (Rudolfsson et al. 2003, 2007, Gustafsson et al. 2010, Kelvered et al. 2012) and in children undergoing surgical care (Lindberg et al. 2012, Wennström et al. 2008), and has been experienced as a useful approach to establishing a caring relationship.

Essential concepts related to the model of perioperative dialogue are person-centered care, individualized care, and continuity of care. These essential concepts will be described and defined in the next three chapters.

Person-centered care

The concepts "person-centered" and "patient-centered" are often used synonymously, although they differ from their perspective of care. The concept "patient-centered" does not mean the same as "person-centered". When talking about patient-centered care the focus is on the medical condition of a group of people suffering from a certain illness and treatment of the specific illness, often using standardized care protocols in the treatment of illness (Zhao et al. 2016). The variation of use of the concepts depends on which context they are used in. Hospitals and institutions often use the concept "patient-centered" (Morgan & Yoder 2012), for example. Concepts can be powerful and that is why they matter from the individual's point of view. If being reduced to only a diagnosis or a surgical procedure, it might be depersonalizing, causing a feeling of powerlessness for the individual (Lines et al. 2015).

When using the concept "person-centered", the focus is on health promotion and recovery from the illness. In person-centered care the patients' own resources and participation in their own care are considered essential (Morgan & Yoder 2012, Arakelian et al. 2017). In person-centered care the individual has an influence over the decision-making concerning their care. Standardized care protocols might not fit all patients and therefore person-centered nursing interventions could be useful for completing these protocols (Berg et al. 2019).

Person-centered care approaches have been successful in completing standardized care protocols in patients undergoing THA. In a study by Olsson et al. (2014) conducted via a person-centered intervention, when participants were included as partners in healthcare decision-making, this resulted in shorter LOS for the participants in the intervention group compared to the control group. The person-centered approach has been reported to improve patients' experience of the quality of nursing care and improved cost-effectiveness and improved working environments (Edvardsson et al. 2017). In another study conducted using an integrated care pathway including individualized care in a sample consisting of patients suffering from hip fracture aged 65 years and older, the findings showed that the average total treatment costs decreased by 40% for each participant included in the study (Olsson et al. 2009). McCann-Spry et al. (2016) found that the LOS was shortened by half a day for patients scheduled for THA and TKA by adding more information and communication for these patients. This intervention improved patient satisfaction and decreased hospital costs (McCann-Spry et al. 2016). In a randomized clinical trial comprised of participants with chronic obstructive pulmonary disease and chronic heart failure, the findings showed a person-centered approach to be highly cost-effective compared to standardized care (Pirhonen et al. 2020).

Although person-centered care interventions have been found to be valuable, barriers to the implementation of such interventions have also been identified, mostly due to cultural aspects, old traditions, and habits, and in attitudes among both patients and healthcare personnel (Kiwanuka et al.2019, Moore et al. 2017). Some patients still think that the nurse knows what is best for them and do not want to take part in decisions concerning their care (Henderson 2003). What comes to nurses, it could be that a positive attitude from the nurse managers that allows nurses to be innovative in testing out care interventions could be beneficial and inspiring for nurses. With good planning, education, and multi-professional cooperation, person-centered interventions can be implemented successfully (Alharbi et al. 2012, 2014, Olsson et al. 2014).

Individualized care

Individualized care is a key element of nursing (Henderson 2006). Nowadays people are aware of individualized care. Patients want to participate in the decisions made concerning their health and care. Patients are no longer passive care receivers; they are equal partners in their care (Tekin & Findik 2015, Wolf et al. 2017). The definition of individualized care encompasses the adjustment of nursing care tailored in accordance to the perceptions, emotions, experiences, and the values of a patient. The whole individual is recognized, including social, mental, emotional, and spiritual needs, personal values, and strengths, and their weaknesses are also considered in the care. Patients' own participation and control over making decisions concerning their own care is promoted (Suhonen et al. 2006, 2009). Studies have shown individualized care to positively influence patient satisfaction, patient autonomy and experienced HRQoL of the patient, and enhanced recovery (Suhonen et al. 2006).

Both barriers and facilitators have been identified in delivering individualized care, such as: patient characteristics, the personal characteristics of nurses, a lack of skills to deliver individualized care among nurses, issues related to ethics, organizational factors, nurse staffing, teamwork dynamics, and managerial and leadership properties (Suhonen et al. 2009, 2013).

Continuity of care

Continuity of care has been advocated as an essential part of high-quality patient care and has been associated with better patient outcomes and patient satisfaction (Gulliford et al. 2006). Continuity of care can be seen both from the perspective of the patient and the care provider. When patients become active partners in their care in the relationship between themselves and the nurse it can foster trust and confidence in the patient, leading to improvements in patient outcomes (Haggerty et al. 2013, Siow et al. 2013, Bahr et al. 2019). The word continuity can simply be defined as a continuous whole without fragmentation or interruptions. Haggerty et al. (2003) identified three different types of continuity to be present in all settings: informational, management, and relational continuity.

'Continuity' in this study means that the patient is assigned to the care of their own AN during the entire perioperative care process and refers mainly to relational continuity. The NPPM also includes elements of managerial and informational continuity. Managerial continuity is due to how perioperative nursing care is organized by the nurse manager in the perioperative care setting to ensure continuity of patient care. Informational continuity refers to the patients' earlier documents about care received and its connectedness and coherence to actual perioperative care (Haggerty 2013). Good documentation ensures informational continuity of care of

the patient along with all involved in the patients' care (Junttila et al. 2005). In a recent study by Facchinetti et al. (2020), the findings showed that continuity-creating interventions prevented short-term readmissions (one to three months) to hospital among older people suffering from chronic diseases. This meant decreasing costs without decreasing the quality of care. Similar findings have been reported by Bahr et al. (2020). The findings of their study stated that continuity of nurse assignments on the last two days for patients before discharge from hospital could reduce readmissions. Their findings also showed that staff allocation for continuity of hospital discharge benefited both patients and the organization, and improved quality of care in patients with multiple comorbidities (Bahr et al. 2020). Allen (2015) stated that using nurses or a team assigned to the patients' care can decrease LOS, diminish adverse events, and decrease hospital costs. In the same study it was stated that as a result of such assignments, nurse dissatisfaction and staff turnover could be reduced. Further, Allen (2015) states that environmental characteristics play a great role in the assignment process. The role of the nurse manager is crucial in implementing such care to the patients. The advantages of nurse assignment should be discussed before implementation, as well as proper education arranged for nurses so that they have a mutual understanding of the goal of such practice (Allen 2015).

Summary of background

A rather sparse number of studies concerning research in perioperative settings using nurse-delivered practice models in patient care have been reported to date. Research with the model of perioperative dialogue has been conducted in elderly care, care among children, and in patients undergoing surgery, all with a qualitative research approach, and none with a quantitative approach using instruments to measure care outcomes. The qualitative studies conducted earlier using the perioperative dialogue model have been reported as being beneficial both for patients and nurses.

Patient-centered care and individualized care interventions have been considered by patients to be beneficial when undergoing surgery, and have been also cost effective, resulting in decreased LOS, diminished adverse events, and decreased readmission rates. Both person-centered and individualized care approaches require multi-professional cooperation to be successfully implemented. As the perioperative dialogue has been experienced by patients and nurses to be a beneficial approach, including both person-centeredness, individualized care and continuity of care, it seems justified to test and explore its effect on patients undergoing hip and knee arthroplasty in terms of their satisfaction, experienced anxiety and HRQoL, on nurse engagement and as a process within the pathway of the organization. The background of the study is presented in Figure 1.
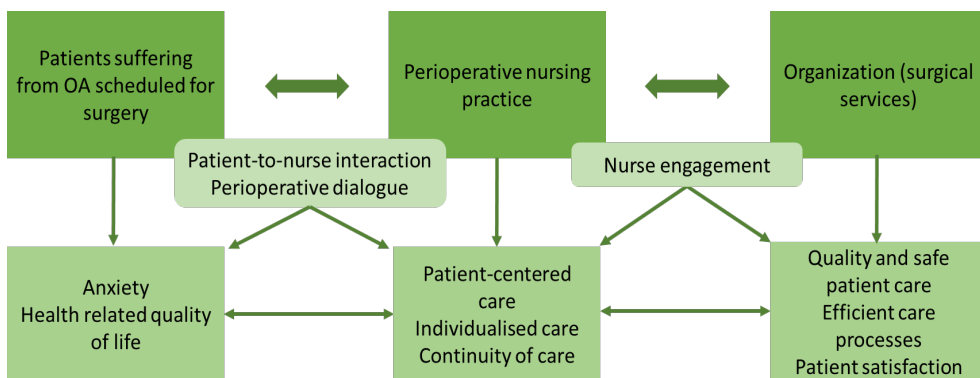
Figure 1. Background and main concepts of the study.

3   Aims and Objectives

The ultimate aim of the study was to improve surgical patients' care process, to make it person-centered and individualized, rewarding for the nursing personnel, and efficient for the hospital organization. The aim was to develop a new and innovative method to organize perioperative nursing services (Phase 1). The objectives of this study were to explore the effect of a new perioperative practice model (NPPM) on patient outcomes, nursing outcomes, and organizational outcomes (Phases 2–3).

The objectives of the study were as follows:

1) To explore the feasibility of the NPPM in adult patients undergoing THA or TKA under spinal anesthesia (Phase 2)
2) To explore the effect of the NPPM on anxiety and HRQoL (Phase 3)
3) To explore the effect of the NPPM on the LOS and on time points in the surgical care process (Phase 3)
4) To explore the effect of the NPPM on patient satisfaction (Phase 3)
5) To explore the effect of the NPPM on perioperative nurses' organizational engagement (Phase 3)

The research questions and hypotheses of the sub-studies were:

Phase 2 / Sub-study I (pilot study)

➢ What experiences did the patients have during the perioperative dialogue? How did the ANs experience the perioperative dialogue? (Publication I)

Phase 3 / Sub-study II

➢ What is the effectiveness of the NPPM on anxiety and HRQoL compared to contemporary perioperative nursing practice measured with STAI and 15D instruments? (Publication II)
➢ How does the NPPM influence anxiety and HRQoL from baseline to follow-up three months postoperatively? Our hypothesis was that the

intervention group would have statistically significantly higher mean improvements in anxiety and HRQoL than the control group. (Publication II)

Phase 3 / Sub-study III

➢ What is the effect of the NPPM on the LOS, and the time points of the surgical care process? Our hypothesis was that the intervention group would have statistically significantly shorter mean LOS compared to the control group. (Publication III)

Phase 3 /Sub-study IV

➢ What is the effect of the NPPM on patient satisfaction? Our hypothesis was that the intervention group would be more satisfied than the control group. (Publication IV)
➢ What is the effect of the NPPM on nurse engagement? We hypothesized that the NPPM would influence nurse engagement in a positive way. (Publication IV)

3.1   Studydesign

The design of this study was adopted from the Medical Research Council's (MRC) framework for Developing and evaluating complex interventions (Craig et al. 2008). The framework consists of the phases of development, feasibility, evaluation, and implementation (Figure 2). In this study, the development encompassed the development of the NPPM, and its feasibility was explored in the pilot study. The evaluation included the clinical trial during which the effect of the NPPM was studied.
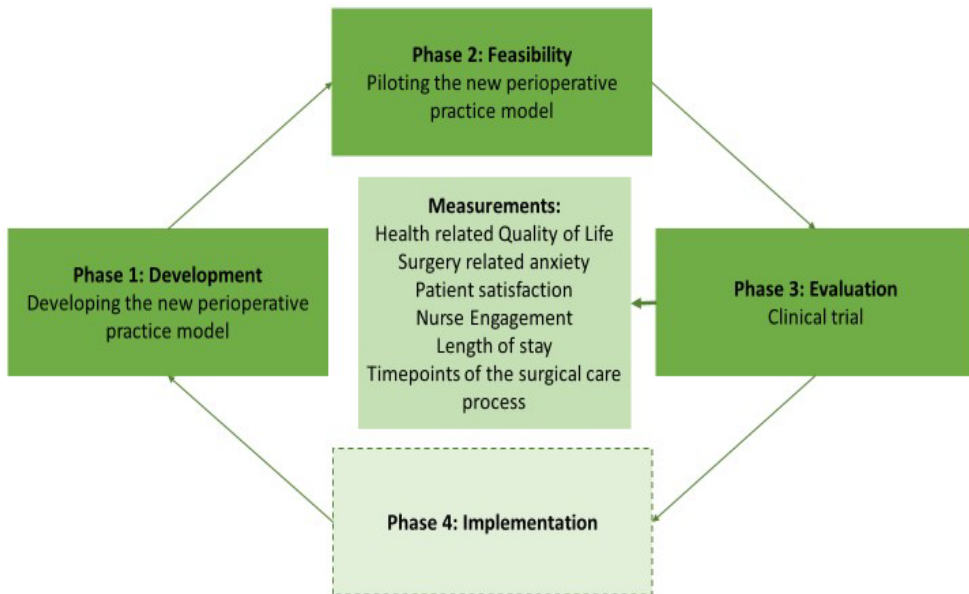
Figure 2. Design of the study.

A complex intervention means that the intervention interacts with several components at the same time, and the effects of the intervention must be studied from different perspectives (Craig et al. 2013). The main question is how an intervention will function in clinical practice (Craig et al. 2013). In this study the effects were studied from three different perspectives: that of the patient, the nurse, and the organization. Furthermore, different study designs and data collection methods were used: a qualitative method in Phase 2, and a randomized clinical trial (RCT) in Phase 3.

In nursing science RCT as a method is one of the key factors, due to evidence-based practice. The phases of an RCT can be described as follows: 1) Choice of the intervention and a literature review about the intervention (what is known already); 2) The formulation of a hypothesis on how the intervention is expected to affect the study sample; 3) A pilot study (feasibility study), in which the intervention is tested in the study environment with a smaller study sample; 4) Power analysis (what is the size of a proper study sample); 5) Choice of instruments to be used in the data collection of the RCT; 6) Analysis of the study results and evaluation of their clinical value and finally implementation of an intervention (Craig et al. 2013). The study design, including the study phases, is presented in Figure 2.

The method of RCT is considered the "golden standard" for determining the cause and effect of an intervention, a drug, or a therapy on a patient sample and can provide high-quality evidence. An RCT is conducted to compare one or two treatments. The study sample is randomly assigned to an intervention group and a control group. Blinding of the study population and the participants in the data collection is important, in order to minimize bias and to maximize the validity of the study result. The intervention group receives an intervention (treatment) and the control group receives a standard treatment or intervention (Bench et al. 2013, Craig et al. 2013, Abbott 2014).

The knowledge produced about nursing interventions by RCTs in nursing science has been reported to strengthen the knowledge base of nursing science and supports the realization of evidence-based care in practice (Axelin et al. 2012). By using RCTs in nursing research, knowledge is obtained about nursing interventions and about their efficiency in patient care. Efficiency is a major goal of healthcare organizations that aim to deliver high-quality care to all patients (Munday et al. 2020).

4 Materials and Methods

The study began with the development of the NPPM from the perioperative dialogue introduced by Lindwall and von Post (2003, 2009) (Phase 1). The next step of the study was the piloting of the NPPM to explore its feasibility (Phase 2). The pilot testing was followed by a randomized clinical trial (Phase 3) in which the NPPM and its effect was evaluated, as well as surgery-related anxiety, HRQoL, patient satisfaction (patient outcomes), nurse engagement (nursing outcome), and the LOS and the time points of the surgical care process (organizational outcomes). The study phases, materials, and methods for each sub-study are presented phase by phase in this chapter. The materials and methods used in the study are presented in Table 1.

Table 1.   Materials and methods of the study.

STUDY PHASE DESIGN	STUDY SETTING	STUDY PARTICIPANTS	DATA COLLECTION	ANALYSIS METHOD	REPORTED IN
PHASE 2 **QUALITATIVE DESIGN**	One operating department at Helsinki University Hospital	19 patients undergoing THA or TKA	The patient-to-nurse dialogues were transcribed on paper forms from the dialogues of the pre-, intra-, and postoperative phases	Latent content analysis of the transcribed dialogues	Publication I
PHASE 3 **RCT**	One operating department at Helsinki University Hospital	Intervention group n=231 patients Control group n=222 Undergoing THA or TKA	15D STAI	Descriptive statistics. One- and multi-factor ANOVAs to compare the means of the groups. Tukey's adjustment	Publication II
PHASE 3 **RCT**	One operating department at Helsinki University Hospital	Intervention group n=230 patients Control group n=220 Undergoing THA or TKA	Time points of the surgical care process (retrospectively gathered from each participant's electronic hospital records)	Descriptive statistics. Multifactor ANOVA to compare the groups.	Publication III
PHASE 3 **RCT**	One operating department at Helsinki University Hospital	Intervention group n=219 patients Control group n=217 Undergoing THA or TKA Nursing personnel Pre-test 39 nurses Post-test 34 nurses	GPNCS NES	Descriptive statistics. Nonparametric tests to compare patients' background factors with quality categories (GPNCS), and nurses' background factors with drivers of engagement (NES)	Publication IV

Abbreviations: RCT, Randomized clinical trial; THA, total hip arthroplasty; TKA, total knee arthroplasty; 15D, a generic instrument for measuring health-related quality of life; GPNCS, Good Perioperative Nursing Care Scale; STAI, State-Trait- Anxiety Inventory; NES, Nurse Engagement Survey; ANOVA, analysis of variance.

4.1 Study phases, setting, participants, and data collection

4.1.1 Development phase

The NPPM has its origins in the model of perioperative dialogue (Lindwall et al. 2003, Lindwall & von Post 2009). In a Nordic Project in 2012 ("Den perioperative dialogen—ett applikationsmoment som skapar kontinuitet", conducted by Professor Lillemor Lindwall), the perioperative dialogue was developed as the NPPM by the Finnish co-researchers. In the original model of perioperative dialogue, the model included preoperative visits to the surgical ward prior to surgery conducted by operating room nurses. Since the surgical process of patients has become very rapid and patients are admitted to hospital in the morning on the day of the planned operation, this was not possible.

We decided to solve this problem by assigning an AN to the care of the patient from the moment the patient arrived in the operating department. At this short meeting, the patient and nurse became acquainted with each other and were able to have a chat in a quiet corner of the operating department. The assigned AN cared for the patient through all phases of the perioperative process. The continuity of perioperative care was ensured while the same assigned AN met the patient preoperatively, cared for the patient intra-operatively and moved together with the patient to the PACU when the surgical procedure was performed. In the PACU the same assigned AN cared for the patient and handed the patient over to the ward nurse when the patients' discharge criteria were fulfilled for safe transfer to the surgical ward. The next day after surgery, the assigned AN visited the patient in the surgical ward to see how the patient had recovered from surgery. The postoperative visit made it possible for the patient to ask additional questions. Both the patient and the AN had the opportunity to evaluate the perioperative process in the meeting postoperatively.

To be successfully conducted, the NPPM required good planning in advance by the nurse manager. The working shifts of the ANs were organized in a new way, so that they worked both in the OR and in the PACU during their shift. One assigned AN started in the OR at 07:30 to care for the first scheduled patient. When the operation was finished the AN moved together with the patient to the PACU. Another AN started work at 10:00 and was assigned to the care of the patient who was scheduled second in the OR. When the first patient was ready for discharge from the PACU, the AN met the third scheduled patient and went with them to the OR. In this way the NPPM was conducted. This new way of organizing the perioperative nursing practice did not require any extra nurses and, thus, did not incur any extra personnel costs. The NPPM is a theoretical framework that guides perioperative

nurses to meet and to care for the individual patient. This differs from the original model of perioperative dialogue, in which the same AN did not continue with the patient to PACU. The AN in the original model visited the patient at a convenient time either in PACU or the surgical ward. The focus of NPPM is on the continuity of care delivered by the assigned AN. This is a new model of perioperative practice in Finland. In contemporary perioperative care the patients are cared for by different nurses during the phases of the perioperative procedure.

4.1.2 Pilot study

As a target group for the pilot test, patients undergoing THA and TKA was chosen. This was due to the fact that THA and TKA procedures are mostly performed under local anesthesia, which makes it possible for the patient and the AN to interact during the phases of the perioperative care process. Another reason was that these patients are usually discharged on the second postoperative day. They need to be engaged in their care to be able to cope with timely and safe discharge. The pilot study with a qualitative method focused on how patients undergoing either THA or TKA under spinal anesthesia experienced the perioperative dialogue as a new perioperative practice model. The study was conducted between 2013 and 2014 and has been reported (Publication I). A total of 20 patients booked for either THA or TKA were invited to participate. The invitation to participate was declined by one patient. The final sample consisted of 19 patients: 14 female and five male, and they were aged between 48 and 70 years. Four voluntary female ANs conducted the perioperative dialogues in the study setting. The patients and their ANs held perioperative dialogue in the pre-, intra-, and postoperative phases of the perioperative process. The ANs documented the content of these dialogues together with background data concerning the patient on a specific data collection paper form. The texts comprised the content of the dialogues between the patient and the nurse, including how the patients described their life situation and their emotions in each dialogue, and how the ANs described the experiences of their involvement in the dialogues with the patients. (Detailed information in Publication I.)

4.1.3 Randomized clinical trial (Sub-studies II–IV)

Phase 3/ Sub-study II. The study was designed as a two-group parallel single-blind RCT aiming to explore the effect of the NPPM on anxiety and HRQoL in patients scheduled for THA or TKA under spinal anesthesia. The study participants were recruited during their preoperative visit to the outpatient clinic two to three weeks prior to their scheduled operation. The study participants were divided into one intervention group (n = 231) and one control group (n =222). From the total number

(n= 453) of patients, 63% were female and the rest were male. Their age ranged from 29 to 92 years, with the mean age being 67 (SD 10.44). The intervention group received NPPM care and the control group received contemporary perioperative care. The medical and nursing care was the same in both groups. The only difference was that the patients in the intervention group had their own assigned AN throughout the perioperative process, forming a continuous relationship. The patients in the control group were cared for by different nurses during their perioperative process and did not receive postoperative visits. Participants in both groups responded to two self-reported paper-based questionnaires; the generic 15D HRQoL instrument and the State-Trait Inventory (STAI) to measure anxiety, two to three weeks prior to their scheduled operation and three months postoperatively. The Finnish and Swedish versions of the 15D instrument and STAI inventory were used. Each study participant was asked to provide demographic data including age, gender, diagnosis, procedure, and ASA classification (detailed description in Publication II).

Phase 3 / Sub-study III. The study participants were the same as described in sub-study II. Data was retrospectively collected from each study participant's electronic hospital record. Time points of each study participant's surgical care process were collected from admission to discharge using the operating room management software (Opera, CHCA, Quebec, Canada) and the hospital information system (Uranus, CGI Finland Oy, Helsinki, Finland).

Phase 3/Sub-study IV. The patient participants of this sub-study were the same as described in sub-studies II and III. In addition, this sub-study included nurses from the operating department (n = 69) where the clinical trial was conducted. The aim of the sub-study was to explore the effect of the NPPM on patient satisfaction and nurse engagement. The patient data was collected by the Good Perioperative Nursing Care Scale (GPNCS) (Leinonen & Leino-Kilpi 2001) at discharge. Demographics collected from the patients were age, gender, surgical procedure, ASA class, and level of education. The nurses responded to the Nurse Engagement Survey (NES) prior to the start of the study and after the last study participant had been discharged from hospital. The electronic surveys were executed via Secure Socket Layer connection. The demographic data collected from the nurse participants included education, working role, and length of experience.

4.2   Randomization and sample size calculation

A third-party randomization was performed during the patients' preoperative visit to the outpatient clinic. Two nurse assistants were trained for this purpose by the primary investigator (PI). The eligible patients drew one of two cards; one indicating

a proposal to participate in the study and the other being empty. One week the patients were recruited to the control group and every other week to the intervention group. Their operations were scheduled according to the group every other week. Thus, patients in the control group were neither recruited nor operated on during the same week as patients in the intervention group and vice versa. In this way we ensured that the patients in the two groups did not exchange information at any time, either beforehand or afterwards in the postoperative ward. The patients randomized for this study were blinded. The assigned ANs were not blinded due to the nature of the intervention.

For sub-study II, the sample size determination for comparing two independent samples' means was done using power analysis with $\alpha = 0.05$, $\beta = 0.9$, standard deviation (s) = 0.08, and differences of means ($\bar{x}_1 - \bar{x}_2$) 0.03 in 15D scores, which is within the slight difference of 0.015–0.035 (Alanne et al. 2015). A sufficient sample size was determined to be 152 patients in both groups.

For sub-study III, the sample size calculation for comparing two LOS means was done with s = 1.6 and $\bar{x}_1 - \bar{x}_2 = 0.5$ days. Sample sizes were to be 217 patients in both groups. For PACU time, sample size was determined as 76 patients per group (s = 0.94, $\bar{x}_1 - \bar{x}_2 = 0.5$ hours).

In sub-study IV, the sample size calculation was the same as in sub-study II. No sample size calculation was conducted for the nurse participants in sub-study IV.

4.3   Instruments used in the study

4.3.1   Anxiety and health-related quality of life

Anxiety was measured with the State-Trait-Anxiety Inventory (STAI) (Spielberger 1983). The STAI instrument comprises two scores, one for state anxiety (situational anxiety, STATE) and the other for trait anxiety (anxiety tendency, TRAIT). Both scores have 20 items each. The items of situational anxiety (STATE) arouse emotions on a four-point Likert scale from 1 (not at all) to 4 (very much). The TRAIT items elucidate feelings in general on a frequency scale ranging from 1 (hardly ever) to 4 (almost always). For both scales, the summarized scores range from 20 to 80. Anxiety is classified under three categories: low (20–39), moderate (40–59), and high (60–80), according to the row score (Koivula et al. 2010, Koivula et al. 2002, Spielberger et al. 1983, Spielberger et al. 2010). (Detailed information in Publication II.)

To measure HRQoL, the 15D instrument was used. It is a generic, standardized, self-administered instrument with 15 dimensions: mobility, vision, hearing, breathing, sleeping, eating, speech, excretion, usual activities, mental functioning, discomfort and symptoms, depression, distress, vitality, and sexual activity. Each

dimension has five levels, out of which the respondent chooses the option that best describes their state of health at the time of measurement (level 1 representing the best and level 5 the worst state) (Sintonen 2001). (Detailed information in Publication II.)

The single index score (15D score) represents the overall HRQoL on a scale from 0 (being dead) to 1 (full health). The dimension level values range from 0 (being dead) to 1 (no problems in the dimension). Both the index score and the dimension values are calculated from the health state descriptive system using utility weights or a set of population-based preferences. When drawing 15D profiles for groups, mean dimension level values are used (Sintonen 2001). (Detailed information in Publication II.)

4.3.2 Patient satisfaction and nurse engagement

For patient data collection we used the Good Perioperative Nursing Care Scale (GPNCS) developed for surgical patients in perioperative care by Leinonen (2002). The GPNCS is a self-administered instrument assessing patient satisfaction and patient experience of perioperative nursing care. The GPNCS includes the background variables of age, gender, and level of education of the respondents. Additionally, the current version contains 24 questions exploring the respondents' memories of their surgical process, and their estimation of the severity of experienced symptoms, such as pain, chills, and fear, and information needs preoperatively and during their stay in the operating department. Further, the GPNCS is composed of 36 statements measuring quality of care condensed into nine quality categories: Pain management (5 statements), Temperature maintenance (2), Technical skills (4), Information (6), Encouragement (3), Respect (3), Staff characteristics (5), Environment (6), and Process (2). For questions related to process memories, the response options are "yes", "no", "cannot say/cannot remember". Questions related to symptoms and needs are responded to using a five-point Likert scale (fully agree – fully disagree) with an option "neither agree nor disagree" and another option "cannot evaluate this aspect". The study participants filled in the paper-based questionnaire prior to their discharge from hospital.

In data collection with the nurses, we used the Nurse Engagement Survey (NES). The NES has been developed by the Global Centre for Nursing Executives. It measures nurses' organizational engagement and the factors influencing it (NEC 2007, 2014, 2015). The NES instrument consists of demographic data such as working role, highest level of education, and experience. In addition, the questionnaire contains 48 items, four of which measure engagement level and the rest are defined as drivers of engagement. The items are condensed under the following sum variables: Autonomy (7 items), Nurse-to-nurse collaboration (6),

Nurse-to-others collaboration (3), Professional growth (3), Head of the unit (4), Recognition (4), Work engagement (9), Passion for nursing (5), and Personal engagement (4). We used a six-point Likert scale ranging from "strongly disagree" to "strongly agree". As the mean value of the sum variable Personal engagement, the respondent should gain a value of 5.50–6.0 to be considered engaged, 4.50–5.49 to be content, 3.5–4.49 to be ambivalent, and less than 3.5 to be unengaged. For a respondent to be considered engaged they must answer "strongly agree" to no fewer than two statements of the sum variable and respond with "agree" at a minimum to any of the four statements.

4.4 Data analysis of sub-studies (I–IV)

4.4.1 Patients' experiences of the perioperative dialogues (I)

Data was analyzed using qualitative latent content analysis (Graneheim & Lundmark 2004). The handwritten texts from the perioperative dialogues were brought together in one large text (three dialogues with 19 patients). The analysis process was initiated by reading the handwritten texts from the conducted dialogues. After the first reading of the texts from each perioperative dialogue, the texts were transcribed word by word according to the phases of perioperative care. The texts from different phases were repeatedly read to get a general impression of the content in the dialogues. This phase was followed by looking for meaningful units such as single words and citations, sentences, or parts of sentences related to experiences expressed by the patients. After this we abstracted the meaningful units into sub-categories, which were further abstracted into main categories. Detailed information about the analysis is provided in Publication I.

4.4.2 Anxiety and health-related quality of life at baseline and at follow-up (II)

The description of study participants' characteristics was given using statistics of location and dispersion. One- and multi-way analysis of variance was used to compare means of groups. Interaction terms were used to compare means of the groups defined by combinations of categorical independents. In post hoc analysis, the outcomes were tested for gender and the type of arthroplasty (THA vs. TKA). Significances of dependencies between categorical variables were tested using Chi-square tests. SAS® statistical software, version 9.4 (SAS Institute Inc., Cary, NC, USA) was used in statistical analysis.

4.4.3 Length of hospital stay and the time points of the surgical care process (III)

In presenting the characteristics of the study participants, descriptive statistics were used. In comparing means of the groups, we used multi-factor ANOVAs. Interaction terms were used to compare means of the groups defined by a combination of categorial independents. The statistical analysis was conducted using SAS® version 9.4 (SAS Institute Inc., Cary, NC, USA). The potential sub-groups were tested for gender, type of arthroplasty, ASA classification, age, weekday of operation, and LOS in the post hoc analysis.

4.4.4 Patient satisfaction and nurse engagement (IV)

In the analysis of patient data, descriptive statistical methods were used. In cases where a respondent answered less than half of the quality statements, their response was omitted from the analysis (n = 20). Frequencies and percentages were calculated for background data using the Pearson Chi-square test. In comparing background factors with quality categories, non-parametric tests were used. The option "I cannot evaluate this aspect" was excluded for this analysis. In the reliability check of the GPNCS, Cronbach's alpha coefficient was used. In the data collected from the nurses using the NES, the differences between the baseline and follow-up measurements, and the relationship between the nurses' background factors and drivers of engagement, the analysis was performed with non-parametric tests. In the analysis of both data sets (patient and nurse data), the non-parametric tests used were the Kruskall-Wallis test and Mann Whitney U-test with Bonferroni corrections. P-value of statistical significance was considered to be 0.05. Both data sets were analyzed using IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.

4.5 Ethical considerations

This study was carried out in accordance with the Declaration of Helsinki. Ethical codes and good scientific practice and principles of research integrity founded by the Finnish National Board on Research Integrity (TENK 2019) were followed throughout the research.

The participants of the pilot study were asked to participate in the study by the voluntary ANs, who provided them with both written and oral study information, upon their arrival at hospital. The written information was given to the participants prior to premedication, to ensure that the participants fully understood the implications of their participation in the study. If the patient wanted to participate in the study, written consent was obtained in duplicate. The study information also

included information about the patient's right to withdraw from the study at any time, and that this would in no way affect their care.

A third-party randomization was performed during the patients' preoperative visit to the outpatient clinic of the study participants in sub-studies II, III, and IV (two trained nurse assistants from the outpatient clinic). The participants in this study were not intentionally selected. All patients attending the outpatient clinic for their preoperative visit, prior to THA or TKA, were invited to participate if they satisfied the inclusion criteria for the study.

The study participants in both groups received written and oral information about the study prior to randomization, and written informed consent was received in duplicate from all study participants. The content of the written information was different for the intervention group and the control group because the control group did not have access to the same AN during their perioperative process. The written information for the control group described that the aim of the study was to improve the perioperative care process for patients undergoing THA and TKA and that therefore we wanted to receive information about how the care received influenced patient satisfaction, surgery-related anxiety and HRQoL. The written information for the intervention group described that the aim of the study was to obtain information on how a new perioperative practice model, where the one and same AN was assigned to the patient's care throughout the entire perioperative process, influenced patient satisfaction, surgery-related anxiety, and HRQoL. It could be considered if there was an ethical dilemma, while the control group participants did not have their assigned AN. However, this potential ethical dilemma was minimized due to the fact that the control group received nursing care according to contemporary practice, meaning that none of the patients despite group was left without care. The study was also planned so that patients from different groups did not meet each other, since the recruitment took place on different weeks for each of the groups. The patients did not meet at the outpatient clinic for recruitment or in the surgical ward, since they were operated on during different weeks. It would have been questionable to let the patients mix with each other in hospital.

The participants were informed about their right to withdraw from the study at any time, and they were informed that this would not affect their care in any way. They were also informed about their right to withdraw their consent, in which case their data would not be used in the study. After they had filled in the two questionnaires, they returned them in a closed envelope in a locked mailbox for this specific purpose. The paper forms of questionnaires 15D and STAI, which the participants filled in two to three weeks preoperatively and at three months postoperatively, were kept in a locked cupboard to ensure confidentiality. Questionnaires 15D and STAI were not handled by anyone other than the PI, except for the ward secretary who coded the data from the questionnaires into the computer

matrix for the research. The electronic data was password-protected. The secretary who performed the coding was informed of the confidentiality of the material prior to starting the coding.

Prior to the start of the study, all nurses at the study setting received oral information about the research study and had the opportunity to ask additional questions about the procedure along with the study. The data collected by the NES was not handled by the PI, since she was the nurse manager for the personnel at the study setting. The personnel data was collected and analyzed by another member of the research group, who forwarded the final results as such to the PI. Thus, the PI had no access to the raw data, nor could she influence the results of the analysis. The electronic surveys were executed via Secure Socket Layer connection to all nursing staff at the operating department to their work email address. Responses to the electronic survey were interpreted as consent to participation.

The pilot study was approved by the Ethics Committee, Department of Surgery (Dnr 252/13/03/02/2012). This clinical trial was approved by the Operative (surgical) Ethical Committee of Helsinki University Hospital (decision number §114/11.5.2016, Dnr. 157/13/03/02/16).

This study has been registered in NIH Clinical.Trials.gov under registration number NCT02906033. The study permission was obtained from the hospital authorities (decision number §16/215/2016). Permission to use instruments (15D, STAI, Good Perioperative Nursing Care Scale, and Nurse Engagement Survey) has been requested from the copyright holders. The original publications have been reprinted with permission from the copyright holders.

5 Results

In this chapter the main results of the sub-studies are presented, followed by a summary of the main results of the study.

5.1 Patients' and nurses' experiences of the perioperative dialogue

The findings of the latent qualitative content analysis resulted in three themes according to the patients' experiences of the dialogues: *Suffering while waiting for surgery* (preoperative dialogue), *Continuity creates togetherness* (intraoperative dialogue) and *Uniqueness–the patient had been seen* (postoperative dialogue). The patients in this study experienced the new model of perioperative care as valuable. They experienced that their desires were taken into consideration, and they felt they were met with respect and as unique human beings. From the participating ANs' perspective, the new model of perioperative care provided them with enough time to spend with the patient, to exchange information, to get to know each other and to plan the care together with the patient. (Detailed information in Publication I.)

5.2 The effect of the new perioperative practice model on anxiety and health-related quality of life

At the baseline, the response rates of the 15D questionnaire were 91% in the intervention group and 85% in the control group. At follow-up, the corresponding figures were 65% and 61%, respectively. Regarding the STAI questionnaire at the baseline, the response rate in the intervention group was 86%, and 86% in the control group. At follow-up, the corresponding figures were 67% and 61%, respectively. (Detailed information in Publication II.)

The results showed that state anxiety mean scores improved in both groups statistically significantly from baseline to follow-up. In the intervention group, the state anxiety mean score decreased from 38.06 at baseline to 33.14 at follow-up (difference of means -4.19, 95% CI [-8.02, -1.79], P = <.001). The corresponding figures in the control group were 36.98 at baseline and 33.03 at follow-up (difference

of means -5.21, 95% CI [-8.47, -1.95], P = <.001). Female THA participants in the intervention group reported a moderate level of state anxiety (41.13) at baseline, while at follow-up their state anxiety mean score was 33.03 (difference of means -8.09, 95% CI [-13.92, -2.27], P = <.001). For female THA participants in the control group, the mean state anxiety score was 39.28 at baseline and 31.46 at follow-up (difference of means -7.82, 95% CI [-14.21, -1.44], P = <.05). Trait anxiety scores did not improve statistically significantly in either of the groups from baseline to follow-up. (Detailed information in Publication II.)

The intervention group and the control group did not differ from each other statistically significantly in the mean 15D scores at baseline (difference of means -0.019, 95% CI [-0.040, 0.0001], P = 0.075) or at follow-up (difference of means -0.016, 95% CI [0.041, 0.008], P = 0.343). Within the groups some differences were detected between female and male participants. In the intervention group, in THA participants, the difference of means in HRQoL scores of female participants was 0.072 (95% CI [0.032, 0.111], P = <0.001), while in male participants the difference of means was 0.054 (95% CI [0.003, 0.105], P = 0.026). In the control group, in THA participants, the difference of means in HRQol scores of female participants was 0.086 (95% CI [0.041, 0.132], P = <0.001), while in male participants the difference of means was 0.053 (95% CI [0.004, 0.102], P = 0.021). (Detailed information in Publication II.)

Both groups showed a statistically significant improvement from their own baseline to follow-up in mean scores of the 15D dimensions of moving, usual activities, vitality, distress, and discomfort and symptoms. The 15D dimensions with a statistically significant improvement for both groups at baseline and at follow-up are presented in Figure 3. Participants undergoing TKA showed improvement only in the 15D dimension of moving.
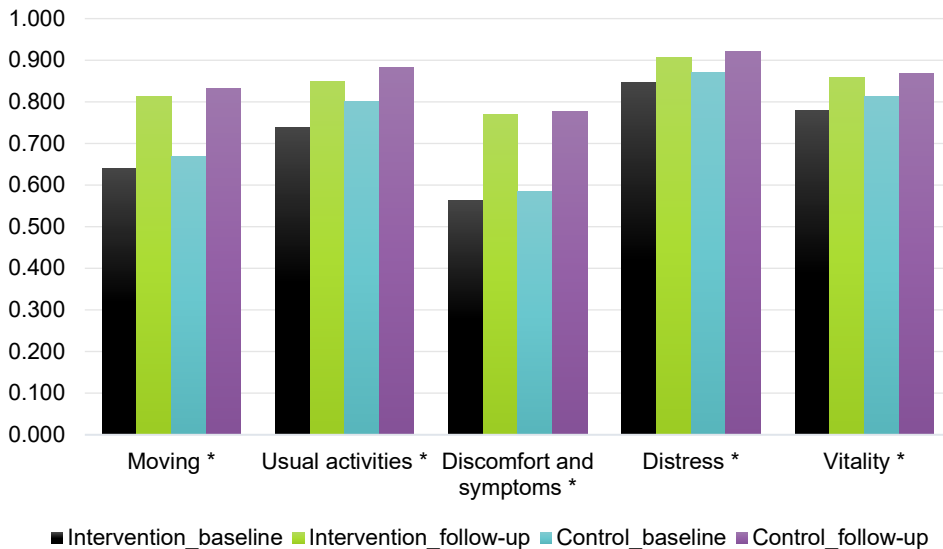
Figure 3. The dimension of 15D with a statistically significant improvement for both groups from baseline and at follow-up (p<.05 are marked with an asterisk*) modified from Original Publication II, Figure 2.

5.3 The effect of the new perioperative practice model on length of hospital stay and the time points of the surgical care process

The mean LOS (days) was 3.08 in the intervention group and 3.18 in the control group (difference of means = -0.10, 95% CI [-0.40, 019], P = 0.49). The mean LOS was 2.40 hours shorter in the intervention group. THA participants had shorter LOS than TKA participants. Male THA participants in the intervention group had the shortest LOS. Out of the participants having LOS >3 days, two-thirds were female.

Variables that associated statistically significantly with extended LOS were:

- high age; mean age for LOS> 3 days 71 years vs. 64 years for LOS ≤ 3 days, P = <.0001

- type of arthroplasty; out of 280 THA participants, 113 (40%) had LOS> 3 days vs. 167 (60%) participants with an LOS≤ 3 days, P = <.001

- ASA class; out of 179 participants in ASA classes 3 and 4, 114 (64%) had LOS> 3 days vs. 64 (36%) participants with LOS≤ 3 days, P = <.0001. (Detailed information in Publication III.)

Of the patients undergoing surgery on Tuesday, 63% had LOS≤3 days, while for patients who had their surgical procedure performed on Wednesday or Thursday, the corresponding figure was 43%.

5.4 The effect of the new perioperative practice model on patient satisfaction and nurse engagement

The results showed that there was no statistically significant difference between the groups in patient satisfaction measured with the mean value of GPNCS. The quality of care was rated as good in both groups. When examining the quality categories of the GPNCS, some differences were found between the groups, although not of statistical significance. Patients with multiple comorbidities (ASA class 3–4) were less satisfied than healthier patients (ASA class 1–2).

The mean values of the nine quality categories were overall somewhat higher in the intervention group compared to the control group, although not statistically significantly higher (Figure 4) (detailed information in the manuscript of Publication IV).
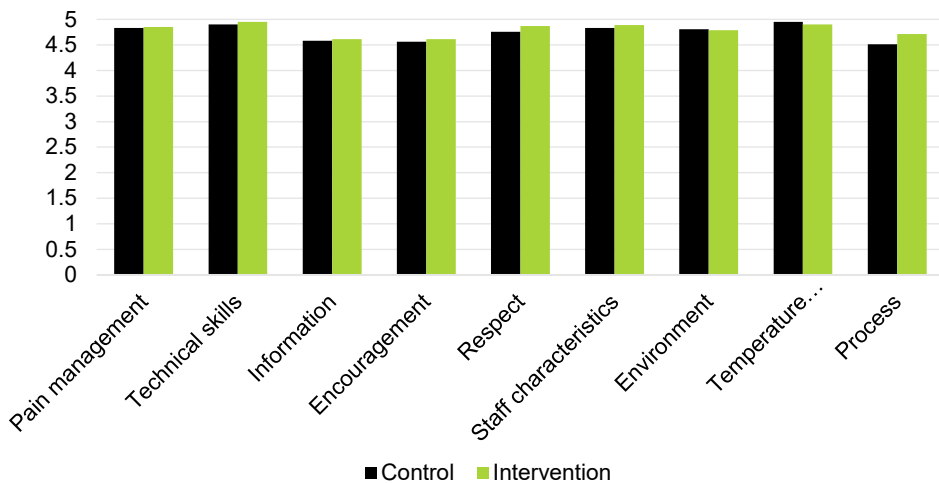
Figure 4. Mean values of the nine quality categories of the GPNCS of the intervention group and the control group.

The results showed that patients felt they received enough information. Also, they did not have very much fear either of anesthesia or the surgical procedure. Patients' memories, symptoms, and receipt of information are presented in Table 2.

**Table 2.** Participants' memories, symptoms, and receipt of information.

ITEM		INTERVENTION GROUP N (%)	CONTROL GROUP N (%)	P-VALUE
PATIENT MET PERIOPERATIVE NURSE PREOPERATIVELY (N=424)	YES NO CANNOT SAY	168 (79.3) 25 (11.8) 19 (8.9)	172 (81.1) 25 (11.8) 15 (7.1)	NS *
PATIENT MET ANESTHESIOLOGIST PREOPERATIVELY (N=420)	YES NO CANNOT SAY	135 (64.3) 66 (31.4) 9 (4.3)	135 (64.3) 66 (31.4) 9 (4.3)	NS
PATIENT MET SURGEON PREOPERATIVELY (N=415)	YES NO CANNOT SAY	129 (62.3) 69 (33.3) 9 (4.4)	128 (61.5) 65 (31.3) 15 (7.2)	NS
FEAR OF ANESTHESIA PREOPERATIVELY (N=414)	CANNOT SAY NOT AT ALL ONLY SOME MUCH VERY MUCH	1 (0.5) 97 (46.4) 83 (39.7) 20 (9.6) 8 (3.8)	5 (2.4) 107 (52.2) 65 (31.7) 18 (8.8) 10 (4.9)	NS
FEAR OF THE OPERATION PREOPERATIVELY (N=410)	CANNOT SAY NOT AT ALL ONLY SOME MUCH VERY MUCH	0 (0.0) 69 (33.7) 91 (44.4) 30 (14.6) 15 (7.3)	2 (1.0) 63 (30.7) 98 (47.8) 28 (13.7) 14 (6.8)	NS
RECEIVED INFORMATION ABOUT SURGERY PREOPERATIVELY (N=423)	CANNOT SAY NOT AT ALL ONLY SOME MUCH VERY MUCH	0 (0.0) 4 (1.9) 29 (13.5) 132 (61.7) 49 (22.9)	2 (1.0) 5 (2.4) 27 (12.9) 124 (59.3) 51 (24.4)	NS
RECEIVED INFORMATION ABOUT ANESTHESIA PREOPERATIVELY (N=426)	CANNOT SAY NOT AT ALL ONLY SOME MUCH VERY MUCH	0 (0.0) 6 (2.8) 41 (19.3) 113 (53.1) 53 (24.8)	0 (0.0) 10 (4.7) 37 (17.4) 111 (52.1) 55 (25.8)	NS

*Not statistically significant.

Nurse engagement was higher prior to the intervention than after it. The mean value of engagement was 4.44 prior to intervention and 3.87 post intervention (P = 0.041). Prior to the intervention, 7/39 nurses were engaged, 12/39 were content, 14/39 were ambivalent and 6/39 considered themselves to be unengaged. In the post measurement, 4/34 nurses were engaged, 9/34 were content, 11/34 were ambivalent and 10/34 considered themselves unengaged. The difference between the levels of engagement was not statistically significant between the measurements. The level of

engagement was dependent on the educational level and was statistically significant in pre-intervention measurement (Kruskal-Wallis test; P = 0.030). The engagement level was also dependent on the length of experience (Kruskall-Wallis test; P = 0.017); however, the difference between the measurements was not of statistical significance. The changes in the level of nurse engagement (%) prior to and after intervention are presented in Figure 5.

Level of engagement, %
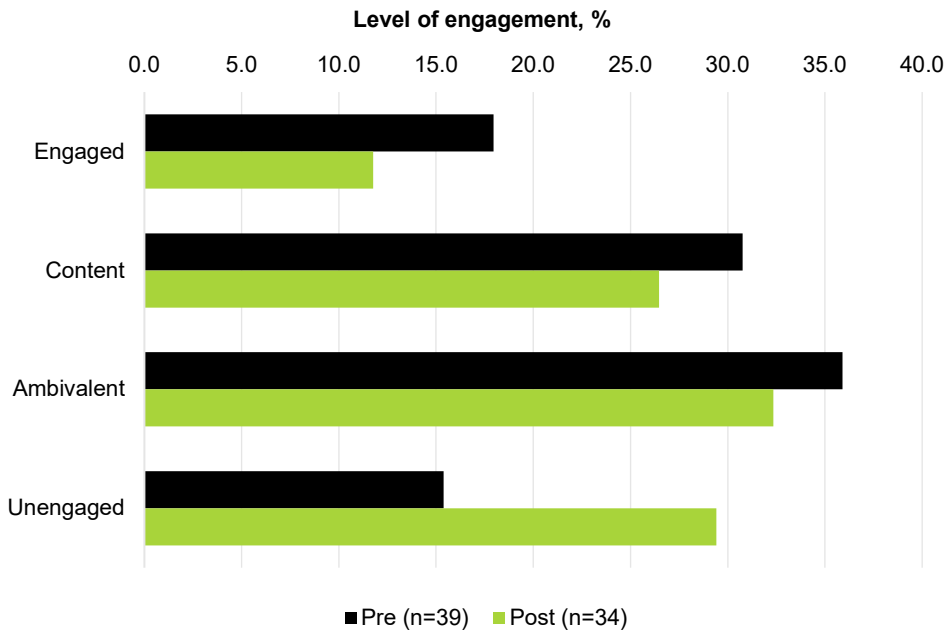
Figure 5. Changes in the level of nurse engagement (%) prior to and after the intervention.

The mean values of the drivers of nurse engagement were higher prior to the intervention than after it. The driver Passion for nursing decreased least of all the drivers. The statement "nurse-patient interaction" in the driver *Passion for Nursing* was higher post intervention (mean value 5.35) than prior to intervention (mean value 4.97), P = 0.006. The mean values of the drivers for nurse engagement before and after the intervention are presented in Figure 6.
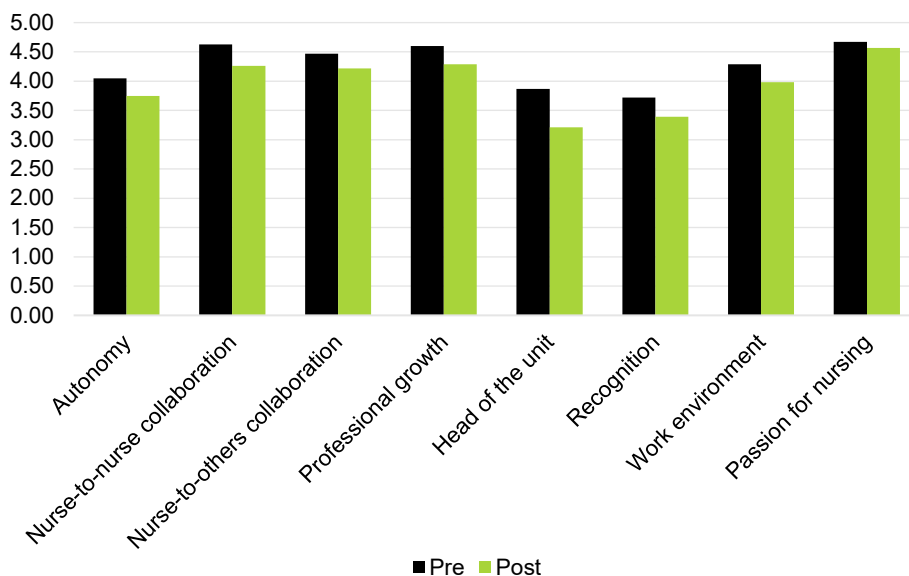
Figure 6. The mean values of the drivers for nurse engagement before and after the intervention.

5.5 Summary of the main results of the study

From the patients' perspective, the NPPM was experienced as beneficial. The patients appreciated the caring, continuous relationship with the same nurse. Patients felt that they had been seen as individuals, and were able to participate in their care. The patients sensed that the nurses were really listening to them and took their opinions seriously. The support and encouragement from the nurses were experienced to be important. From the nurses' point of view, it was felt that the NPPM offered enough time to care for the patient in a fulfilling manner. The nurses felt that they had been able to encourage the patients to trust in their own abilities. (Detailed information in Publication I.)
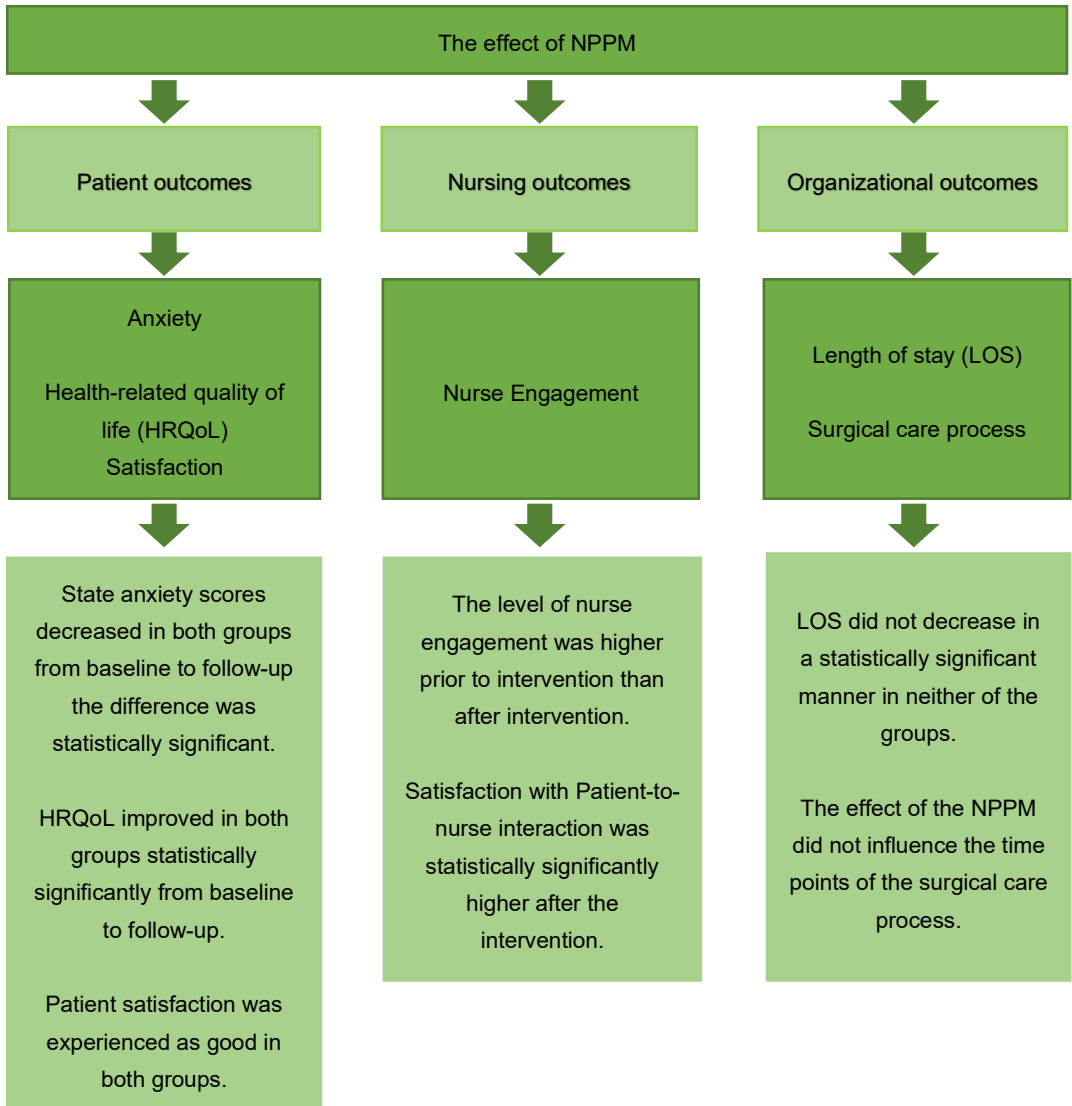
In comparison to the contemporary perioperative care model, the NPPM did not reduce surgery-related anxiety or improve HRQoL in a statistically significant way. Both groups showed statistically significant improvements in HRQoL and in anxiety mean scores compared to their own baseline measurements. In post hoc analysis we found female and male participants responded differently to care. Female participants in both groups undergoing THA seemed to gain the most of the NPPM. (Detailed information in Publication II.)

We did not find the NPPM to shorten either LOS or the surgical care process in a statistically significant way when compared to contemporary perioperative care. The shortest LOS was found in male participants undergoing THA. The LOS was slightly shorter in the intervention group compared to the control group. The

subgroup examination revealed that older age, type of operation and ASA class 3–4 seemed to influence prolonged LOS. (Detailed information in Publication III.)

Patients experienced the quality of perioperative care as equally good in both groups. The study also revealed that the patients in this study evaluated their receipt of information about anesthesia and surgery positively in both groups. The intervention group showed higher mean values of the quality categories of GPNCS than the control group. The NPPM did not increase the engagement of the nurses. However, interaction between patients and nurses was experienced more positively after the intervention than before. (Detailed information in the manuscript of Publication IV.)

A summary of the main findings of the study are presented in Figure 7.

The effect of NPPM

Patient outcomes

Nursing outcomes

Organizational outcomes

Anxiety

Health-related quality of life (HRQoL)
Satisfaction

Nurse Engagement

Length of stay (LOS)

Surgical care process

State anxiety scores decreased in both groups from baseline to follow-up the difference was statistically significant.

HRQoL improved in both groups statistically significantly from baseline to follow-up.

Patient satisfaction was experienced as good in both groups.

The level of nurse engagement was higher prior to intervention than after intervention.

Satisfaction with Patient-to-nurse interaction was statistically significantly higher after the intervention.

LOS did not decrease in a statistically significant manner in neither of the groups.

The effect of the NPPM did not influence the time points of the surgical care process.

Figure 7. Summary of the main findings of the study.

6 Discussion

The ultimate aim of this study was to improve surgical patients' care processes and to make them person-centered and individual, rewarding for the nursing personnel, and efficient for the hospital organization.

The aim was to develop a new and innovative method to organize perioperative nursing services.

The first objective of the study was to explore the feasibility of the NPPM in adult patients undergoing THA or TKA under spinal anesthesia. The second objective was to explore the effect of the NPPM on surgery-related anxiety and HRQoL measured from baseline to follow-up, the third objective was to explore the effect of the NPPM on the LOS and the time points of the surgical care process, and the fourth objective was to explore the effect of the NPPM on patient satisfaction and on the perioperative nurses' organizational engagement.

The feasibility study in Phase 2 was conducted in order to gain a deeper understanding of how the patients undergoing THA and TKA under spinal anesthesia and ANs experienced the perioperative dialogue as a new model of caring. Phase 3, the explorative phase, gave answers to how the levels of surgery-related anxiety and HRQoL changed from baseline to follow-up. We also explored the effect of the NPPM on LOS and on the time points of the surgical care process, and on patient satisfaction and nurse engagement.

6.1 Discussion of the study results

Next, the results of the study will be discussed according to the phases of the study.

Patients' and nurses' experiences of the perioperative dialogue

In the pilot study we wanted to describe how the patients and the nurses experienced the perioperative dialogue as a new model of caring. When the patients described their experiences of the perioperative dialogue, they appreciated that there was time to establish a caring relationship with the same AN. The patients felt the AN was present only for them. Patients experienced they were involved in their own care and had the opportunity to influence their care since their desires were taken seriously.

They were very satisfied about not having to tell their stories to different nurses, and they felt confident in asking questions of their AN (Sibbern 2016). The patients experienced both fear and anxiety about the operation, and they sensed loss of control over their own lives. Similar results have been reported by Arakelian et al. (2018). The patients were not afraid of asking questions from the AN. They felt they could trust their AN and felt safe and comforted knowing that the AN was by their side. The patients were informed about postoperative pain by the AN, which helped the patients to acknowledge the sense of pain. The encouragement from the AN was experienced as empowerment for the patients, which gave them strength and hope for the future. The patients felt that the ANs did not do things for their part, but they did things together with the patient, which encouraged them to use their own resources to recover. Similar results have been reported in earlier research where patients have been involved in their care as equal partners, finding their own resources to recover (Olsson et al. 2016, Wolf et al. 2017, Sundqvist et al. 2018, Arakelian et al. 2019).

The ANs described their experiences as having enough time to care for the patient in a fulfilling way. For the ANs, enough time that they were able to thoroughly explain matters during the perioperative process. The ANs felt it was important to spend time with the patient. Time as an important concept has been reported in an earlier investigation of perioperative dialogue (Rudolfsson et al. 2003, 2007). In existing nursing research it has been stated that nurses have too little time to spend with their patients, and therefore patients' emotional support has been left unaddressed (Ball et al. 2016, Ball et al. 2014). It has been found that emotional support, such as talking with patients, is often not done, due to nurses' heavy workload with other tasks (Blackman et al. 2018, Brembo et al. 2017). The perioperative dialogue as a new model of caring for patients undergoing THA and TKA was experienced as vital by the patients involved, and the ANs reported that they had enough time to care for the patient in a fulfilling manner.

The new way of organizing the work of ANs did not require a greater number of nurses, and neither did it harm other patients not participating in the study.

The effect of the new perioperative practice model on anxiety and health-related quality of life

We aimed to explore what the effect of the NPPM was on anxiety and HRQoL compared to contemporary perioperative nursing practice, measured with STAI and 15D instruments. Further, we wanted to study the potential changes in the levels of surgery-related anxiety and HRQoL from baseline to follow-up at three months postoperatively.

Our hypothesis was that the intervention group would have statistically significantly higher mean improvements in the levels of surgery-related anxiety and in HRQoL in comparison to the control group. Our hypothesis could not be proven.

The findings revealed that there was no statistically significant difference in mean anxiety levels between the groups. However, both groups showed the state anxiety scores to be lower at follow-up compared to their own baseline levels. The study also revealed that none of the study participants suffered from high levels of anxiety; only moderate levels of anxiety could be seen in female patients of the intervention group undergoing THA. Our results are in line with an earlier study (Montin et al. 2007). Female patients in both groups undergoing THA improved in terms of state anxiety scores from baseline to follow-up, and the improvement was of statistical significance.

The study findings showed that there was no statistically significant difference between the groups in HRQoL. In both groups the average improvement in HRQoL could be seen in the dimensions of moving, usual activities, distress, and in discomfort and symptoms and in vitality from their baseline to follow-up measurement. Similar results has been reported by Miettinen et al. (2020). In patients undergoing TKA, only improvement in the dimension of moving could be seen. Recovery from TKA is known to be much slower than recovery from THA. The reasons for this have been reported as being anxiety, pain, wound stiffness, and fatigue (Szöts et al. 2015, Strickland et al. 2018, Sveinsdottir et al. 2021). It has been reported that recovery from TKA might take from one year up to five years for some patients (Bierke et al. 2020). This could be a reason why patients undergoing TKA did not show improvements in the HRQoL to the same extent as the patients undergoing THA. The female patients in the intervention group undergoing THA experienced a statistically significant improvement in the 15D dimensions of moving, usual activities, depression, distress, and vitality. Earlier studies have reported similar results (Montin et al. 2007, Räsänen et al. 2007). The results indicate that female patients undergoing THA in both groups gained the most from the NPPM. According to Mansukhani et al. (2016) sex bias has not been taken into account in clinical research, although it exists in surgical clinical research. The study findings of Mansukhani et al. (2016) indicated that few studies included females and males identically in their studies. It could be important to address this disparity so that an intervention benefits both genders (Mansukhani et al. 2016). This was the reason why we tested the outcomes for gender and the type of surgical procedure (THA vs. TKA) in post hoc analysis. Our results indicate that it could be important to take gender stratification into account at the time of randomization and recruitment of study participants.

It could be that the timetabling of measurements of anxiety and HRQoL should be rescheduled, since earlier reports indicate anxiety to be at its highest just prior to

the surgical procedure ahead (Hodges & Spielberger 1966, Mitchell 2008, 2012, Sveinsdottir et al., 2020) and to be influenced by environmental factors such as the OR environment.

The effect of the new perioperative practice model on length of hospital stay and on the surgical care process

We wanted to explore the effect of the NPPM on LOS and on the surgical care process. We hypothesized that the intervention group would have a statistically significantly shorter mean LOS than the control group. This hypothesis could not be proven. Although the LOS was 2.40 hours shorter in the intervention group than the control group, the difference was not statistically significant. One explanation for this could be that the LOS in the study setting was already short; about two days for patients undergoing THA and three days for patients undergoing TKA. There was a fast-track program in use at the study setting, including established discharge criteria, and the processes were already very smooth. We found patients undergoing THA to have a shorter mean LOS than patients undergoing TKA; this finding is in line with findings from earlier studies (Mandzuk et al 2015, Sutton et al. 2016). The results of the sub-group examination showed that male patients in the intervention group undergoing THA had the shortest LOS (mean LOS 2.71 days, transformed into hours 65.04 hours); this finding was not of statistical significance but it was of clinical importance. Compared to control group male patients undergoing THA, the mean LOS was 3.29 days, or 78.96 hours. The difference in means for the aforementioned groups was 13 hours 92 minutes. In our study, two-thirds of the patients having an LOS of > 3 days were female patients. The study by Hustedt et al. (2011) reported the probability for longer LOS to be about 40% higher in female patients compared to male patients. The findings of our study indicate that patients aged over 65 years, classified as ASA classes 3 or 4 and undergoing TKA, could be a group that would need extra support and encouragement in the preoperative phase. Similar findings have been reported earlier (Johansson Stark et al. 2016, Bierke et al. 2020).

When examining the weekday of surgery, our study results indicate that of the patients operated on Tuesday, 63% had an LOS of ≤3 days. In comparison, 55% of the patients having their operation on Wednesday and 43% of the patients having their procedure on Thursday had an LOS of ≤3 days. Our study results are similar to those reported earlier (Newman et al. 2017, Malik et al. 2018). These results could be used in planning the day of surgery for elective patients so that those at risk of prolonged LOS could be scheduled for surgery at the beginning of the week.

The effect of the new perioperative practice model on patient satisfaction and nurse engagement

We wanted to explore the effect of the NPPM on patient satisfaction and nurse engagement, measured with the GPNCS and the NES instruments. Our hypothesis was that the intervention group would be more satisfied than the control group. The results of the study revealed that patient satisfaction was rated good in both groups. The study showed that patients in both groups were very satisfied with the level of information they received about the surgical procedure and about the anesthesia. These results also indicate that the patients in both groups did not report very much fear for anesthesia or for the surgical procedure. Earlier studies have emphasized that orthopedic patients do not receive as much information as they need and their knowledge expectations might not be fulfilled (Charalambous et al. 2018, Johansson Stark et al. 2014, 2016). This was not seen in the results of our study.

In this study, patients belonging to ASA classes 3 and 4 were less satisfied with their care than patients in ASA classes 1 and 2. Patients' expectations concerning nursing care and the surgical outcome from a surgical procedure can influence patient satisfaction (Okafor & Chen 2019). Patients that have been less satisfied with nursing care might feel their expectations were not met (Montin et al. 2008, Conner-Spady et al. 2020). It remains unclear whether the patients of ASA classes 3 and 4 in this study had their expectations met or not.

Although the study findings did not show any statistically significant difference between the groups, the quality categories measured by the GPNCS were found to be somewhat higher in the intervention group, especially the quality categories "respect" and "process", which might indicate that the patients in the intervention group appreciated the individual care delivered by NPPM. The intervention group participants might also have been continuously informed about the procedures, which could be supported since they evaluated the quality category "process" more highly than the control group participants. It has been reported that patients undergoing orthopedic surgery wish to receive more individualized care (Berthelsen & Fredriksen 2017, Sjøveian & Leegaard 2017, Kaptain et al. 2019) to be ready for early discharge from hospital.

We hypothesized that nurse engagement would be statistically significantly higher after the intervention than prior to it. In fact, the NES results showed quite the opposite: we found a statistically significant decrease in nurse engagement from baseline to follow-up among the nurses. Nurses who had graduated recently and had work experience of ≤ 1 year experienced the highest engagement compared to nurses who had more work experience. This finding differs from earlier findings that reported quite the opposite (Bamford et al. 2013, Rivera-Fitzpatrick & Boyle 2011), in that nurses with longer work experience were more engaged. Similar results have been reported in a recent study by Petean et al. (2020). They found the most engaged

nurses to be those close to retirement, which indicates that they were nurses with substantial experience. Nurses could need more autonomy to use individualized care interventions in their practice and this can be influenced by leadership and management, and by organizational structure factors, but it also depends on the cultural circumstances of the context (Charalambous et al. 2010, Charalambous et al. 2018, Papastavrou et al. 2014).

The findings by Petean et al. (2020) share some similarities with the findings of our study. The engagement percentage in their study was similar to the findings of our study. In both studies the nurses were proud of their profession and felt compassion for nursing, felt they had good communication with their colleagues and other healthcare professionals. The findings of our study and the Italian study also found that recognition from nurse managers and the organization was lacking and this caused dissatisfaction among nurses. Nurse managers play a crucial role in promoting staff empowerment and in creating positive working environments, resulting in job satisfaction and lower rates of turnover (Kelly et al. 2012, Dempsey & Assi 2018, Havens et al. 2018). The driving forces for nurse engagement comprise autonomy, responsiveness, personal development, access to leadership, interprofessional relationships, sufficient staffing, quality nursing care, good teamwork, and collaboration (Freeney & Tiernan 2009, Havens et al. 2018). In our study, external factors during the intervention might have influenced the way nurses responded to the NES. At the time of the study the nurses had a huge workload in supervising newly-graduated nurses at the study setting. This could have caused them stress and influenced their responses to the NES.

A lack of nurse staffing can cause stress in nurses, giving them a sense of not having enough time to do the work as well as they would like to (McNair et al. 2016). This can lead to value conflicts among nurses (Ball et al. 2014, Blomberg et al. 2019). In a recently published study, perioperative nurses reported that they had to miss out on the areas of preparation and communication (handovers in patient transfers). They also reported that the time pressure was caused by maintaining the timetables and schedules to be able to perform the all operations of the day (Marsh et al. 2020). Nurses are constantly facing ethical dilemmas due to stressful workflow and therefore they felt guilty about not having enough time for patient education and patient support (Aiken et al 2013, Aiken et al. 2018, Rooddehghan et al. 2018).

Although the results of the NES were worse after the intervention, it did not have an influence on their compassion for nursing, meaning that the interaction with patients was statistically higher after the intervention than prior to intervention. This could also indicate that the patients were very satisfied with the care they received.

Summary of discussion

Participants in both groups showed a statistically significant decrease in mean scores of state anxiety, from baseline to follow-up. No significant improvements in trait anxiety scores were found in either of the groups. The results of this study showed statistically significant mean improvements in HRQoL dimensions in both groups, although there was no statistically significant difference between the groups in changes in HRQoL. All patients improved in physical functioning concerning mobility. State anxiety diminished in both groups. The LOS did not diminish in a statistically significant way between the groups, and the time points of the surgical care process did not diminish in a statistically significant way. However, the LOS was lower in the intervention group, but not statistically significantly lower than in the control group. Patient satisfaction with received nursing care was regarded as good by both groups. The quality categories of the GPNCS were somewhat higher in the intervention group compared to the control group. Nurse engagement was better prior to intervention than after.

In the next section, the validity and reliability of the study will be discussed.

6.2   Validity and reliability of the study

In this chapter, issues concerning the validity and reliability of this study will be discussed considering the study sample, recruitment, data collection, and analysis of the data.

    A qualitatively descriptive design analyzed by inductive content analysis was used in the pilot study of the RCT. We aimed to obtain the experiences of both patients and nurses regarding the perioperative dialogue. We determined 20 participants to be an adequate patient sample for ensuring the creditability of the study and for achieving a sufficient variation of experiences (saturation) for the analysis of the patients' experiences of the perioperative dialogue as a new model of perioperative care (Graneheim & Lundman 2004). The saturation of data is considered a major criteria for the sample size in studies with content analysis (Elo et al. 2014). No strict rules exist for how many informants a sample should include (Elo et al. 2014, Sandelowsky 1995). Potential participants were selected from the operation schedule in accordance with inclusion criteria by the PI. The sample included both female and male patients undergoing THA and TKA. Four voluntary ANs participated in the study and collected the data from the dialogues. They transcribed the dialogues they had with their patients, using a purposive data collection form. We used a data collection form which comprised a section for pre-, intra-, and postoperative dialogues. The data collection form included some leading questions for the patients and nurses. For example: What did you and the patient talk

about? How did the patient describe their situation and their body image? What did you plan together with the patient? Questions directed at the nurse included: How were you able to help the patient feel comfortable?

The data analysis followed the steps required for content analysis described by Graneheim & Lundman (2004) and was reported in accordance with the analysis (meaningful units, sub-categories, main categories and themes) – these are reported in Publication I. Inductive content analysis might be influenced by the pre-understanding of the researcher and can influence the interpretation of the content (Elo et al. 2014). In this study the PI did not participate in the data collection and did not know the informants, although she has a lot of experience in perioperative settings and her preunderstanding of the context could have influenced the data collection if she had cared for the informants. In the pilot study in phase I, the patients' and nurses' own experiences of the perioperative dialogues were gathered on the data collection forms, and this can be considered as a strength. The texts consisted of the genuine narratives of the patients and nurses. The results of the content analysis could be transferred to similar contexts with similar informants (Polit & Beck 2010).

For sub-studies II, III and IV, adequate sample size calculation was performed prior to the recruitment of the study participants to ensure a representative sample. The sufficient sample size was estimated as 152 participants per group, considering the potential dropouts (estimated to be approximately 30% per group). The large sample size can be regarded as a strength of the study, as well as the similarity of the intervention group and the control group. The blinding and randomization of the study participants was planned carefully so as to avoid any bias of the results, and this gives the RCT its strength (Blackwood et al. 2010). The best strategy for receiving a representative sample has been advocated to be random methods of sampling (Polit & Beck 2010).

A risk-of-bias tool was used in assessing the risk of bias of the results (Sterne et al. 2019). The level of missing outcome data was at an acceptable level in the follow-up questionnaires. As we used per-protocol analysis, we additionally analyzed the results with Generalized Estimating Equations (GEE). The GEE estimation provided similar results to the original results, analyzed with ANOVAs, which strengthens the study result. The CONSORT statement (Moher et al. 2010) for reporting RCTs was used to report the results and to ensure the transparency of the study (Craig et al. 2008). The instruments used in the study (15D, STAI Inventory, GPNCS, and NES) are reliable and validated instruments, and have been used in several previous studies worldwide. The high response rates in sub-studies II and IV can be considered a strength of this study. The high response rate also indicates that the questionnaires were suitable for collecting data from the participants. The availability of a statistical expert in the analysis improved the reliability of the study results.

One limitation is that the scheduling of the measurements of HRQoL and anxiety could have provided different results if they had been taken during the waiting time for surgery, just prior to the surgical procedure and follow-up measurements six months or one year postoperatively (Hodges & Spielberger 1966, Mitchell 2008, 2012, Sveinsdottir et al., 2020).

In sub-study III, we investigated routine care in patients undergoing hip and knee arthroplasties in the study setting, and their LOS. This can be considered a strength of the study. With regard to the rather short LOS in the study setting, no statistically significant differences between the intervention group and the control group were possible to discern, and this is one limitation of this study.

Another limitation of this study was that there was a rather low response rate from nurses (sub-study IV). Another limitation concerning the nurse sample was that it could have given us different results if only the ANs that participated the study had been involved. This was not the case since all nurses in the study setting were invited to participate and the nurse sample was mixed. Since this study concerned only one operating department, the results of this study cannot be generalized.

6.3   Implications for nursing practice

This study raised some ideas for implications in perioperative nursing practice. It could be convenient to develop or use a simple existing instrument to measure anxiety in patients who are already in need of hip and knee arthroplasty preoperatively. In this way patients in need of more support and encouragement could be detected and offered care delivered by the NPPM approach so as to ensure safe and timely discharge from hospital. Findings of the study indicate that older patients and those classified as ASA 3–4 could be the target group that could benefit from the NPPM. The model of NPPM can be used as a supplement to standardized care protocols (fast track).

The NPPM can be offered to those patients who are at risk of prolonged LOS. The NPPM did not require extra personnel—it is more a matter of attitude, good planning, and re-organization of resources. Thus, it can be worth trying.

Nurses in a perioperative setting might benefit from having time to care for their patients in a meaningful way. Nurse managers could allow nurses to be creative by recognizing ideas that the perioperative nurses have. This could increase job satisfaction among perioperative nurses.

In ongoing quality improvement in the organization, the patients' experiences of received care are valuable in developing the processes as well as the experiences of the perioperative nurses. It can be recommended that perioperative nurses could have their voices heard in decisions made concerning their work that involves caring for their patients. Shared decision-making could benefit all parties in a perioperative

setting, instead of being directed only by those who do not participate in patient care in practice.

Communication and multi-professional cooperation could be improved to mutually improve the quality of perioperative patient care. Communication among healthcare professionals, i.e., nurses, anesthesiologists, surgeons, ward nurses, and nurses in the outpatient clinic could be improved. In fast-track programs, such an improvement could benefit the individual patient if all parties are aware of the direction and goals for the care of the patient. It could also diminish hospital costs.

6.4   Suggestions for further research

➢ The NPPM could be expanded to involve other patient groups than arthroplasty patients in the future. Nowadays, certain kinds of gastrointestinal procedures such as rectopexies, hernia operations, and laparoscopic cholecystectomies are performed as out-patient procedures. Patients coming to the aforementioned procedures could benefit from the NPPM.

➢ Nowadays, patients come from different cultures with different values and traditions, and they might feel exceptionally insecure and anxious prior to a surgical procedure. For these patients, the model of NPPM could be tested.

➢ In future nursing research studies concerning surgery-related anxiety and HRQoL, it is recommended that the scheduling of the measurement timepoints be rescheduled to include measurements during the waiting time, on the day of operation, and at three months, six months and one year postoperatively.

➢ It is recommended that gender differences are tested further using randomized gender stratification.

➢ More research studies are needed in the future to investigate what effect the NPPM has on patients undergoing THA and TKA who are over 65, have ASA scores of 3 or higher and according to their sex/gender.

➢ In the future, patients undergoing TKA could be studied more thoroughly, as they are known to suffer more often from anxiety and depressive symptoms than patients undergoing THA. These symptoms have been found to influence the rate of postoperative complications.

➢ It could be of interest to conduct further research concerning patient safety and adverse events in patients receiving NPPM care, while the NPPM ensures there is only one handover from the AN to the ward nurse.

7 Conclusions

The aim of this study was to develop a new perioperative practice model to organize perioperative nursing care so that it is patient-centered and individualized, rewarding for the nursing personnel, and efficient for the hospital organization. The objective of this study was to explore the effect of a new perioperative practice model (NPPM) on patient outcomes, nursing outcomes, and organizational outcomes. The pilot study showed evidence that the NPPM served the patients' desires for individual and dignified care and thereby ensured a higher quality of care. The NPPM made it possible to create caring encounters in which the patients were in focus. The nurses felt they had time to care for the patients in a meaningful way.

This study contributes knowledge on a new perioperative nursing intervention that was hypothesized to diminish anxiety and increase HRQoL in patients undergoing THA and TKA. The NPPM is an intervention that offers person-centered, continuous nursing care, although our study did not find it superior compared with contemporary perioperative care in terms of reducing anxiety or increasing HRQoL in a statistically significant manner in unselected patient material.

The study results indicate men and women to respond differently to the intervention.

This study did not find the NPPM to be superior to contemporary perioperative care in terms of diminishing LOS for patients undergoing THA and TKA, due to existing smooth processes. This study revealed that some patients were at risk of prolonged LOS due to age, gender and surgical procedure. These patients could be identified at the preoperative visit to the outpatient clinic, and offered the support needed to be discharged in a timely fashion from hospital.

We did not find the NPPM to either improve patient satisfaction or nurse engagement in a statistically significant way. The results of this study revealed that patients get good perioperative care and are rather content with the information they receive. The nurse-patient interaction was experienced positively by the nurses after the intervention.

The NPPM offers person-centered, individual, continuous perioperative nursing care, which includes all the elements for high-quality care and can be organized without extra costs.

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