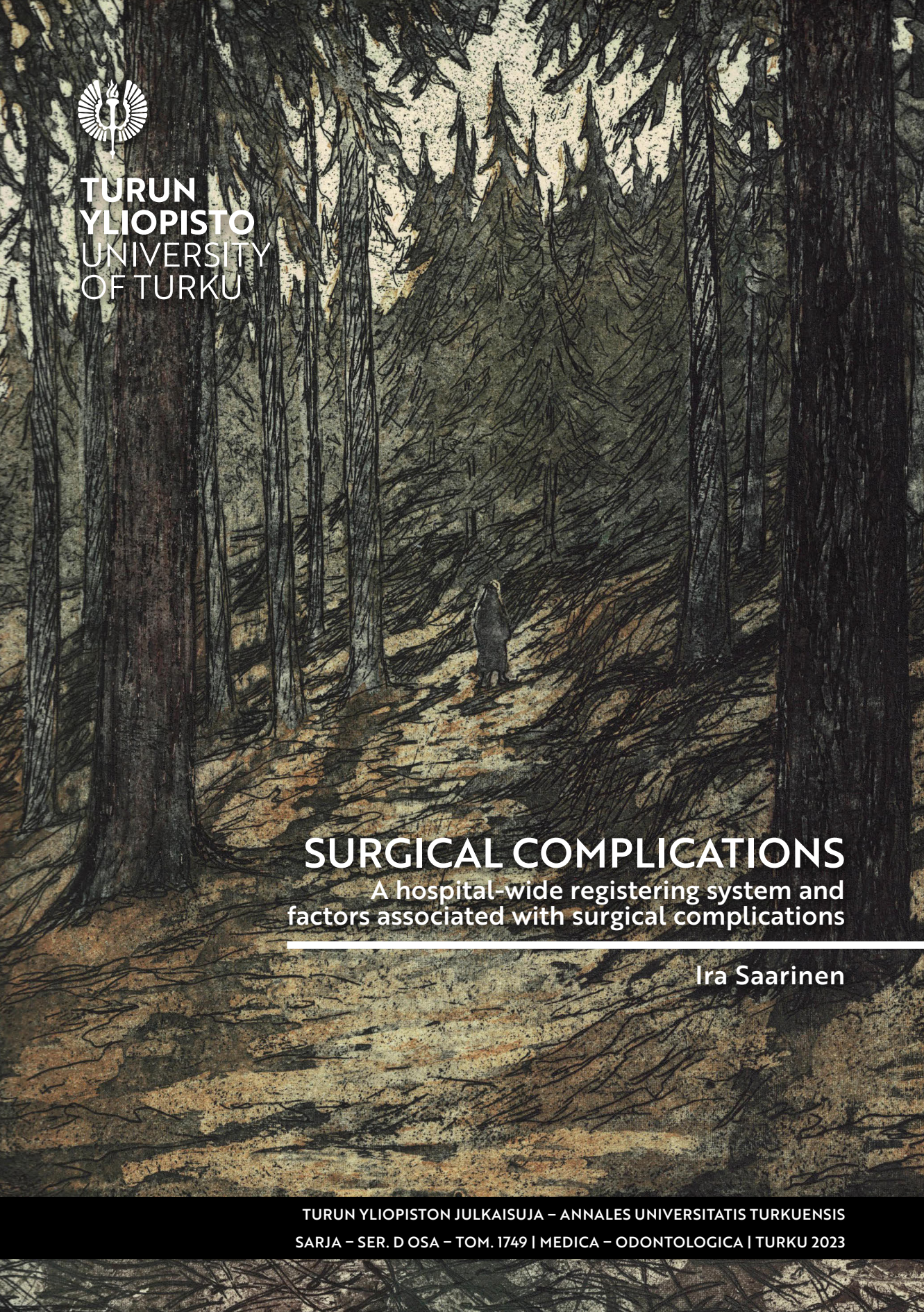

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UNIVERSITY OF TURKU

SURGICAL COMPLICATIONS

A hospital-wide registering system and factors associated with surgical complications

Ira Saarinen

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If knowledge can create problems, it is not through ignorance that we can solve them.

Isaac Asimov

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ABSTRACT

The primary aim of the present thesis was to study how surgical quality can be measured in a single hospital, by creating and describing a simple and usable tool for registering outcomes data based on severity of complications.

First, a systematic review of the subject was conducted. The evaluation of the articles revealed wide methodological heterogeneity in the classification and categorization of complications and data collection methods. Subsequently, a pilot hospital-wide surgical complication register was created and implemented in Satasairaala, Pori, Finland.

Perioperative data related to all adult general and orthopedic surgery procedures for 3 years (2016–2018) were included in the study. Complications were recorded according to a modified Clavien–Dindo classification, and the preoperative risk factors were compiled based on the literature and coded as numerical measures. The overall complication rate in 4529 patients was 17.2% (95% confidence interval (CI) 16.1–18.3), and 4.6% (95% CI 4.0–5.2) were graded as major complications. The results also showed that only a few patient-related risk factors were sufficient to account for the case mix.

Further aims of this thesis were to study factors associated with patient education and patient perceptions on surgical quality, and their association with surgical complications. Adult patients undergoing surgical operations were studied by questionnaires in 2016–2017 in Satasairaala, Pori. The results indicate that the information needs of the patients vary individually. The level of received information by patient education and the patient perception on quality of care may have an association with reported surgical complications.

KEYWORDS: surgery, quality improvement, health policy, health services management, performance measures, quality in healthcare, patient safety, human resource management, human factors, real-world effectiveness

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TIIVISTELMÄ

Tämän tutkimuksen ensisijaisena kohteena on kirurgisten komplikaatioiden mittaaminen sairaalatasolla. Väitöskirjan tavoitteena oli luoda kaikki kirurgian alat kattava komplikaatioita mittaava rekisteri, joka hyödyntää olemassa olevaa sähköistä sairaskertomusjärjestelmää. Järjestelmällisen katsauksen avulla selvitettiin ensin tieteellisessä kirjallisuudessa julkaistut tutkimukset olemassa olevista vastaavista rekistereistä sekä ne potilaaseen ja kirurgiseen toimenpiteeseen liittyvät tekijät, joiden tiedetään olevan yhteydessä kirurgisiin komplikaatioihin. Järjestelmällinen kirjallisuuskatsaus osoitti, että tiedonkeruumenetelmissä ja komplikaatioiden luokittelussa on maailmalla suurta vaihtelua.

Satasairaalaan luotiin pilottihankkeena koko kirurgian klinikan laajuinen komplikaatiorekisteri, ja tässä väitöskirjassa esitellään tulokset kolmen vuoden ajalta (2016–2018). Komplikaatioita todettiin 17.2 %:lla (95 %CI 16.1–18.3) 4529 leikatusta potilaasta. Näistä 4.6 % (95 %CI 4.0–5.2) luokiteltiin vakaviksi. Tulosten mukaan potilaskohtaisen riskin määrittämiseen saattaa riittää muutama kliininen mittari.

Lisäksi tässä väitöskirjassa tutkittiin, missä määrin potilaan informointi ja ohjaus sekä potilaan kokemus hoidon laadusta ovat yhteydessä komplikaatioiden esiintyvyyteen kotiutuksen jälkeen. Tulosten mukaan potilaskohtaisen ohjauksen tarve vaihtelee yksilöllisesti, ja potilasohjauksella ja potilaan kokemalla laadulla saattaa olla yhteyttä leikkauksesta toipumiseen ja komplikaatioiden esiintymiseen.

Tässä väitöskirjassa kuvataan koko aikuiskirurgian kattava komplikaatioita mittaava järjestelmä, sekä tuodaan esiin kirurgisen hoidon osa-alueita, joilla saattaa olla yhteyttä hoidon lopputulokseen, esimerkkeinä potilasohjaus ja potilaan kokema laatu.

AVAINSANAT: kirurgia, laadun parantaminen, terveyspolitiikka, terveydenhuoltohallinto, dokumentointi, potilasturvallisuus, terveydenhuollon laatu, henkilöstöhallinto, inhimilliset tekijät, arkivaikuttavuus

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Abbreviations

AHRQ	Agency for Healthcare Research and Quality
AI	Artificial Intelligence
ACS-NSQUIP	American College of Surgeons National Surgical Quality Improvement Program
ADLs	Activities of daily living
ALP	Alkaline phosphatase
ARD	Allergic respiratory disease
ASA	American Society of Anesthesiologists Physical Status Classification system
ASN	Association of Surgeons of the Netherlands.
AST	Aspartate aminotransferase
BMI	Body mass index
BUN	Blood urea nitrogen
CABG	Coronary Artery Bypass Graft
CAD	Coronary artery disease
CCI	Comprehensive Complication Index
CI	Confidence Interval
CHF	Congestive heart failure
COPD	Chronic obstructive pulmonary disease
CQR	Clinical quality register
CVA	Cerebrovascular accident
DIC	Disseminated intravascular coagulation
DM	Diabetes mellitus
EMR	Electronic medical record
ESRD	End-stage renal disease
HF	Human Factors
HT, HTN	Hypertension (high or raised blood pressure)
INR	International normalized ratio (blood clotting)
IOM	The Institute of Medicine
IPR	The Swedish National Inpatient Register
MET	Metabolic equivalent of task

MeSH	Medical Subject Headings
MI	Myocardial infarction
ML	Machine learning
NA	Not applicable
NLP	Natural language processing
NR	Not reported
NRS2002	Nutrition Risk Screening 2002
NTS	Non-technical skills
NYHA	New York Heart Association (functional classification of heart failure)
OT	Operating theatre
OSA	Obstructive sleep apnea
PIC	Finnish Patient Insurance Centre
RCT	Randomized controlled trial
RRCT	Registry-based randomized controlled trial
RVU	Relative value unit by Medicare
SD	Standard deviation
SOReg	Scandinavian Obesity Surgery Registry
TIA	Transient ischemic attack
UK	United Kingdom
US	United States
VHA	Veterans Health Administration
WBC	White blood cell count.
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 Saarinen, I., Malmivaara, A., Miikki, R., & Kaipia, A. (2018). Systematic review of hospital-wide complication registries. *BJS Open*, *2*, 293–300. https://doi.org/10.1002/bjs5.87

II Saarinen, I. H., Malmivaara, A., Huhtala, H., & Kaipia, A. (2022). Creating an inexpensive hospital-wide surgical complication register for performance monitoring: A cohort study. *BMJ Open Quality*, *11*, e001804. doi: 10.1136/bmjoq-2021-001804

III Koivisto, J. M.*, Saarinen, I.*, Kaipia, A., Puukka, P., Kivinen, K., Laine, K. M., & Haavisto, E. (2020). Patient education in relation to informational needs and postoperative complications in surgical patients. *Int J Qual Health Care*, *32*(1), 35–40. doi: 10.1093/intqhc/mzz032.

IV Saarinen, I. H., Koivisto, J., Kaipia, A., & Haavisto, E. l. (2020). Perceived quality of surgical care in association with patient-related factors and correlation to reported postoperative complications in Finland: A cross-sectional study. *BMJ Open*, 10, e037708. doi: 10.1136/bmjopen-2020-037708

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1 Introduction

The common sense notion [is] that every hospital should follow every patient it treats, long enough to determine whether or not the treatment has been successful, and then to inquire, If not, why not?

- Ernest Codman, 1911

Surgical quality is a heterogeneous concept, and there has been no consensus on how to evaluate the quality of surgical outcomes (Domenghino et al., 2023). Donabedian (1989) suggested that the concept of quality should be divided into three domains: outcome, structure, and process. This thesis concentrates on the domain of outcomes, which can be measured in several ways, for example, through functional gain or health benefit, patient satisfaction, economic gain, quality-of-life measurements, and complications or adverse event frequency (Martin et al., 2002). Surgical complications have been chosen as the outcome quality indicator for this thesis because they cause major economic and human burden (Birkmeyer et al., 2012; Dimick et al., 2004; Gawande et al., 1992; Stokes et al., 2022; Vonlanthen et al., 2011).

A central element of meaningful outcome reporting and comparison is the use of appropriate risk-adjustment techniques. This process helps account for variation in case mix across hospitals, since a hospital with a higher proportion of comorbid, complex patients would be expected to have a higher number of complications than a hospital with younger, less sick patients (Dimick et al., 2010). The expanding volume of data collection in surgery and medicine poses a substantial financial and administrative burden on clinicians (Wadhera et al., 2020), which is why the decision and studies on ‘what and how to register’ are fundamentally critical for valid data collection and quality assurance. This thesis concentrates on this issue by aiming for a simple surgical complication registering system with only a few patient-related risk factors.

Data collection and management for outcomes and quality reporting have traditionally been done within electronic medical records (EMR) and clinical

registers. Written or dictated clinical notes in the EMR describe the patient's condition but are the most challenging for computer analysis due to unstructured and heterogeneous data formats, typing and spelling errors, and violations of natural language grammar (Meystre et al., 2008). The main idea in the complication registering system described in this thesis was to use structured data in the form of numerical codes.

Clinical registers are structured, rigid frameworks that have been developed during the past decades to detect and share outcomes within different areas of healthcare, for example, among surgical subspecialities. They are an important quality control tool and serve as a large dataset for register-based studies (Venermo et al., 2018). Today, big data in healthcare and medicine refers to various large and complex heterogeneous data that hold a promising resource for quality measurement but are difficult to analyze and manage with traditional software or hardware (Ristevski et al., 2018; Wang & Alexander, 2020; Yang et al., 2020).

In recent years, there has been growing interest in patient-centered care, patient education, participation, and experience, and their relation to objective measures of quality of care (Doyle et al., 2013; Luxford, 2012; O'Hara et al., 2018). These measures are becoming increasingly important when assessing the quality of hospital organizations and treatment outcomes (Doyle et al., 2013; Luxford, 2012; O'Hara et al., 2018).

Rationale for this Thesis

Clinical knowledge, skills, and current scientific evidence are cornerstones for providing effective treatment for patients. However, to improve the effectiveness and *value* of treatment in ordinary practice, appropriate documentation of care at healthcare units is needed—we cannot improve what we cannot measure (Malmivaara, 2015). Adverse event reporting systems have been recommended by the Institute of Medicine (IOM) in the United States (US). Such systems are used extensively in the Aviation industry to identify potential safety hazards, but their use in medical care has been inconsistent (Mitchell et al., 2016). In Finland, outcome reporting is not required, and is only seldom done, mainly by individual physicians keeping record of their own operations. Local quality control tools, such as the complication register described in this thesis, can be considered a parallel system to the use of big data, representing agile solutions within the EMR.

Although big data is considered a promising and essential future technology area, it withholds major challenges (Awrahman et al., 2022). An important issue in today's world of data abundance and "noisy data" is to comprehend and classify which data and *knowledge* are important, valid, and valuable for describing and improving the quality of surgical care. Although artificial intelligence (AI) and machine learning

(ML) solutions have been developed, they are so far incapable of understanding and integrating relevant knowledge in specific domains (Chen & Decary, 2019). It is therefore equally important to maintain and improve such comprehension, which is also the purpose of this thesis.

Despite the current excitement, investment, and studies on modern technical solutions, such as big data and AI, we cannot ignore the fact that all effect and *value* in healthcare is generated between the healthcare giver and the patient (Malmivaara 2018, 2022). Recently, patient safety has been recognized to be strongly associated with contextual and human factors, with a lot to learn from other disciplines, such as aviation (Mathavara & Ramachandran, 2021; O'Logbon, 2020). In addition to technical treatment, surgical care comprises other elements, such as preoperative evaluation, patient education, and care on the ward. These elements of quality data involve the patient's view, which was selected for this thesis in the form of studying patient education and patient experience on quality.

The aim of this thesis was to study surgical quality in a single hospital by creating and describing a simple and usable *ad hoc tool* for registering outcome data based on the severity of complications. The basic principle of the monitoring system was to collect patient-related risk factors, process-related data, and treatment outcomes during clinical care in a simple and numerically coded fashion within the framework of preexisting electronic patient records and ready for data analysis. Assessing credible comparisons of competing care providers, accurate data collection of both negative and positive outcomes, preferably for all medical specialties in an institution, is needed. This thesis focuses on understanding the essential points of ever-expanding quality data and describes an idea for real-time outcome measuring that could be generated and expanded to other medical specialties with appropriate metrics and indicators.

The first aim of the thesis was to systematically evaluate how hospital-wide surgical complication registering systems are reported in the literature. The second aim was to describe the setting up of a local cross-discipline surgical complication registry, and to study the detected complications with surgery- and patient-related factors. Other aims of this thesis were to evaluate the potential association between patient reported surgical complications 30 days after discharge and patient education and empowerment, and patient perceptions of the quality of care.

2 Review of the Literature

2.1 History of Measuring Surgical Quality

Ernest Codman (1869–1940) was a surgeon in Boston, and the first to introduce the idea of keeping track of patients and complications after treatment. He recorded diagnostic and treatment errors and linked these errors to outcomes—to make improvements and 'to prevent similar failures in the future'. He recognized errors due to lack of knowledge or skill, surgical judgment, lack of care or equipment, lack of diagnostic skill, and "those accidents and complications over which we have no known control" (Neuhauser, 2002). Indeed, all poor patient outcomes are not a result of an error: complications in surgical care are strongly related to patient- and disease-related factors. Codman's work preceded contemporary approaches to quality monitoring and assurance, although complexity and ambiguity in healthcare objectives, decision making, and costs today hinder full application of his vision (Donabedian, 1989).

2.1.1 Domains of Quality According to Donabedian

Quality in healthcare is a very heterogeneous concept due to the many perspectives of care: individual (patient), population, payer, department, organization, nursing care, and doctor (surgeon). The result is always dependent on the metrics: what is being measured and how.

Donabedian (1988) suggested that the concept of healthcare quality should be divided into three domains: structure, process, and outcome. He defined structure as the environment in which healthcare is provided, process as the method by which healthcare is provided, and outcome as the consequence of the healthcare provided. Structure measures reflect provider's capacity and systems to provide high-quality care, for example, the number or proportion of board-certified physicians and the ratio of providers to patients (Agency for Healthcare Research and Quality, AHRQ). From a patient's view, structural measures can focus, for example, on waiting times and continuity of care (IOM, 1990). Process measures constitute most healthcare quality measures used for public reporting. Healthcare processes comprise hospital admissions, discharge, billing, patient transfers to different facilities, patient flow,

etc. Lean and Six Sigma methodologies are efficiency measures developed in the manufacturing industry to increase productivity by eliminating non-value-added steps and have been widely introduced in healthcare over the past two decades (Joosten et al., 2009). The use of Lean and Six Sigma methodologies has been shown to increase operative department productivity (Cima et al., 2011).

Outcomes can be measured in many ways, including functional gain or health benefit, patient satisfaction, economic gain and cost-effectiveness, quality-of-life measurements, and complications or adverse event frequency (Dimick et al., 2004; Gawande et al., 1992; Shah et al., 2020; Vonlanthen et al., 2011). Surgical complications cause a major economic and human burden, are somewhat avoidable, and can serve as an outcome quality and safety indicator. There is also evidence of a strong correlation between hospital complication rates and episode payments for surgical procedures (Dimick et al., 2004; Birkmeyer et al., 2012). Therefore, efforts aimed at improving surgical quality may ultimately reduce costs and improve outcomes.

2.1.2 Expansion of Quality Measurement

The IOM has defined quality as pertaining to healthcare as 'the degree to which healthcare services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge' (IOM, 2000). According to Donabedian (1966), "Many problems are present at the fundamental level of ´what quality of healthcare means´, for it is a remarkably difficult notion to define."

In 2000, the IOM published its work *To Err is Human* on preventable errors and patient harm within the US medical system (IOM, 2000). It calculated that human error in healthcare results in almost 100,000 deaths in the US annually, and the IOM proposed that healthcare practitioners must develop an explicit focus on providing care that is safe, effective, patient-centered, efficient, timely, and equitable (IOM, 2000).

In the US, every year, hospitals are ranked or rated by public and private organizations that aim to identify centers that provide high-quality healthcare (Hota et al., 2016). Although the reports are intended to help guide consumers in determining where to seek care, these ranking systems often yield conflicting information or, worse, misinformation for patients and their clinicians (Hota et al., 2020). Despite the potential merits of public ranking systems, methodological limitations, especially due to risk adjustment, can result in misinformation for patients (Bae et al., 2020).

Traditional outcome measures, such as morbidity and mortality statistics, are essential, but they tend to overlook the patient's perspective on healthcare. This has

recently been recognized, and patient-centered measures are becoming increasingly important when assessing the quality of organizations and treatment outcomes (Luxford, 2012). Patient-reported outcome measures (PROMs) are standardized, validated questionnaires completed by patients to measure their perceptions of their own functional status and wellbeing. Patient-reported experience measures (PREMs) are questionnaires that measure patients' perceptions of their experience while receiving care (Kingsley & Patel, 2017).

The complexity and different viewpoints of the quality of healthcare, along with the expansion of medical data, have led to new problems: many measures may not be meaningful, and the administrative and financial burden placed on clinicians to report quality measures is substantial (Blumenthal et al., 2015; Casalino et al., 2016). In the US, after the IOM report in 1999, the Centers for Medicare & Medicaid Services (CMS) have invested more than one billion dollars in quality measure development (Wadhera et al., 2020). Over 2000 quality measures have been developed, of which one-third are in use, and even fewer are shown valid. Recently, it has been recognized that the expanding volume of data collection in surgery and medicine poses a substantial financial and administrative burden on clinicians (Wadhera et al., 2020). However, there is a promising future technology to solve these problems.

2.1.3 Quality Measurement from Different Perspectives

Increasing technological progress has initiated a digital transformation process in many sectors, including healthcare (Aarathi & Vasundra, 2019), which has led to the announcement of a new domain called big data. In information technology, the term "big data" is usually used to express enormous data that are too big and hard to deal with by the traditional database (Awrahman et al., 2022; Raja et al., 2020). The term artificial intelligence (AI) can be broadly defined as a computer program that can make intelligent decisions, analyze extensive healthcare data from different sources, reveal hidden knowledge, and identify risks (Awrahman et al., 2022; Dash et al., 2019; Hong et al., 2019; Raja et al., 2020). In this regard, AI encompasses ML and natural language processing (NLP) and can present opportunities for healthcare delivery, management, and policy making (Choudhury & Asan, 2020) to improve patient safety outcomes, quality of care, and cost of care (Awrahman et al., 2022).

The traditional EMR is confined to one healthcare practice, but the electronic health record contains a more complete record that is shareable between all providers involved in an individual's healthcare (Gunter & Terry, 2005). EMR data can be unstructured (e.g., clinical notes) or structured (e.g., ICD-9 diagnosis codes, administrative data, chart, and medication) (Häyrinen et al., 2008), but due to digitalization, nowadays, it also includes phenomics, genomics, laboratory, or

radiology data (Wu et al., 2017). In addition to traditional EMR, information sources can include others, such as web /mobile applications, as patients are able to send their signs and symptoms directly to the provider/ specialists through these media (Awrahman et al., 2022; Panda et al., 2017).

Importantly, the definition and measurement of quality needs representation for the patients' benefit. In the US, the Agency for Healthcare Research and Quality (AHRQ) has defined healthcare quality as "the right care for the right patient at the right time" (Clancy, 2009; Henry et al., 2018). The American College of Surgeons (ACS) offers another description, focusing on greater access to care, fewer complications, and better outcomes (Henry et al., 2018; The American College of Surgeons). Measurement of healthcare institution performance is important for several stakeholders and reasons: the payers or external institutions, benchmarking, performance improvement, planning, and creating competitive strategies (Henry et al., 2018; Garvin et al., 1987). Institution-level quality improvement initiatives should concentrate on utility and simplicity in the era of staff shortages.

2.2 Study Sources and Methods of Quality Measurement

Complications and quality are being studied at various levels of the healthcare system. In addition to clinical measurement, administrative and claims data are the traditional ways of reflecting quality, often on a national level. Big data mining and AI are bringing new aspects to the area. Patient surveys have gained importance over the years.

2.2.1 Administrative Data

While providing and paying for care, organizations generate administrative data on the characteristics of the population and the use and charge of services. Common data elements include type of service, number of units (e.g., days of service), diagnosis and procedure codes for clinical services, location of service, and amount billed. Hospital and national administrative data provide general incidence information on perioperative mortality and morbidity (Reilly et al., 2020).

Advantages of administrative data include electronic availability, inexpensive cost, availability for an entire population of patients and across payers and uniform coding systems. Some challenges of administrative data include inaccurate and nonspecific International Classification of Diseases (ICD) coding, and limited clinical information. Metrics, such as mortality, readmission, and length of hospital stay are most likely recorded accurately in administrative data—even more accurately than in a clinical registry (Lawson et al., 2015) —but using ICD-10 codes

to identify postoperative complications may underestimate the incidence of complications and morbidity (Reilly et al., 2020).

2.2.2 Claims Data

Claim data reflect the quality of a broad (often national or regional) spectrum of the healthcare system. According to studies that compare reporting between claims data and national/other registries, agreement on the data has been poor for patient-level complications (Lawson et al., 2012, 2015; Ohrn et al., 2011). Many patients who sustain a medical injury or complication after treatment do not sue. On the other hand, claims not involving errors have been reported to account for 13 to 16 percent of the system's total monetary costs; most of the claims not associated with injuries or errors do not result in compensation (Studdert et al., 2000).

In Finland, patients are entitled to claim economic compensation from the Patient Insurance Centre (PIC) in Finland if they believe that they have sustained an injury because of their treatment. This national no-fault insurance system is unique to the Nordic countries (Norway, Denmark, Finland, and Sweden). Approximately 9,000 claims are filed every year in Finland (with 5.5 million inhabitants), and 27% of these claims are for economic compensation due to patient injuries (Potilasvakuutuskeskus). The PIC also plays a role in preventing complications by making the data of the claims available for independent analysis and publication to inform healthcare workers (Antikainen et al., 2010).

Patient-generated malpractice claims, as collected in the Nordic national malpractice insurance systems and adjusted for clinical volumes, have high validity, as assessed by standardized physician review (Pukk-Härenstam et al., 2009). They provide unique new information on malpractice risks, preventable medical errors, and patient injuries (Pukk-Härenstam et al., 2009). Linking medical malpractice claims' data with clinical data from medical records can provide detailed information on error sequences that lead to adverse events (Studdert et al., 2006). An important study subject from claims data could be "index operations"—typical and common operations for each subspecialty—which carry a rather stable risk of surgical complications (i.e., cholecystectomy) (Antikainen et al., 2010). Surgical complications can be studied via such index operations to avoid inappropriate weighting of uncommon cases (outliers).

2.2.3 Big Data and AI

Historically, the healthcare industry has generated large amounts of data, driven by record keeping, regulatory requirements, and patient care (Raghupathi & Raghupathi, 2014). The digitalization of large quantities of data—big data—holds

the promise of supporting a wide range of medical and healthcare functions, including clinical decision support, disease surveillance, and population health management (Burghard, 2012; Fernandez, 2017). Big data can, for example, detect gaps in care that worsen health outcomes and cause more costs, or can be used for pharmaceutical data to obtain a better view (Awrahman et al., 2022). As a result of big data, there is the potential to improve patient outcomes, personalize care, improve relationships between the patient and the provider, manage and control processes, and decrease hospital costs (Awrahman et al., 2022). Big data, along with ML capabilities and AI-based analytics, can be used to make improvements in quality and cost of care by collecting data from everything related to patients (Awrahman et al., 2022).

Although much excitement surrounds the use of AI and ML in healthcare, there are major challenges of implementing such tools in routine clinical practice, such as ensuring privacy, security, and ethics, as well as inadequate understanding of what a specific AI can or cannot do (Cohen & Mello, 2019; Jha & Topol, 2016; Stead, 2018). ML identifies superficial patterns and complexes but lacks understanding of meanings and concepts; it identifies correlations but not causal relations; it lacks common sense reasoning and general intelligence, and it needs big data. ML models are as good as their training sets (Chen et al., 2020).

2.2.4 Patient Surveys

Medical research has traditionally concentrated on biological (i.e., pharmaceuticals) or physiological (such as surgery) treatments by randomized controlled studies (RCTs) or register-based randomized controlled studies when analyzing the effectiveness of an intervention. However, an intervention beholds not only the medical or physical treatment but also the interaction between the patient and caregivers. Information on the diagnosis and contributing factors needs to be conveyed appropriately to the patients, and they need to be advised and supported in their own efforts to ease symptoms and increase the probability of recovery (Malmivaara, 2018; Malmivaara, 2022).

In recent years, there has been an increased focus on placing patients at the center of healthcare research to improve their experience (Batbataar et al., 2017). A patient-reported outcome is directly reported by the patient without interpretation of the patient's response by a clinician or anyone else. It refers to the patient's health, quality of life, or functional status associated with healthcare or treatment (Weldring et al., 2013; Black et al., 2014). Patient-reported outcomes may be measured using standardized, validated questionnaires (patient-reported outcome measures or PROMs). PROMs can examine predominantly short-term measures, for example, quality of recovery or longer-term measures, aimed at evaluating the impact of

surgery on a longer term and overall health (Weldring et al., 2013). The outcome-based definition of PROMs distinguishes them from questionnaires used to measure patients' experiences of the care process. Patient-reported experience measures (PREMs) are tools that report patient satisfaction to capture the overall patient experience of healthcare (Almeida et al., 2015; Jenkinson et al., 2002).

2.2.5 Clinical Quality Registries

2.2.5.1 Single Specialty Registries

Complications and other quality data have been monitored at various levels of the healthcare system. Traditionally, surgical specialties have taken responsibility for the research of operation techniques and treatment protocols within their own domains. Within single surgical specialties, diagnoses, or procedures, there are numerous examples of quality and complication registries, the earliest of which started in the field of trauma surgery. The first recorded systematic attempt to obtain and collect casualty and medical information was ordered by the Surgeon General of the US Army in 1818 (Love et al., 1973). Computerized trauma registries appeared nearly a century and a half later (Boyd et al., 1973) and were finally defined as an essential part of a hospital trauma system across the world (Aharonson et al., 2007; Boyd et al., 1973; SCANTEM, 2004).

In the US, both the Department of Veterans Affairs and the Society of Thoracic Surgery Registry began their activities in clinical data registries, risk adjustment, performance measurement, and data-driven quality improvement on separate but parallel and similar tracks in 1986 (Hannan et al., 1994). In 1989, when the State Department of Health began collecting, analyzing, and disseminating information regarding the risk factors, mortality, and complications of coronary artery bypass graft (CABG) surgery, the Society of Thoracic Surgery Registry database was initiated. These new data stimulated specific quality improvement activities at hospitals throughout the US (Hannan et al., 1994; Winkley et al., 2015). The National Veterans Administration Surgical Quality Improvement Program (NSQIP) provides a reporting and managerial structure for continuous monitoring and enhancement of the quality of surgical care in the Veterans Health Administration (VHA), and the standardized platform is now expanded to many American private and public hospitals (The American College of Surgeons National Surgical Quality Improvement Program, ACS-NSQIP).

In addition to randomized controlled trials (RCTs), real-world data (RWD) (Blonde et al., 2018) from clinical registries help in determining the natural history of a disease, assessing long-term outcomes and rare adverse events, determining trends in management, or examining guideline compliance (Beckmann et al., 2021).

During the past decades, single specialty quality and complication registers have developed, and there are now numerous examples of such registries within surgical specialties, diagnoses, or procedures (Beckmann et al., 2021; Lefering & Ruchholtz, 2012;), including commercially produced clinical registers (bcbmedical.com).

2.2.5.2 Nationwide and International Registries

Nationwide registers have been implemented in some countries, with the leading example being Sweden (Ludvigsson et al., 2011). The Swedish National Inpatient Register (IPR), also called the Hospital Discharge Register, is part of the national patient register, and in 2011, more than 99% of all somatic (including surgery) and psychiatric hospital discharges were registered in the IPR (Ludvigsson et al., 2011). The IPR is now a principal source of data for numerous research projects: nationwide registries can offer a cost-effective means for registry randomized clinical trials (RRCT) that can provide information on real-effectiveness and real-cost-effectiveness (Fröbert et al., 2013; Malmivaara et al., 2022).

There has been a rise in international collaborative registers, such as the Scandinavian Obesity Surgery Registry (SOReg). Among vascular surgeons, the drive for an international registry has been ambitious and pioneering: the US has a history of vascular registers since 1975, and in the late 1980s and 1990s, population-based national vascular registries have been established in several parts of Europe: in 1987 in Sweden, in 1989 in Denmark and Finland, and later in several other countries (Venermo et al., 2017). The VASCUNET collaboration has been an official working group bringing together 12 vascular surgery registries from Europe, Australia, and New Zealand and aiming to improve the quality of vascular surgery and patient safety using national clinical registries (Venermo et al., 2017; Behrendt et al., 2019).

With the enforcement of the European Union (EU) General Data Protection Regulation (GDPR) in 2018, a data protection strategy—especially data privacy and security compliance—has become essential for any organization processing personal data in the EU (Hussein et al., 2021, Behrendt 2020). Thus, researchers and clinicians need to spend extra effort in understanding, implementing, and maintaining compliance with the GDPR organizational and technical requirements, that is, data encryption and anonymization, authorization, access control, and consent management (Mondschein & Monda, 2018).

2.2.5.3 Institutional Registries

The development of institutional registries that combine all surgical specialties has been challenging (Dindo et al., 2010). The ACS now uses a wide, standardized

platform called the National Surgical Quality Improvement Program (ACS-NSQIP), which was initially instituted by the Veterans Health Administration in response to the need for quality improvement (Khury et al., 1995, 2008). It creates reliable, valid information on patient presurgical risk factors, the process of care during surgery, and 30-day morbidity and mortality rates available for all major surgical procedures (Khuri et al., 1995). This system has produced a great amount of data for quality research.

The ACS-NSQUIP has proved effective and reliable, but in today's scarce resources, such a surgical platform is somewhat costly and laborious, with the requirement for extra dedicated staff. It seems reasonable that surgical units should record their results and monitor the frequency of adverse events and complications. Ideally, such monitoring systems would be real-time, contain patient-related risk factors, and encompass all surgical subspecialties (Bilimoria et al., 2009; Russell et al., 2003; Veltkamp et al., 2002).

Articles on the institutional registration of surgical complications or quality data are scarce and seem to have gone distinct during the past decade. The shift in the literature seems to be toward large healthcare datasets, including ACS-NSQUIP and Medicare data. However, there are recent articles on mobile-based perioperative surgical complication reporting system applications in single hospitals (Li et al., 2023; Rubin et al., 2019).

2.3 Surgical Complications

The worldwide volume of surgery is large: approximately 313 million surgical procedures are performed each year. Only 6% of them occur in the poorest countries, where over a third of the world's population lives (Vanderbilt Global Surgery). About half of the adverse events in all healthcare are related to surgery (de Vries et al., 2008, Gawande et al., 1999; Leape et al., 1991; Thomas et al., 2000).

2.3.1 Terms and Definitions

There is still no consensus on how surgical complications should be measured and reported, and universal definitions of the terminology of harmful outcomes are lacking (Murff et al., 2003). Various terms, such as complications, adverse events, medical or patient injuries, substandard care, or malpractice, are used; therefore, the data search and reliable comparisons between studies are difficult (Andrews et al., 1997). Further, the timeframe varies in the literature: complications have been measured as in-hospital (occurring at the time of discharge), 30-day, or 90-day postoperative complications (Bosma et al., 2011; Lin et al., 2017; Veen et al., 2005; Veltkamp et al., 2002).

An ‘adverse event’ in healthcare is generally defined as an unintended injury or complication that results in prolonged hospital stay, disability at the time of discharge or death, caused by healthcare management rather than the underlying disease itself (Bosma et al., 2011; Thomas et al., 2000). These events can be the result of errors, substandard care, known side effects, or unexpected complications that may not have been preventable. The consequences of adverse events for the patient vary from harmless inconvenience to permanent disability or even death (Brennan et al., 1991). An adverse event may be caused by an error or incident, but most errors or incidents do not cause adverse events. It has also been suggested that adverse events should be distinguished as complications (any deviation from the normal postoperative course), sequelae (inherent to the procedure and expected to occur, such as pain or scar formation), or failure to cure (diseases that remain unchanged after surgery or reoccur, for example, early recurrence of an inguinal hernia) (Dindo et al., 2010).

Quality and safety research has demonstrated that errors causing adverse events result from failures on either the individual level (i.e., unsafe or inappropriate acts by staff in direct contact with the patient) or systemic level (conditions residing within the organization) (Wilson et al., 1999). The latter has been the primary focus of most recent initiatives aimed at improving the safety climate of medicine (Dankelman & Grimbergen, 2005). An adverse event or complication may not necessarily happen during the actual medical care or operation, as often considered, but during ward care. A frequent unwanted complication for a patient during hospitalization is pressure ulcer, the incidence of which continues to account for 4.5–8.9% of hospitalized patients despite quality and education programs (Koivunen et al., 2018; Lyder et al., 2012).

2.3.2 Surgical Complication Frequency

The incidence of surgery-related major or severe complications in industrialized countries has been reported to vary between 3% and 17% (Gawande et al., 1999; Treadwell et al., 2014). However, due to the heterogeneity of adverse event terminology and reporting, the true incidence data of all adverse events are difficult to ascertain (Wanzel et al., 2000). Further, surgical complication rates have a wide global variation: surgical morbidity and mortality are dependent on the quality of the healthcare system and the economic status of the country in question (Semel et al., 2012; Weiser et al., 2008). A substantial proportion (30%) of surgical complications and deaths occur after hospital discharge (Bilimoria et al., 2010).

2.3.3 Surgical Complication Measurement and Grading

A standardized method for the classification of surgical complications was proposed by Clavien et al. (1992), which was known as the Clavien classification of surgical complications. In 2004, Clavien and his colleague Dindo revised the basic model to be named the "Clavien–Dindo Classification" (Dindo et al., 2004). The authors studied and provided evidence of five years of experience in the proposed classification (Clavien et al., 2009).

There has been a new modification to the original Clavien–Dindo Classification system, the Comprehensive Complication Index (CCI) (Slankamenac et al., 2013). For CCI, the authors focused on the criteria that the Clavien–Dindo classification system graded as the single most severe complication that occurred in the patient, thus ignoring the less severe events. This failed to represent the true overall postoperative morbidity, and a mathematical formula was developed for the CCI (Manekk et al., 2022; Slankamenac et al., 2013). However, the original Clavien–Dindo classification has been applied to most fields of surgery, has been widely utilized, and is less complicated than CCI.

There is currently no agreement as to when outcomes should be captured; historically, surgical complications have been collected by discharge or 30-day data only (Domenghino et al., 2023; Lawson et al., 2012). A recent consensus suggests the outcomes should be measured at 5 time points from before the operation until 5 years postoperatively (Domenghino et al., 2023).

2.3.4 Factors Associated with Surgical Complications

2.3.4.1 Patient-Related Risk Factors – "Case Mix"

Surgical complications are strongly related to patient-specific factors, and socioeconomic factors have been identified as having a major effect on patient health and outcomes. Patterns of socioeconomic deprivation, race, and ethnicity vary markedly by region, and individuals in some regions are more likely to experience serious chronic illnesses (e.g., obesity, diabetes, cardiovascular disease, and cancer) and higher rates of postoperative complications than patients in other regions (Bae et al., 2020; Stringhini et al., 2017). Therefore, for benchmarking purposes, it is essential to consider the case mix.

The objective patient-related demographic variables in surgery are age and sex. Although age has been considered a primary predictor of surgical outcomes, preoperative functional status has been suggested as a better surrogate for postoperative risk (Malani et al., 2009). Perioperative malnutrition is also a known independent predictor of postoperative mortality and morbidity (Correia et al., 2002).

Many single comorbidities or symptoms are described as surgical risk factors, such as cancer, congestive heart failure, ascites, and chronic pulmonary disease (Daley et al., 1997; Khuri et al., 1997;). They are presented in diagnostic medical measures, such as electrocardiograms, lab tests albumin, blood urea nitrogen, and alkaline phosphatase, which serve as predictive risk factors (Best et al., 2002). The American Society of Anesthesiologists Physical Status Classification System (ASA class) has long been used to describe anesthesia-related risks (Saklad, 1941; Sankar et al., 2014) and constantly updated (Mayhew et al., 2019; Hurwitz et al., 2017) (Table 1).

Table 1. Current definitions and ASA-approved examples.

ASA Classfication	Definition	Examples
ASA I	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use
ASA II	A patient with mild systemic disease	Mild diseases only without functional limitations. Current smoker, social alcohol drinker, pregnancy*, obesity (30 >BMI <40), well-controlled DM/HTN, mild lung disease
ASA III	A patient with severe systemic disease	Substantive functional limitations; One or more moderate to severe diseases. Poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, history (>3 months) of MI, CVA, TIA, or CAD/stents.
ASA IV	A patient with severe systemic disease that is a constant treat to life	Recent (<3 months) MI, CVA, TIA or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, shock, sepsis, DIC or ESRD not undergoing regularly scheduled dialysis
ASA V	A moribund patient who is not expected to survive without the operation	Ruptured abdominal / thoracic aneurysm, massive trauma, intracranial bleed with mass effect
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	

* Although pregnancy is not a disease, the parturient's physiologic state is significantly altered from when the woman is not pregnant, hence the assignment of ASA II for a woman with uncomplicated pregnancy. DM, diabetes mellitus; HTN, high blood pressure (hypertension); COPD, chronic obstructive pulmonary disease; ESRD, end-stage renal disease; MI, myocardial infarction; CVA, cerebrovascular accident; TIA, transient ischemic attack; CAD, coronary artery disease; DIC, disseminated intravascular coagulation.

In addition to ASA grade, there are several indexes to measure comorbidities and general health status, that is, the Charlson Comorbidity Index (Charlson et al., 1987), and electronic FRAILTY index (Lin et al., 2018). Special risk scores for surgery have also been designed, for example, the Physiological and Operative Severity Score for the numeration of Mortality and morbidity (POSSUM) (Copeland et al., 2002), the Surgical Risk Scale (SRS) (Sutton et al., 2002) and Surgical Outcomes Risk Tool (SORT) (Oakland et al., 2021). These tools also consider the operation-related risk factors.

2.3.4.2 Surgery-related Risk Factors

Patients undergoing surgery are prone to both surgical and anesthesia-related complications. For low-risk patients (ASA scores I and II), anesthesia accounts for about 30% of deaths and serious complications during surgery (Schiff et al., 2014).

Operation-related factors refer to the classification of operation complexity or subspecialty and whether the operation is performed as planned (elective) or emergency. Emergency/urgent operations carry a strong risk factor (Wanzel et al., 2000). The strongest operation-related risk factors include contaminated wounds, length of the operation/operative severity/multiple procedures, total blood loss, and presence of malignancy (Pillai et al., 1999; Prytherch et al., 1998).

2.3.4.3 Human Factors in the Surgical Care Process

Patient safety and surgical complications have traditionally been approached as matters of a surgeon's individual technical performance. However, in the operating theatre, five domains of intraoperative performance have been defined as affecting the surgeon's performance: declarative knowledge, personal resourcefulness, interpersonal skills, psychomotor skills, and cognitive skills (Madani et al., 2017). The interdisciplinary research field of human factors (also known as ergonomics) brings together knowledge from psychology, such as human cognition, behavior, motivations, and physical abilities or limitations, and engineering, that is, the design of technology, systems, and environments (Carayon et al., 2012). The principles of human factors have been much studied in aviation (Mathavara & Ramachandran, 2022) and could also be used to improve healthcare quality and patient safety (Holden et al., 2013). On the surgical ward, risk assessment for escalation of care has identified communication problems, understaffing, and hierarchical barriers as the root causes of failure (Johnston et al., 2015). Human factors intervention on a surgical ward showed improvement in teamwork, supervision, and safety practices (Johnston et al., 2018).

2.3.4.3.1 Patient education and postoperative recovery

Since more than 30% of postoperative complications occur at home within 30 days after hospital discharge (Bilimoria et al., 2010; Wanzel et al., 2000), sufficient patient empowerment and education is essential. The trend to shorten hospital stays, and utilization of ambulatory surgery has required a shift to better preoperative patient education and preparedness of patients as well as good coordination between the patient and the healthcare system (Berg et al., 2013; Bowyer et al., 2016). Preoperative education and counseling have been associated with reduced rates of perioperative complications and levels of anxiety (Zhang et al., 2012). Sufficient staff resources, well-organized system processes and a good attitude of the staff are necessary prerequisites for successful patient education (Ha et al., 2010; Aiken et al., 2012). According to previous studies (Pelt et al., 2018), successful patient education can reduce pain and hospital stay, and decrease readmissions, reoperations, and patient discharges to post-acute care centers.

2.3.4.3.2 Patient experience in recovery

The provision of good information and emotional support have been associated with better recovery from surgery and heart attacks (Doyle et al., 2013; Mumford et al., 1982). Healthcare staff empathy, non-technical skills (NTS), and communication skills have been associated with a high perception of quality and with better treatment outcomes (Cheng et al., 2003; O'Hara et al., 2018). Positive associations between patient experience and self-rated and objectively measured health outcomes have been reported: adherence to recommended clinical practice and medication, preventive care, such as health-promoting behavior, and resource use, such as hospitalization, length of stay, and primary-care visits (Doyle et al., 2013). The Royal Society for Physicians and Surgeons of Canada has since the 1990s used a competence framework, CanMeds, which assesses the competence of all healthcare staff, related to communication, co-operation, management, health advocacy, scientific skills, and professionalism, including relevant ethical issues (Turner et al., 2012).

2.3.5 Costs of Surgical Complications

Surgical complications have a dramatic impact on full in-hospital costs (Vonlanthen et al., 2011; Birkmeyer et al., 2012). In view of the rising cost of healthcare, policymakers and stakeholders have begun to seek value in the quality of care while controlling costs (Shah et al., 2020). The occurrence of *any* complication was reported to result in a 1.5-fold mean increase in direct hospital cost in a large American database study, where the top 4 most costly complications (septic shock,

renal insufficiency/failure, any respiratory complication, and myocardial infarction/cardiac arrest) resulted in a 3–4-fold mean increase in costs (Stokes et al., 2022).

In Finland, according to the PIC report from 2022, malpractice claims are most often related to operation- or anesthesia-related interventions (Potilasvakuutuskeskus). In 2022, 773 injuries were granted for reimbursement in Finland. Out of the 773 injuries, there were 164 interventions outside the fields of general surgery and orthopedics (dental, gynecological, ophthalmological, and otorhinolaryngological operations). Of the remaining 609 operations, 347 were orthopedic or traumatology operations, covering over half of the reimbursed operations within the surgical field. In 2022, the amount of reimbursement was over 41.0 million euros, of which almost half (48%) were due to compensation for loss of income (Potilasvakuutuskeskus).

2.4 Institutional Register Design and Rationale

2.4.1 Data Collection and Management

The process of how and by whom surgical complications should be registered is an unresolved matter. A surgeon reporting his or her own surgical complications might carry a risk for bias and underreporting: Physician participation in adverse event reporting has been suggested to be only 5% to 10% using a formal adverse event reporting system (Cullen et al., 1995). Dindo et al. (2010) reported that surgical residents recorded outcomes poorly and unreliably, and concluded (along with several other studies) that surgical outcomes should be evaluated by dedicated personnel (see also Russell et al., 2003). An example of such a system is the ACS-NSQIP (Khuri et al., 1995; 2008).

Surgical complications are typically registered at discharge or at 30 days postoperatively. In-hospital complications are easy to register at discharge, but to assess 30-day complications, a mobile device, outpatient visit, telephone call, or patient survey should be performed. The simplest way to store data would be using the existing electronic care records instead of, for example, an extra commercial software product (https://bcbmedical.com/). Ideally, the data would be stored in a dedicated locus of the electronic patient record in a numerically coded format that could be directly extracted for subsequent analyses and monthly reports with no extra cost.

2.4.2 Register Contents

When assessing quality in healthcare, at least robust risk adjustment is needed, since socioeconomic factors have a major effect on patient health (Anderson et al., 2012; Wadhera et al., 2020). Regional heterogeneity should also be recognized within

benchmarking purposes: patterns of socioeconomic deprivation, race, and ethnicity vary markedly by region, and individuals in some regions are more likely than those in other regions to experience serious chronic illnesses (e.g., obesity, diabetes, cardiovascular disease, and cancer), higher rates of associated complications, and lower life expectancy (Bae et al., 2020). However, previous studies have demonstrated that only a few preoperative risk variables may be needed for risk adjustment at the hospital level (Anderson et al., 2012; Anderson et al., 2014; Dimick et al., 2010). Reducing the register parameters to a minimum while still covering the case mix would cut down the staff workload and system costs. To further decrease the costs, patient-related risk factors could be collected and measured based only on patients' general status and comorbidities, since diagnostic medical measures have not shown any incremental value for the risk prediction (Tsiouris et al., 2013).

To assess complications, it seems essential that the severity of the complication has been considered. The Clavien–Dindo system was introduced in 2004 and was based on the severity of the complication and the type of therapy required to treat the complication (Dindo et al., 2004). The rationale was to eliminate subjective interpretation of serious adverse events and any tendency to downgrade complications because it is based on data that are usually well documented and easily verified (Clavien et al., 2009). It is now widely used and accepted in many fields of surgery (Mentula et al., 2014).

2.4.3 Use of a Clinical Quality Register (CQR)

Clinical quality registers are established with the purpose of monitoring quality of care, providing feedback, benchmarking performance, describing pattern of treatment, reducing variation, and as a tool for conducting research. Despite the large number of published articles using data derived from CQRs, few have evaluated the impact of the registry as an intervention on improving health outcomes; however, those that have evaluated this impact have mostly found a positive impact on healthcare processes and outcomes (Hoque et al., 2017).

A clinical hospital-wide registry might provide a tool for quality improvement beyond single disease- or intervention-specific registries since it captures all patients across all surgical specialties.

3 Aims

The main aim of this thesis was to evaluate how surgical complications can be measured and reported in a hospital-wide register. The first aim was to study whether such registers are reported in the literature through a systematic review. The second aim was to create, establish, and report a hospital-wide multispecialty complication register, and the third aim was to determine which patient- and surgery-related factors are most associated with surgical complications.

The subsequent aims of this thesis were to evaluate patient education and perceived information and patient perceptions of treatment quality in relation to surgical complications.

Research Questions

The following research questions guided the studies in this thesis:

1. What are the standard definitions and grading systems for surgical complications? Are there prospective or on-line local hospital-wide complication registering systems reported in the literature? Is there consensus on their standard definitions, methodology, and data contents?
2. Can a hospital-wide surgical complication monitoring system produce valid numerical data for monitoring risk-adjusted surgical quality? How many and which patient-related risk factors may be sufficient to account for the case mix?
3. Do patients differ in terms of preoperative expectations and information needs? Do patient education and the level of perceived information have an influence on a patient's recovery from surgery and surgical complications?
4. Does patient-evaluated quality of care have an association with reported postoperative complications? Do patient-related factors have an influence on the patient-evaluated quality of quality of care?

4 Materials and Methods

4.1 Study Settings

This academic thesis is based on four separate studies: Study I, a systematic review; Study II, a descriptive cohort study; Study III, a comparative descriptive study; and Study IV, a correlation cross-sectional study.

4.1.1 Study I

Study I was a systematic review of hospital-wide multispecialty registers, and the PRISMA statement (Liberati et al., 2009) was used as a guideline. Studies describing surgical monitoring systems that aimed to identify and record surgery-related complications within different surgical specialties at single institutions were included. Studies that evaluated registries for a single surgical specialty or indication were excluded. Surgical records of pediatric patients and reports that did not comply with the PICO criteria (Patients = surgical patients in a hospital, Intervention = complication registering, Comparator = new registering system vs. the old, and Outcome = complication frequency) were not included.

4.1.2 Study II

Study II was a descriptive study on building a simple and cost-effective surgical cross-disciplinary complication registering system that would catch in-hospital complications during clinical care in a tertiary referral center related to all general and orthopedic surgery procedures, with the exclusion of ambulatory and pediatric surgery. As a simultaneous cohort study, the complication rate was assessed according to the severity of the complication using a modified Clavien–Dindo classification (Clavien et al., 2009; Dindo et al., 2004;). In addition, a minimal set of preoperative risk factors, according to the literature, was recorded. The register was set up in a tertiary central hospital in Western Finland in January 2016, and the cohort included complications graded on non-ambulatory surgical operations performed in 2016–2018. The contents of the register are shown in Table 2.

Table 2. The Contents of the Surgical Complication Register.

VARIABLE_NAME	FINNISH	DESCRIPTION
ANE_ALCOHOL	Alkohonlinkäyttö	Ei koskaan = 0, Kerran kuussa tai harvemmin = 1, 2–4 kertaa kuussa = 2, 2–3 kertaa viikossa = 3, 4 kertaa viikossa tai useammmin = 4, Tieto puuttuu = -1
ANE_SMOKING	Tupakointi	Ei = Ei (0), Lopettanut vuonna = Lopettanut (1), Kpl/vrk = Tupakoi (2), Tieto puuttuu = -1, Tupakointi vuodet -> ei merkitä
ANE_CHARLSON	Charlson-indeksi	0-30
ANE_BMI	BMI	Tieto puuttuu = -1
ANE_MET	Kliininen suoritus-kyky (MET)	Lepo/vuodepotilas = 1, Liikkuu autettuna = 2, Liikkuu sisätiloissa, omatoiminen = 3, Kevyt fyysinen aktiivisuus = 4, Kohtalainen fyysinen aktiivisuus = 5, Reipas fyysinen aktiivisuus = 6, Tieto puuttuu = -1
ANE_NRS_2002	Vajaaravitsemus-riski (NRS-2002)	0 Ei ravitsemusriskiä= 0, 1–2 Lievä ravitsemusriski = 1, 3–4 Kohtalainen ravitsemusriski = 2, >4 Vakava ravitsemusriski = 3, Tieto puuttuu = -1
ANE_CLAVIEN_DINDO	Clavien–Dindo	Normaali toipuminen = 0, Mikä tahansa poikkeama normaalista toipumisesta = 1, Komplikaatio, joka vaatii lääkehoitoa (poislukien kipulääkkeet, antiemeetit, diureetit, elektrolyytit) = 2, Komplikaatio joka vaatii kirurgisen, endoskooppisen tai radiologisen intervention = 3, Komplikaatio joka vaatii yleisanestesiassa tehtävän kirurgisen, endoskooppisen tai radiologisen intervention = 4, Henkeä uhkaava komplikaatio, joka vaatii tehovalvontaa/tehohoitoa. Aivotapahtuma, muu kuin TIA + elinvaurio (mukaan lukien dialyysi) = 5, Henkeä uhkaava komplikaatio, joka vaatii tehovalvontaa/tehohoitoa. Aivotapahtuma, muu kuin TIA + monielinvaurio = 6, Kuolema = 7, Potilas kärsii komplikaatiosta kotiuttaessa = 8, Muu (esim. Väärin annetut lääkkeet, leikkauksen siirtyminen/peruuntuminen) = 9, Tieto puuttuu = -1

4.1.3 Study III and Study IV

The study population in Studies III and IV was the same: it consisted of adult patients undergoing surgery and surgical ward care at a central hospital in Southwestern Finland between 18 April 2016 and 31 January 2017, with the exclusion of the vacation period (21 June 2016, to 14 August 2016). The central hospital serves a population of 230,000, with approximately 10,000 operations performed yearly. Within the three participating units, approximately 1,600 elective operations were

performed during the study period. Ambulatory and memory disorder patients were excluded from Study III. In Study IV, emergency patients were also included.

Study III was a comparative descriptive study on patient education and information needs and their association with complications. Study IV was a correlation cross-sectional study on patient-evaluated quality of care, combined with a phone call interview at 30 days postoperatively to examine complications.

4.2 Data Collection and Methods

4.2.1 Systematic Review (Study I)

4.2.1.1 Literature Search and Study Selection

Four medical bibliographical databases for published literature were searched systematically: Ovid MEDLINE® In-Process and other non-indexed citations and Ovid MEDLINE® from 1946 to 19 February 2015; EBM Reviews – Cochrane Database of Systematic Reviews between 2005 and January 2015 (OVID); PubMed (only ahead-of-print articles to February 2015); and Web of Science – Core Collection to February 2015 (Core Collection, Indexes = SCI-EXPANDED, SSCI). Searches consisted of three search aspects, each including both Medical Subject Headings (MeSH) terms and text words: search terms related to surgical complications; search terms related to hospital information systems, registries, databases, and records; and search terms related to risk adjustment and risk assessment, quality, safety, and economic aspects (Figure 1).

Records were retrieved through electronic databases. Eligible studies included original data in English on surgical, multidisciplinary (surgical subspecialties), prospective monitoring systems to identify, record, and monitor surgery-related complications using validated outcome measures and well-described system protocols and parameters. The remaining studies were discussed by all three reviewers and retained if they were single-hospital, prospective complication registries covering all surgical specialties.

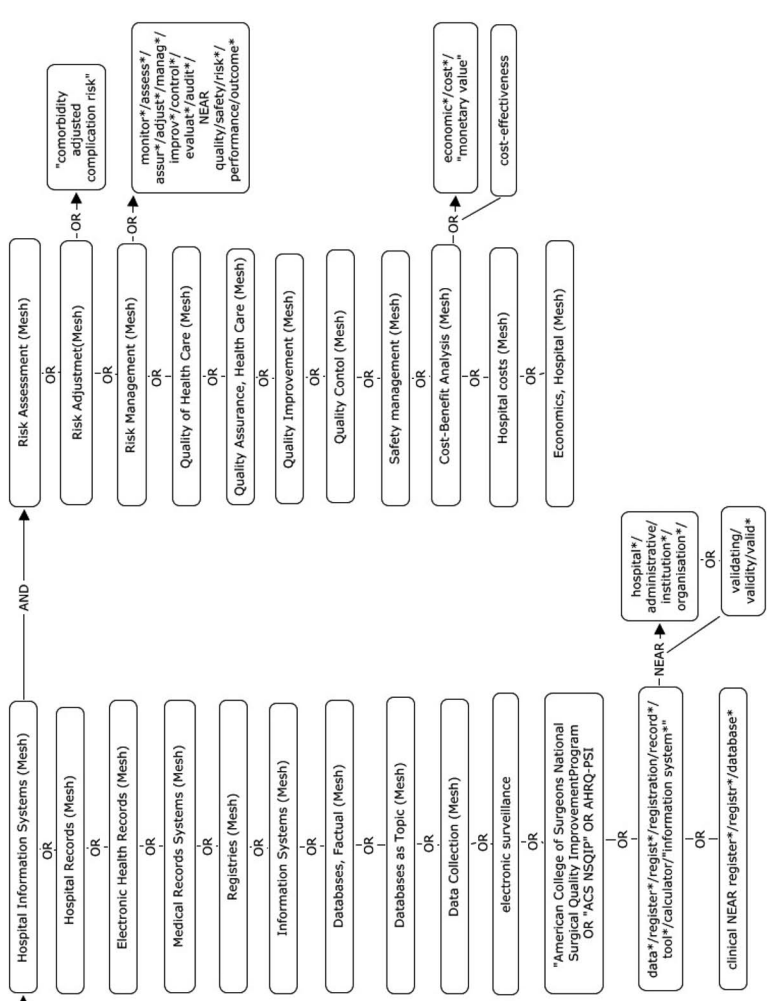

Figure 1. Literature search strategy.

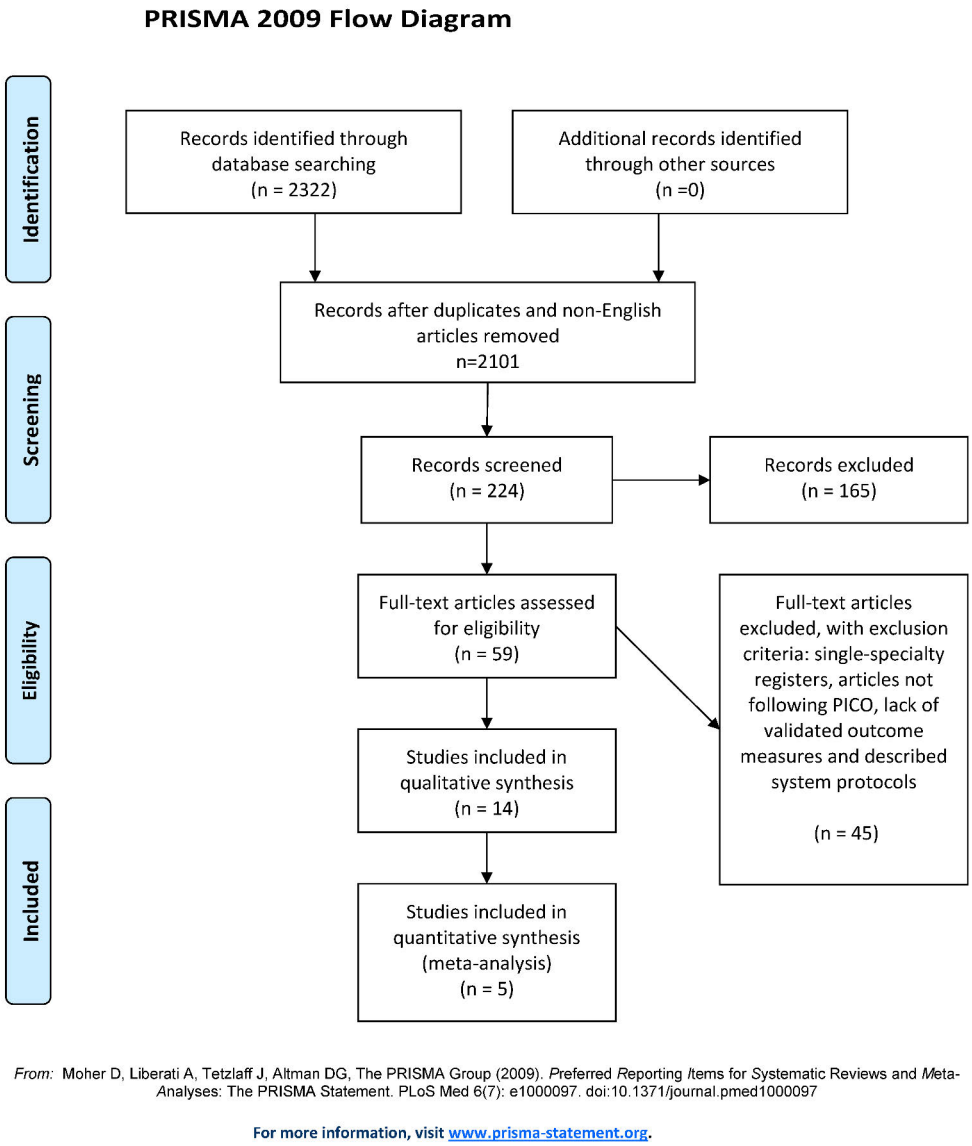

Figure 2. PRISMA Flow Diagram.

4.2.1.2 Data Extraction

The following data were extracted from the registries and categorized: country, hospital type, duration of follow-up, standard definitions, a denominator from which incidence rates were calculated, inclusion of risk factors, number of patients, study design, output, and feedback, coverage, data monitoring, data processing, and findings (Table 7 in Results).

4.2.1.3 Data Synthesis

Based on the heterogeneity of the articles, meta-analysis was not applicable, and the qualitative evidence was synthesized.

4.2.1.4 Risk of Bias Assessment

As all the studies were observational, a recently presented method for assessing the risk of bias was used (Malmivaara, 2015; Malmivaara, 2016). The 10 main methodological issues and descriptions of how to assess whether these issues possess a risk of bias are shown in Table 3.

Table 3. Assessment of Validity of the Surgical Clinical Complication Registry Studies.

	Veltkamp et al, 2002 the Netherlands	**Veen et al, 2005, the Netherlands**	**Bilimoria et al, 2009, USA**	**Daley, Khuri et al, 1995, USA**	**Rebasa et al, 2008, Spain**
1. Power calculated (differences indicated)	N/A	N/A	N/A	N/A	N/A
2. Selection of patients described*	Partially	No	No	Partially	Partially
3. Valid and sufficient documentation of baseline characteristics	Yes	No	No	Yes	No
4. Baseline comparability acceptable	N/A	N/A	N/A	N/A	N/A
5. Sufficient documentation of surgical procedures	Yes	Yes	No	Yes	No
6. Valid and sufficient documentation of outcomes	Yes	Yes	Yes	Yes	Yes
7. Dropout rate acceptable	Yes	No	Not reported	No	No
8. System-related features documented**	Yes	Yes	Partially	Partially	Yes
9. Documentation of staff competence***	No	No	No	No	No
10. Appropriate statistical analyses and risk adjustments	Yes	No (no risk-adjustment)	No (no risk-adjustment)	Yes	No (no risk-adjustment)
Total validity points (0–10)	6	4	2	7	3

*Yes, if described or covers the whole catchment area. **Checklists, quality improvement systems, resources, volume, etc. ***Description of experience, etc. n.a., not applicable; n.r., not reported

4.2.2 Creating a Cross-Disciplinary Surgical Complication Registry (Study II)

4.2.2.1 Register Design and Data Collection

In Study II, the registering system was designed to require as little extra effort as possible, taking advantage of the existing clinical process (no extra staff needed) and the EMR (Lifecare/Tieto, no extra software needed). The staff registered the chosen set of preoperative parameters and, on discharge, the occurrence of eventual complications. Data were stored in a dedicated locus of the electronic patient record in a numerically coded format that was extracted for subsequent analysis (Figure 3). The data output included the patient's personal data encryption and, since being incorporated in the EMR, normal staff authorization and access control.

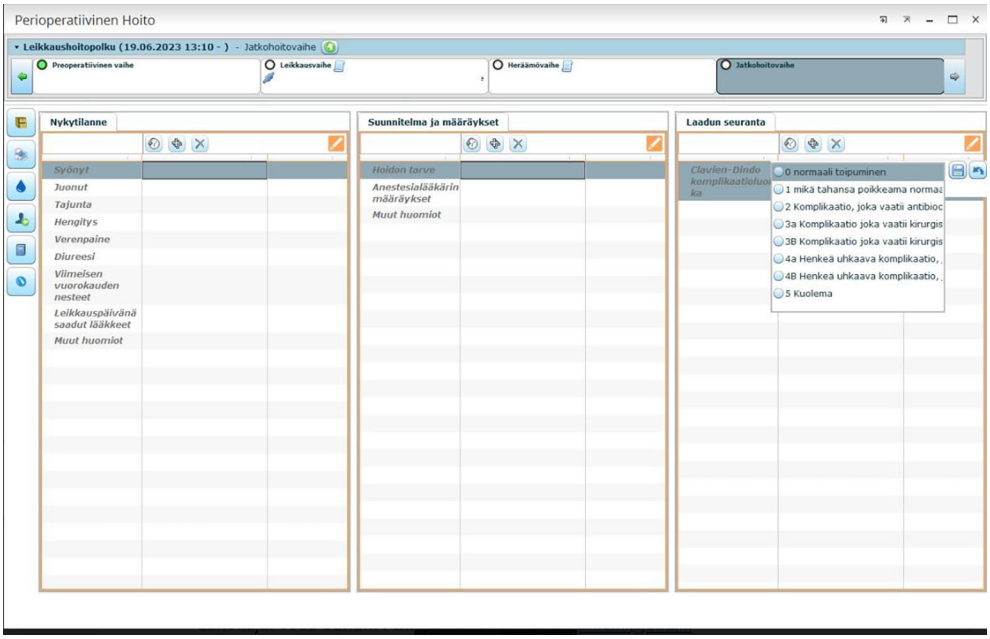

Figure 3. Screenshot of the Registering Site in the Electronic Medical Record (EMR).

To record complications by the severity grade expressed numerically, a modified Clavien–Dindo classification was chosen (Clavien et al., 2009). Technical and process failures were included in the system, as shown in Table 4.

Table 4. Modified Clavien–Dindo Classification for Postoperative Complications.

Grade	Postoperative recovery and complications according to Clavien–Dindo classification
Grade 0	Normal postoperative recovery with no complications.
Grade 1	Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions. (Allowed therapeutic regimens: drugs as antiemetics, antipyretics, analgesics, diuretics and electrolytes and physiotherapy; also includes wound infections opened at the bedside.)
Grade 2	Requiring pharmacological treatment with drugs other than such allowed for grade I complications. (Blood transfusions and total parenteral nutrition included.)
Grade 3	Requiring surgical, endoscopic, or radiological intervention not under general anesthesia
Grade 4	Intervention under general anesthesia
Grade 5	Life-threatening complication (including CNS complications) * requiring IC/ICU-management, *single* organ dysfunction (including dialysis)
Grade 6	Life-threatening complication (including CNS complications) * requiring IC/ICU-management, *multiorgan* dysfunction *(MOF)*
Grade 7	Death of a patient
Grade 8	Complication at discharge, category cannot be defined (i.e., recurrent nerve paralysis after thyroid surgery)
Grade 9	Other (i.e., wrong medication, postponement/ cancellation of surgery)

4.2.2.2 Patient- and Procedure-related Risk Factors

A wide literature search was done as described in Study I to determine the relevant patient-related risk factors containing only bedside data. According to the literature, exclusion of laboratory datasets maintains predictive accuracy (Anderson 2014; Dimick et al., 2010; Tsiouris et al., 2013). Objective demographic variables included age and sex. Body mass index (BMI), alcohol intake, and smoking were included since they reflect lifestyle factors that could be monitored and influenced by patient information and advice. BMI was graded in three categories (>18.49 = low, 18.5–31.99 = normal and >32 = overweight). Smoking was recorded as non-smoker = 0, ex-smoker = 1, and current smoker = 2. Alcohol intake was recorded as never = 0, less than once a month = 1, 2–4 times a month = 2, 2–3 times a week = 3, and >4 times a week = 4.

Two composite measures were included to include major comorbidities or symptoms: the ASA class and the Charlson Comorbidity Index (Charlson 1987) as a measure of general health status (Table 5). ASA was graded as 1–5 (the lower number, the healthier the patient), and the Charlson Index was graded in three categories (0, 1–3, and >4).

Table 5. Charlson Comorbidity Index Score.

Comorbidity	Score
Metastatic solid tumor	6
Acquired immune-dificiency-syndrome (AIDS)	6
Moderate or severe liver disease	3
Cerebrovascular (hemiplegia) event	2
Moderate-to-severe renal disease	2
Diabetes with chronic complications	2
Cancer without metastases	2
Leukemia	2
Lymfoma	2
Peripheral vascular disease	1
Dementia	1
Chronic pulmonary disease	1
Peptic ulcer disease	1
Mild liver disease	1
Diabetes	1
Rheumatologic disease	1

Nutritional and functional status are additional general health measures that correlate with surgical risk. Modified Nutritional Risk Screening (NRS) 2002 (Kondrup et al., 2002) and the modified Metabolic Equivalent of Task (MET) index (Ainsworth et al., 1993) were chosen to assess these two measures, respectively (Table 6). Nutritional status was graded as NRS 2002 index 0–3 (Appendix).

Table 6. Modified MET Index.

Totally dependent	1 MET	Needs help with eating, using the toilet, dressing up.
Partly dependent	2 MET	Can partly take care of oneself (eat, dress, or use the toilet).
Moderate	3 MET	Can walk indoors and do light work around the house (dusting, dish washing).
Good	4 MET	Can do heavy work around the house like scrubbing floors. Can climb a flight of stairs, walk up the hill, or run a short distance. Can participate in moderate recreational activities like golf, bowling, and dancing.
Excellent	5 MET	Can participate in strenuous sports like swimming, singles tennis, football, basketball or skiing.

Procedure-related risk factors, such as the urgency of surgery (elective/emergency) and subspecialty, were categorized. The surgical wound classification system is routinely recorded to represent the bacterial load in the surgical wound and thus the postoperative risk of a surgical site infection (Herman & Bordoni, 2023), but it was chosen not to be used for this study.

4.2.3 Patient Education and Complications (Study III)

4.2.3.1 Questionnaires

Two questionnaires were used for the data collection: the Knowledge Expectations of Hospital Patients (KEHP) at hospital admission, and the Received Knowledge of Hospital Patients (RKHP) at hospital discharge (Appendix). The KEHP and RKHP are based on the concept of empowering patients through education, and the original versions have been validated in multiple studies (Leino-Kilpi et al., 2005; Rankinen et al., 2007).

4.2.3.2 Data Collection

The KEHP-questionnaire was administered to non-ambulatory adult patients with no memory disorder scheduled for elective surgery. The questionnaire was sent to the patients by the preoperational interviewer nurse, accompanied by a hospital invitation letter. The patients who were willing to participate in the study returned the questionnaire anonymously at the time of hospital admittance. The RKPH questionnaire was administered to the patients at the hospital ward on the day of discharge, and it was returned anonymously in sealed envelopes. Both questionnaires were completed by 258 patients: there were 116 patients not returning the RKPH and 158 patients with incompletely filled questionnaires. Additional data, including the Charlson comorbidity index (Charlson et al., 1987; 1994), diagnosis, and procedure, were collected from the electronic patient records after the surgical procedure.

The original study patients were interviewed by a nurse four weeks after the operation by a telephone call. The patients were asked to report any post-discharge problems, and to describe or categorize the complications as wound complications (redness, swelling, rupture, secretion, infection), excessive pain, fever, permanent disadvantage, or other problems. Of the original 258 patients, 223 participated in telephone interviews.

4.2.4 Perceived Quality of Care and Complications (Study IV)

4.2.4.1 Questionnaire and Measurements

A structured instrument, the Good Nursing Care Scale for Patients (GNCS-P), was used to study the perceived quality of care. The GNCS has been tested and evaluated in multiple studies (Rehnström et al., 2003). The GNCS-P consists of 7 content categories and 39 items measuring quality of care, as described in Study IV (see Hyvä Hoito – mittari in the Appendix). The GNCS-P questionnaire also includes 10 questions on education, living, and working status, number of visits to the hospital, and commitment to treatment. Additional data, including demographic factors, factors affecting overall health, and diagnosis and procedure codes, were collected from the electronic patient records after the surgical procedure.

4.2.4.2 Data Collection

The GNCS-P was administered to 436 adult consenting eligible patients admitted for elective or emergency surgery on the general and orthopedic surgery wards. The participating patients returned the questionnaires anonymously at the time of hospital discharge. There were 378 patients who had completed at least half of the questions for each sum variable, thus creating the study sample. A research assistant interviewed the patients by phone 30 days after the operation. The patients were asked to report any post-discharge problems and to describe or categorize the complications as wound complications (redness, swelling, rupture, secretion, infection), excessive pain, fever, permanent disadvantage, or other problems. Of the 378 patients, 323 answered the follow-up telephone call (85%).

4.3 Statistical Analysis

4.3.1 Studies I and II

In Study I, meta-analysis was not applicable based on the heterogeneity of the articles, and the evidence was synthesized qualitatively. In Study II, all surgical operations with data on complication severity (modified Clavien–Dindo index) from Satakunta Central Hospital between 1 January 2016 and 31 December 2018 were analyzed. Complications were classified into two classes: minor (Clavien 1–3) and major (Clavien 4–7). ‘No complications’ were marked as zero (0) and other complications as 8–9. Statistical analysis was performed using the crosstabulation

chi square ($\chi 2$) test or Fisher's exact test. The data were expressed as numbers and percentages, and the mean age of each group was presented.

4.3.2 Studies III and IV

In Studies III and IV, the data were analyzed statistically using SAS 9.3 software (SAS Institute Inc., Cary, NC, USA). Descriptive statistics, such as frequencies, percentages, means, and standard deviations, were used to describe the variables. The patients who completed both questionnaires (KEHP and RKHP) were included in Study III. The total sum scales of knowledge expected and received were used to categorize patients into two groups: Group 1 (received less knowledge than expected) and Group 2 (received as much or more knowledge than expected). Complications were reclassified into three categories based on data: wound complications, extra pain, and other complications due to the size of the groups. The $\chi 2$ and t-test were used to analyze differences between Groups 1 and 2.

In Study IV, the perceived quality was classified into two categories: (1) fair quality (sum score 1.0–3.0) and (2) high or very high quality (sum score 3.1–4.0). The $\chi 2$ and t-test were used to analyze univariate associations between characteristics of patients and classified quality categories, and differences in quality of care between those with and without reported complications. If the expected frequencies or counts were too small, Fisher's exact test was used.

Multivariate logistic regression analysis was used to find independent characteristics of patients associated with the received level of knowledge (III) and with quality categories (IV). *p* values less than 0.05 were considered statistically significant.

4.4 Ethical Considerations

There was no patient involvement in Studies I and II. In Studies III and IV, the participants were informed about the scope of the study prior to consenting.

5 Results

5.1 Systematic Review (Study I)

The systematic review was conducted to determine whether there were surgical clinical complication registry studies on existing prospective surgical registries that could be used by single institutions across surgical specialties. Only five such reports were found. The registries were created independently between 1991 and 2005. The risk-of-bias assessment showed at least some deficiencies in the description of patient selection in all five studies, with insufficient documentation of patients' baseline characteristics, surgical procedures, and staff competence in most studies. Valid and sufficient documentation of outcomes and descriptions of system-related features were found in all five studies.

The structural characteristics of the five studies were identified; information on patients, duration of follow-up, definition of outcome, data coverage, monitoring and processing, feedback, and findings according to the study design were gathered (Table 7). The classification and description of complications and the method for data collection varied notably. Patient-related risk factors were collected in two studies, and measured differently based on patient status (age, sex, ASA grade, functional/self-supporting status, BMI, smoking, weight loss, and wound infection), medical tests (such as laboratory variables and electrocardiography results), or co-morbidities (either separately or with an index). Operation-related factors referred to the classification of operation complexity and whether the operation was performed as planned (elective) or an emergency. Four of the five studies measured the coverage of data collection and outcome reporting, with missing data ranging from 5% to 49.7%.

Table 7. Structural Characteristics of the Clinical Surgical Complication Registry Studies.

	Veltkamp et al. (2002)	**Veen et al. (2005)**	**Bilimoria et al. (2009)**	**Daley et al. (1995)**	**Rebasa et al. (2008)**
Country	Netherlands	Netherlands	USA	USA	Spain
Study period	1 year (1996–1997)	>15 years (1986–2001)	2 years (2005–2007)	> 2 years (10/1991–12/1993)	1.5 years (during 2005–2006)
Patients and surgical indications	All surgical ward patients (also non-operative, n=3075)	Patients admitted to surgical department for operation (n=24201 + 31161) *	All surgical (also non-operative patients, n=15524)	Non-cardiac operations (n=83958)	Patients admitted to surgical department for operation (n=3807)
Duration of follow-up	30 days after discharge	Care on ward after surgery	Surgery and care on ward	30 days after surgery	30 days after discharge
Definition of outcome	Complications according to severity (Clavien–Dindo classification)	Complications according to ASN	All complications (categorized)	21 postoperative adverse events and mortality	Adverse events (Harvard Medical Practice Study Group classification†)
Inclusion of operative and patient risk factors	Yes (emergency, minor/major surgery, ASA grade, age, sex, co-morbidities, BMI)	No	No	Yes (17 preoperative risk variables: ASA, serum albumin; urgency and duration for surgery)	No
Study design	Data collection of risk factors + complications for a risk model	Study of definition and registration methods (real-time register)	New system for reporting adverse events	Prospective study with collection of data in 44 medical centers	Prospective surveillance of adverse events and errors in surgery department
Coverage	1 hospital surgical ward	1 hospital surgical department	1 hospital surgical unit	44 hospitals	1 hospital
Data monitoring	Responsible medical team	Physician who noticed the complication	Medical team	Surgical assessment nurse	Any staff member

*This study was conducted in two phases: before and after the system was computerized. †Adverse event, unexpected consequence or lesion caused to the patient as a result of treatment rather than underlying illness; preventable adverse event, adverse event or event attributable to error; error of assistance, error produced by mistakes in the planning or execution of diagnosis and treatment. ASN, Association of Surgeons of the Netherlands.

5.2 Created Complication Register (Study II)

The results from Study I concerning patient- and surgery-related risk factors (Table 8) were used as a reference when creating the surgical complication register. In addition, such matters as data collection and feedback methods were discussed based on Study I when creating the register. The registering of complications was started in January 2016, and the staff training, and data set up was conducted in 2015.

Table 8. Documented Patient Characteristics in Previous Studies Describing Preoperative Risk Factors for Surgical Complications.

Reference	ASA	Age	Sex	BMI	Alcohol	Smoking	Nutritional status	Functional Status	Symptoms/ morbidities/ medical signs	Type of surgery	Category of surgery
Khuri et al., 1997	Increasing	Increasing	NR	NR	NR	NR	Recent weight loss	Independent/ dependent	Albumin, cancer, ascites, BUN, platelets	Emergency	Complexity score*, subspecialty
Daley et al., 1997	Increasing	Increasing	NR	NR	NR	NR	NR	Independent/ dependent	Albumin, hematocrit, WBC, COPD, TIA, AFOS, platelets	Emergency	Complexity score*, subspecialty
Anderson et al., 2014	Increasing ASA	Increasing age	NR	NR	NR	NR	NR	ACS-NSQUIP grading	Albumin, hematocrit, INR, BUN, ALP, AST	Emergency	NR
Veltkamp et al., 2002	ASA 2-5	Over 40y	male	>27.3	NR	yes	>10 kg weight loss during 3mo	Independent/ dependent	Cardiac/pulmonary disease, HT, DM, renal failure, Immunological disorder	Urgent/ emergency	Central part of body surgery/major
Dimick et al., 2010	Increasing ASA	NR	NR	yes	NR	NR	Recent weight loss	Independent/ dependent	Diabetes, HT, dyspnea, albumin, CHF, dialysis	Emergency	NR
Donati et al., 2004	Increasing ASA	Increasing age	Male	NR	NR	NR	NR	NR	Anemia, NYHA 3-4, HT, diabetes	Emergency/ urgent	Increasing severity (major)
Wolters et al., 1997	Increasing ASA	No difference	No	NR	NR	history of smoking	NR	Independent/ dependent	Sepsis	Emergency	Severity of operation
Kable et al., 2008	Nr	>70y, frailty	No	NR	NR	NR	NR	NR	Anemia, asthma, cancer, osteoporosis, AP, warfarin, low albumin	NR	NR

Reference	ASA	Age	Sex	BMI	Alcohol	Smoking	Nutritional status	Functional Status	Symptoms/ morbidities/ medical signs	Type of surgery	Category of surgery
Robinson et al., 2013	NR	(all >65y)	No	NR	NR	NR	NR	1 or more falls in 6 mo. (frailty)	Charlson > 3, anemia, hypo-albuminemia	NR	NR
Turrentine et al., 2006	Increasing ASA	Increasing age	Male	Yes	NR	Current smoker	Recent weight loss	ADL impairment	HT, sepsis, steroids, DM, varices, CHF, ascites, bleeding disorder	Emergency	RVU, physician work relative unit
Glasgow et al., 2014	ASA 2-4	After41y, Increasing age	No	<18.5 and >35	NR	Current smoker	NR	Partially/ totally dependent	HT, COPD, steroids, cancer, vascular disease, CHF	NR	RVU

*Complexity score of each index operation ranked by subspecialist groups. ACS-NSQUIP, American College of Surgeons National Surgical Quality Improvement Program; ADLs, activities of daily living; ALP, alkaline phosphatase; ASA, American Society of Anesthesiologists Physical Status Classification System; AST, aspartate aminotransferase; BMI, body mass index; BUN, blood urea nitrogen; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; DM, diabetes mellitus; HT, hypertension; INR, international normalized ratio (blood clotting); NR, not reported; NYHA, New York Heart Association (functional classification of heart failure); RVU, relative value unit by Medicare; TIA, transient ischemic attack; WBC, white blood cell count.

5.2.1 Data Collection and Complication Rates

From 1 January 2016 to 31 December 2018, 19,158 operations were performed. Data on complications (Clavien-Dindo 0–9) were recorded for 4529 surgical patients (23.6%), and 779 complications were reported (Clavien-Dindo 1–9). The overall complication rate was 17.2% (95%CI 16.1–18.3), which is well in line with the literature reporting a range of 5.8% to even 43.5% (Gawande et al., 1999; Tevis et al., 2000; Wanzel et al., 2000).

5.2.2 Complications and Type of Surgery

Most patients (82.8%, 95%CI 81.7–83.9) were classified as Clavien-Dindo 0 (no complications). There were 565 (12.5%, 95%CI 11.8-13.2) minor complications (Clavien-Dindo 1–3), 207 (4.6%, 95%CI 4.0–5.2) major complications (Clavien-Dindo 4–7), and 7 (0.2%, 95%CI 0.06–0.3) other complications (Clavien-Dindo 8–9) (Table 9). The results are consistent with the literature (Gawande et al., 1999; Kennedy et al., 2013; Tevis et al., 2000). The data collection and complication frequency varied between hospital wards and subspecialties (Table 9).

Table 9. Numbers of Patients with Documented Clavien-Dindo Classification and Incidence of Complications Based on Clavien-Dindo Classification Among Surgical Subspecialties in the Satakunta Central Hospital During Years 2016–2018.

	n total	n registered	Percentage (%) of registered	No complication (0)		Minor (1–3)		Major (4–7)		Other	
Subspecialty				n	%	n	%	n	%	n	%
Gastrointestinal surgery	5291	1376	26	1101	80	158	11.5	116	8.4	1	0.1
Orthopedic surgery	5017	1064	21	926	87	119	11	16	1.5	3	0.3
Urology	3383	819	24	677	83	117	14	24	3	1	0.1
General and Plastic surgery	2189	393	18	315	80	59	15	18	5	1	0.3
Traumatology	1489	276	18.5	227	82	41	15	8	3	0	0
Vascular surgery	836	311	37	275	89	33	11	2	0.6	1	0.3
Endocrinological surgery	435	143	33	129	90	10	7	4	3	0	0
Thorax surgery	7	3	43	2	67	1	33	0	0	0	0
Other	511	144	28	98	68	27	19	19	13	0	0
All	19158	4259	23.6	3750	82.8	565	12.5	207	4.6	7	0.2

5.2.3 Preoperative Risk Factors and Complications

The frequency of complications is presented in Table 10. There was statistical significance between complications and most risk factors due to the large group of patients. ASA (p <0.001), Charlson Index (p <0.001), and nutritional status (modified NRS 2002, p = 0.041) indicated strongest association with complication trends. As an operation-related factor, the urgency of surgery was associated with

subsequent occurrence of complications (p <0.001). Smoking status, age, alcohol consumption and functional status (MET index) did not show an association with complication occurrence.

Table 10. Patient- and Surgery related Risk Factors in Relation to Surgical Complications Based on Clavien-Dindo Classification in Satasairaala During Years 2016–2018.

	No complications (0)		Minor complication (1–3)		Major complication (4–7)		Other (8–9)		*p*
ASA n = 4490	n	%	n	%	n	%	n	%	
0	422	89	40	8	12	2.5	0	0	<0.001
1	1605	86	209	11	59	3	0	0	
2	1563	80	277	14	104	5	0	0	
3	128	70	33	18	21	11.5	0	0	
4	3	30	0	0	7	70	0	0	
MET n = 3765									
1	64	82	9	11.5	5	6	0	0	0.033
2	146	80	23	13	14	8	0	0	
3	214	79	44	16	10	4	2	0.7	
4	1847	83	287	13	100	4.5	3	0.1	
5	856	87	87	9	38	4	1	0.1	
Charlson n = 3367	*1.37 (mean)*		*1.71 (mean)*		*1.97 (mean)*		*2.17 (mean)*		<0.001
0	1083	88	112	9	39	3	1	0.1	
1-3	1503	82	240	13	81	4	4	0.2	
>4	236	78	42	14	25	8	1	0.3	
NRS-2002 n = 3337									0.041
0	1963	86	246	11	76	3	3	0.1	
1	749	83	110	12	45	5	2	0.2	
2	101	81	17	14	7	6	0	0	
3	14	78	4	22	0	0	0	0	
Sex n = 4529									0.916
Male	1848	82.5	283	13	106	5	3	0,1	
Female	1902	83	282	12	101	4	4	0.2	
Type of Surgery n = 4529									<0.001
Emergency	673	72	136	15	1119	13	1	0.1	
Elective	3077	86	429	12	88	2	6	0.2	
Alcohol intake n = 3864									0.004
0	975	83.5	155	13	38	3	0	0	
1	1195	82	187	13	67	5	3	0.2	
2	822	84	105	11	50	5	3	0.3	
3	174	84	17	8	16	8	0	0	
4	53	93	4	7	0	0	0	0	
Smoking n = 3670									0.001
0	2442	83	374	13	113	4	5	0.2	
1	231	84	37	13	8	3	0	0	
2	297	80.5	38	10	34	9	0	0	
BMI n = 5256	*28.4 (mean)*		*27.9 (mean)*		*30.0 (mean)*		*24.1 (mean)*		0.63
<18.49	208	83	29	12	12	5	1	0.4	
18.5–31.99	3234	83	496	13	175	4.5	5	0.1	
>32	928	85	127	12	40	4	1	0.1	
Age n = 4527	*64.7 (mean)*		*67.6 (mean)*		*65.5 (mean)*		*65.1 (mean)*		0.001

5.2.4 Development and Costs of the System

Nurses in the surgical outpatient clinic were trained in using the perioperative system and encoding the parameters of the patients signed up for elective surgery. Permanent staff, frequent reminders for data collection, and close follow-up resulted in improved recording frequency. The total calculated cost of the system was approximately €1,000 for the initial computer programming followed by approximately €19,000 per year, which constituted the labor costs of data recording.

5.3 Patient Education and Complications (Study III)

5.3.1 Characteristics of the Patients and Factors Associated With Differences in the Level of Acquired Information

There were 258 patients who returned both questionnaires, but not everybody answered all questions (Table 11). In the study population, 131 patients (51%) were male, the mean age was 62 years, and 159 patients (62%) were retired. The Charlson indices were low (0.9–1.1) and indicate that the number and severity of patient comorbidities were low (Table 11). Orthopedic implant procedure was performed on 98 (38%) patients, elective other orthopedic and hand surgery (such as spine, foot, hand surgery) on 96 (37%) patients, and non-cardiac general surgery (Gi-, vascular, thoracic, urology, or plastic surgery on 64 (25%) patients. Vocational education, employment status, subjective state of health, and adherence to treatment were characterized (Table 11).

The 258 patients were divided into two groups: Group 1 (received less information than expected, 102 (40%) patients) and Group 2 (received as much or more, 156 (60%) patients). There was a statistical difference between the two groups in gender and diagnosis/procedure. In Group 2, there were mostly patients with orthopedic implant procedures (47%) compared to the patients undergoing other orthopedic (32%) or general surgery (21%) procedure (p=0.0015). Female patients reported a lack of information more often than males (64 female (41%) and 91 male patients (59%) in Group 2 (p = 0.0028) (Table 11). In multivariate logistic regression analysis gender (male vs. female OR 2.67 95%CI 1.55–4.60, p=0.0004) and procedure (elective orthopedic implant surgery vs. elective minor orthopedic and hand surgery: OR 3.25, 95%CI 1.72–6.17, p = 0.0003) were found to be independent predictors of satisfactory patient education in the study population.

Table 11. Characteristics of Patients in the Study Population (N = 258) and the Differences Between Groups I and 2 in Relation to the Level of Received Information.

Characteristics of Patients			**Group 1: Received less knowledge than expected (n = 102)**			**Group 2: Received as much or more knowledge than expected (n = 156)**			
	n	%	n	M(SD)	%	n	M(SD)	%	*p*
Age	256		101	61 (12.6)		155	63 (12.6)		0.1417
Gender	256								**0.0028**
Male	131	51	40		31	91		69	
Female	125	49	61		49	64		51	
Vocational education	252								0.6587
No vocational education	64	25	22		34	42		66	
Secondary vocational degree	146	58	60		41	86		59	
College-level vocational degree	16	6	8		50	8		50	
Academic degree	26	10	10		38	16		62	
Employment status	251								0.1903
Employed	62	25	30		48	32		52	
Retired	159	63	56		35	103		65	
Working at home, student, unemployed/job applicant, other	30	12	11		37	19		63	
State of health at the moment	251								0.3468
Excellent or good	131	52	47		36	84		64	
Fairly good or poor	120	48	50		42	70		58	
Adherence to treatment	258								0.3271
Excellent	96	38	32		33	64		67	
Good	138	54	59		43	79		57	
Fairly good or poor	21	8	9		43	12		57	
Charlson index	249		97	1.08 (1.33)		152	0.87 (1.24)		0.1983
MET index (physical activity)	253								0.6489
Needs assistance	4	2	2		50	2		50	
Does not need assistance	249	98	98		39	151		61	
Diagnosis	257								**0.0032**
Soft tissue	110	43	48		44	62		56	
Orthopedic (hip or knee)	93	36	25		27	68		73	
Orthopedic (not hip or knee)	54	21	29		54	25		46	
Procedure	258								**0.0015**
Non-cardiac general surgery	64	25	31		48	33		52	
Elective orthopedic implant surgery	98	38	25		26	73		74	
Elective minor orthopedic and hand surgery	96	37	46		48	50		52	

5.3.2 Association Between Lack of Acquired Knowledge and Postoperative Complications

A telephone interview was conducted with 223 patients at 30 days postoperatively. There were 70 complications reported by 59 patients (26%) (Table 7). A healthcare service provider was contacted by 47 patients (81% of reported complications). The most common patient-reported complications (26/70 total complications) were wound problems (wound rupture or redness and swelling at the wound site). Other complications reported were excessive pain (18 patients), and a mixture of gastrointestinal, stress-related, and urinary problems (26 patients). The patients in Group 1 were more likely to report any complication (p = 0.01) and a wound complication (p = 0.03) than the patients in Group 2 (Table 12).

Table 12. Postoperative Complications 30 Days After Hospital Discharge.

Patients who participated in the telephone interview (n = 223)			**Group 1: knowledge received less than expected**		**Group 2: knowledge received as or more than expected**		
	n	%	n	%	n	%	*p*
Total postoperative complications at home							**0.01**
Yes	59	26	31	53	28	47	
No	164	74	55	34	109	66	
Wound complications							**0.03**
Yes	26	12	15	58	11	42	
No	197	88	71	36	126	64	
Pain							0.30
Yes	18	8	9	50	9	50	
No	205	92	77	38	128	62	
Other complications							0.68
Yes	26	12	11	42	15	58	
No	197	88	75	38	122	62	

In Study III, the information provided was also studied from different aspects or dimensions. The lack of bio-physiological aspects of patient education (concerning symptoms, examinations, treatment, complications) was associated with reported complications (Table 13).

Table 13. Surgical 30-day Complications* and Different Dimensions of Received Knowledge.

Dimensions of knowledge	Received less knowledge than expected			Received as much or more knowledge than expected			
		Postoperative Complications after 30 days			Postoperative Complications after 30 days		
	n		%	n		%	*p*
Bio-physiological	80		35	143		22	**0.03**
Functional	56		28	167		26	0.7
Experiential	80		30	143		24	0.4
Ethical	116		28	107		24	0.5
Social	115		31	108		21	0.09
Financial	98		28	125		25	0.5
All dimensions	86		36	137		20	**0.01**

* Total number of patients participating in the telephone interview n = 223. Total number of patients with complications n = 59

5.4 Perceived Quality of Care and Complications (Study IV)

5.4.1 Characteristics of the Patients and Their Association With Patient-Related Factors and Patient-Reported Quality of Care

In the Study IV population, 49% (n = 186) were male. The mean age was 60.4 years (SD 15.1, range 19–88). Most of the patients were scheduled for elective surgery (81%). There were 41% orthopedic and 59% general surgery patients (gi-, vascular, urologic, and plastic surgery). The number and severity of comorbidities were minor: the Charlson indices were low (0–2) in 89% of patients, and only 4% needed assistance in their daily living (Table 14).

The patients who lived alone accounted for 25% of the patients, and they evaluated the overall quality of care rate lower (fair quality, sum score 1.0-3.0, $p = 0.0088$). Those who would have sought treatment elsewhere if it had been possible accounted for 5% of the patients and reported a low quality of care (fair quality, sum score 1.0–3.0, $p = 0.0114$). The patients who evaluated their state of health as moderate or poor accounted for 52% of the patients, and they also evaluated the quality of care lower (fair quality, sum score 1.0-3.0, $p = 0.0047$). After logistic regression analysis, the first two remained statistically significant (living alone $p = 0.0259$, state of health $p = 0.0149$).

Table 14. Patient-Related Factors and Overall Quality of Care Evaluated by Surgical Patients (N = 378).

			Fair quality of care (n = 34)		High or very high quality of care (n = 344)		
	n	%	n	%	n	%	*p*
Gender							0.3262
Male	186	49	14	7.5	172	92.5	
Female	192	51	20	10.4	172	89.6	
Type of accommodation							**0.0088**
Lives alone	92	25	14	15.2	78	84.8	
Lives with another person	281	75	18	6.4	263	93.6	
Admission to hospital							0.1067
Elective	306	81	24	7.8	282	92.2	
Emergency	72	19	10	13.9	62	86.1	
Would have sought treatment elsewhere if it had been possible							**0.0114**
Yes	20	5	5	25.0	15	75	
No	352	95	29	8.2	323	91.8	
State of health compared to normal							**0.0047**
Excellent or good	179	48	8	4.5	171	95.5	
Moderate or poor	196	52	25	12.8	171	87.2	
Charlson index							0.8263
0–2	263	89	21	8.0	242	92.0	
3–	33	11	3	9.1	30	90.9	
Met index (physical activity)							0.2114
Needs assistance	11	4	2	18.2	9	81.8	
Does not need assistance	298	96	23	7.7	275	92.3	0.2706
Procedure							
Orthopedic surgery	155	41	11	10.4	144	92.9	
Other	221	59	23	7.1	198	89.6	

5.4.2 The Relationship Between the Perceived Quality of Care and Postoperative Complications

There were 85 patients with reported postoperative complications out of 323 (26%). The reported complications were mainly related to the wound or excessive pain, and therefore seen as minor. The overall quality of care was evaluated as high or very high by 91% of the patients (mean, 3.58, SD 0.37, range 2.17–4.0). Patients who reported postoperative complications evaluated quality of care lower in all categories (Table 15).

Table 15. Quality of Care Evaluated by Surgical Patients and Patient-Reported Postoperative Complications (n = 323).

Quality categories	Patients with postoperative complications (n = 85) Evaluated quality/ Mean (SD)	Patients without postoperative complications (n = 238) Evaluated quality/ Mean(SD)	*p*
Total quality of care	3.49 (0.42)	3.63 (0.35)	**0.0105**
Staff characteristics	3.70 (0.50)	3.81 (0.33)	**0.0621**
Care-related activities	3.55 (0.53)	3.70 (0.41)	**0.0203**
Preconditions for care	3.57 (0.50)	3.69 (0.39)	**0.0529**
Environment	3.79 (0.30)	3.86 (0.26)	**0.0617**
Progress of nursing process	3.45 (0.52)	3.65 (0.43)	**0.0016**
Support of patients' empowerment strategies	3.43 (0.59)	3.57 (0.48)	**0.0630**
Co-operation with relatives	2.72 (0.94)	2.92 (0.92)	0.1778

Scale of good quality: strongly agree=4, strongly disagree=1. *p* values of significance (<0.1) are marked in bold.

Answers to the Research Questions

1. There are still no standard definitions or grading systems for complications. There are only a few prospective or on-line local hospital-wide complication registering systems reported in the literature. There is no consensus on the standard definitions or methodologies of such registers.
2. A hospital-wide surgical complication monitoring system can produce valid numerical data for monitoring risk-adjusted surgical quality. Only a few patient-related risk factors may be sufficient to account for the case mix: ASA and nutritional status.
3. Patients differ in terms of preoperative expectations and information needs. Patient education and the level of perceived information may have an influence on complications and recovery from surgery.
4. Patient-related psychological factors, such as the subjective state of health and emotional needs, may have an influence on the patient-evaluated quality of quality of care. The patient-evaluated low quality of care in healthcare staff's technical and communication skills may have an association with reported postoperative complications.

6 Discussion

The background of this thesis was to bring meaningful and *local* surgical quality and safety control via surgical complications measuring and reporting into spotlight: first by performing a systematic review on the current situation worldwide, and subsequently by describing the process and contents of a pilot inexpensive hospital-wide surgical complication register. The further aims were to study surgical complications in relation to patient education and informational needs and patient perceptions of quality.

There is a need for surgical outcomes to be followed and made public, but surgical quality measurement remains controversial and expensive (Bae et al., 2020; Bruce et al., 2001; Wadhera et al., 2020; Zhan et al., 2003). There is currently no consensus on how surgical quality should be measured and reported, and what might be the most relevant and meaningful data contents (Bosma et al., 2012; Domenghino et al., 2023). In the era of big data and AI, it is important to seek such comprehension from the chaotic data mass.

Socioeconomic factors have a major effect on patient health, and people of lower socioeconomic status experience comparatively worse health outcomes (Stringhini et al., 2017; Wadhera et al., 2020). Recent articles have stated that hospital rankings should shift to benchmarking or ratings (including risk assessment), increase transparency and reproducibility (better methodology), bring attention to measures that matter to patients, and account for socioeconomic differences in regions (Bae et al., 2020; Berwick et al., 2016). This thesis had the intention of concentrating on those issues by creating a complication registry (Studies I&II) and studying associations between complications and patient-evaluated items related to care (Studies III&IV).

6.1 Cross-Discipline Surgical Complication Registry

It seems reasonable that surgical units should record their results, monitor the frequency of surgical complications, and show transparency. If hospitals cannot track or validate their own performance, they will be unable to identify specific opportunities to improve the care they deliver. This thesis focused on these issues by

creating a hospital-wide surgical complication register (Study II), based on the knowledge on valid parameters and the appropriate way of gathering data and reporting surgical complications acquired from the systematic literature review on the subject (Study I).

The classification and categorization of complications were different in all the included studies in Study I, emphasizing the need for international standards on institutional quality control systems and complication classification. It seems likely that a classification system according to complication severity would be most applicable to a cross-specialty surgical registry; the Clavien–Dindo complication index was chosen for our register (Study II).

Quality assessment in healthcare requires at least robust risk adjustment, since socioeconomic factors have a major effect on patient health (e.g., diabetes, obesity, cardiovascular disease, cancer), and people of lower socioeconomic status experience worse health outcomes and lower life expectancy (Wadhera et al., 2020; Anderson et al., 2012). Study II shows the possibility of a broad and clinically relevant quality measurement at a reasonable cost with a combination of the complication index and a limited set of risk factor variables to take the case mix into account. This type of registering system could be used, as such, while there are better AI solutions in hand, or parallel—as structured data on grading and detecting surgical complications or other outcome data—with more complex big data in the future.

The complication register was designed to be a structured part of the EMR and to comprehensively cover surgical subspecialities intended for equality and equity. Reporting data in specific healthcare fields may have unintended consequences, including distortion of healthcare efforts to fit measurement systems (Shah et al., 2018). This is why a complete recording system would offer greater transparency and equality in comparison to subspecialty registers or recording and studying only index operations.

6.2 Experience with the Surgical Complication Registry

The complication registry created for this thesis (Study II) showed feasibility in being a simple real-time surgical complication monitoring system that produces relevant data using the existing patient record system and staff commitment. The data stored includes the patient's personal data encryption and, since being incorporated into the EMR, normal required staff authorization and access control. The data extracted are standardized, numerical, and quantifiable, and can be directly analyzed by statistical means. The system leans on the existing EMR and routine clinical processes, making the training of the staff and setting up of the system easier.

There were automatically formed monthly reports, which required no staff and therefore generated no extra costs. As a comparison, the ACS National Surgical Quality Improvement Program (ACS-NSQUIP) is a broadly used functional complication registering system with an annual fee of between $10,000 and $29,000 for sites participating in. This fee covers program management and administration, on-site audits, and ongoing technical support but does not cover the labor wealth of data collected in ACS-NSQUIP. The commercial registries for single disciplines (e.g., BCB Medical) offer nice features for complication registering, but cost €10,000–11,000 per year per discipline for only the software. The labor costs accompanying the above two registries are anticipated to be much higher due to the multitude of parameters.

The results in Study II suggest that in addition to emergency and nutritional status, recording the ASA grade may be sufficient for robust risk adjustment in surgical performance monitoring. The ASA Physical Status Classification System is based on factors that reflect a patient's overall health status. It has been widely used for over 60 years and has become a routine assessment of a patient's paranesthesia comorbidities. Novel ML algorithms have been created to predict postoperative outcomes, including morbidity, readmission, and mortality. However, the result of this thesis indicates that the professional clinical assessment of the patient's ASA class is valuable for case mix and can be used before access to more elegant AI solutions. Further, reducing the register parameters will cut down the staff workload and system costs, which is essential when resources are scarce.

Prospective clinical data collection can provide a tool for quality improvement efforts within clinics with continuous feedback. However, there are difficulties with the effective use of data of quality improvement projects, such as engaging clinicians and collecting data efficiently, due to fear of reprisal, and confusion on which events should be reported (Rubin et al., 2019); and feeding back results constantly—a time lag of one year to receive data hindered quality improvement, whereas monthly feedback provided invaluable positive reinforcement (Wagstaff et al., 2022). According to the literature, the implementation of a register is likely to succeed when used as a tool in hospital organizational programs and is led by a multidisciplinary team (Aveling et al., 2013; Conley et al., 2011). The complication register described in Study II serves as a pilot study and has not yet fulfilled its potential. Due to changes in organization, leadership, and clinical care, the feedback was insufficient in our register and may have contributed to the low frequency of data collection. The process of how and by whom surgical complications should be registered is an unresolved matter. In Study I, data were found to be collected by all staff, medical teams, or dedicated monitoring staff. Most of the studies on institutional registers in the literature have reported poor data coverage (Study I), which is also a limitation of the register created for the registry in this project (Study II).

An essential prerequisite for any register is the high coverage and validity of data. The higher the coverage of data, the higher the generalizability, since the risk of skewed patient selection decreases. A fundamental issue is the validity of input data: incorrect or missing data reduces the credibility and internal validity of the register (Venermo et al., 2017). Validation should be done regularly, for example, with re-extraction of data from EMR, done by independent reviewers (Axman et al., 2021). Automated or structured processes would undoubtedly solve the problem of unreliable data collection and produce valid data; that is, the coverage should be near 100%.

6.3 Patient Experience and Patient Education in Relation to Individual Needs and Surgical Complications in Surgical Patients

The technical skill of a surgeon accounts for a great part of surgical complications (Birkmeyer et al., 2013), but there are surgical complications that have been studied operation-related, resulting in fact from problems in ward management and discharge processes rather than intraoperative care (O'Logbon et al., 2020). In a UK study, less than 20% of preventable adverse events were directly related to surgical operations or invasive procedures; 53% of preventable adverse events occurred in general ward care and 18% in care at the time of discharge (Neale et al., 2001).

There are many steps along the clinical course of care in which surgical quality can be studied from different aspects. For this thesis, factors contributing to surgical complications concerning individual patient needs, patient education, and patient experience of the quality of care were chosen. These aspects reflect the ward staff's professionality, interaction, and non-technical skills, also studied as human factors (Mathavara & Ramachandran, 2022). Healthcare staff's non-technical skills, such as situational awareness, team management, and communication skills, may play an even bigger role in the future with more technology, multimorbid patients, and complex healthcare settings (Johnson et al., 2019; O'Logbon et al., 2020; Uramatsu et al., 2017).

When the patient is discharged from the hospital, the level of the patient's awareness, knowledge, and emotions about the recovery should be individually considered in relation to patient education and empowerment. Patient characteristics, such as gender, age, educational status, immigrant/non-immigrant status, and health literacy rate, affect the informational needs of the patient (Hälleberg et al., 2018; Krupic et al., 2016; Wright et al., 2017). Women are found to have more expectations of education and knowledge regarding an upcoming surgical procedure (Rankinen et al., 2007; Mora et al., 2012), and their informational needs are not met as often as those of male patients (Study III).

Successful patient education can reduce pain, anxiety, and hospital stay, and decrease readmissions, reoperations, and patient discharges to post-acute care centers (Johansson et al., 2005; Kleiber et al., 2018; McDonald et al., 2014; Pelt et al., 2018). In Study III, the lack of a received level of knowledge was associated with the occurrence of surgical complications. Successful patient education requires sufficient staff resources, well-organized system processes and a good attitude of the staff (Aiken et al., 2012; Ha et al., 2010). In the literature, the benefits of preoperative education in terms of patient empowerment, self-efficacy, and the need for adjunct occupational therapy have been well documented (Zhang et al., 2012). Well-organized patient education among hip and knee patients was seen in the high level of perceived knowledge compared to expectations in Study III.

The overall quality of surgical care at Satakunta Central Hospital in southwestern Finland was evaluated as high or very high (Study IV). The patients who reported complications at 30 days after discharge evaluated lower overall quality already at discharge in both technical care (care-related activities and progress of the nursing process) as well as communication and interpersonal skills (support of patients' empowerment strategies) (Study IV). Several studies have demonstrated a significant association between patient satisfaction scores and objective measures of technical, professional, or system process quality in surgery (Black et al., 2014; Doyle et al., 2013; Kennedy et al., 2014; O'Hara et al., 2018; Sacks et al., 2015). Patient-reported low quality has been associated with the presence of adverse events and medical errors (Taylor et al., 2008), readmissions within 30 days after discharge (Lobo Prabhu et al., 2018), and methicillin-resistant Staphylococcus aureus infection levels (Raleigh et al., 2009).

Empowering patient education, together with healthcare staff empathy, and non-technical and communication skills, has been associated with a high perception of quality and better treatment outcomes (Levinson et al., 1997; Mercer et al., 2002; Naidu et al., 2009; Rakel et al., 2009). In Study IV, lower estimated quality in 'support of patients' empowerment strategies' was associated with reported surgical complication rates. Shared information and patient participation have been associated with perceived good quality of care, whereas the pain and psychological distress of patients have been associated with lower patient satisfaction (Doyle et al., 2013; Gröndahl et al., 2019; Mumford et al., 1982; Sitzia et al., 1997; Weingart et al., 2011). In Study IV, the lower perceived quality of care evaluated by the patients living alone or evaluating their state of health as poor, may reflect more the patients´ psychological distress, pain, or emotional needs.

Healthcare staff empathy and communication skills have been associated not only with a high perception of quality but also with better treatment outcomes: clinician empathy, as perceived by patients with common cold, predicted subsequent duration and severity of illness and was associated with immune system changes

(Rakel et al., 2009; Sacks et al., 2015). Indeed, with any physical or biological intervention, patient information and empowerment should be seen as specific and individual interventions incorporated into the effectiveness of care (Malmivaara et al., 2022). In addition, they may conduct a placebo (or nocebo) effect, adding to the results (Malmivaara, 2018). Patient feedback reflects a patient's unique experience of healthcare and can offer insights into hospital quality that would be unseen from other perspectives—such as the way a treatment, process, or interaction has made them feel and behave (Chow et al., 2009; Doyle et al., 2013). Patient satisfaction can be seen as an example of the perception of quality of care but may be more influenced by patient expectations (Sitzia et al., 1997; Sofaer et al., 2005). In Study IV, the patients who would have sought treatment elsewhere if it had been possible also evaluated the quality of care as lower, which may reflect expectations or preconceptions.

During the period of Studies III and IV, approximately 1600 elective operations were performed within the three participating units. In Studies III and IV, there were many dropouts in patient questionnaires (participants: 468 eligible patients in Study III [in the first phase] and 436 in Study IV). Specific motivating procedures, telemedicine, and electronic questionnaires might help with data collection.

Patient-reported outcomes are considered important but are, however, aberrant, and incomplete in their nature. Carayon et al. (2019) encouraged healthcare leaders to prioritize the actions, procedures, and policies that deliver the greatest value to direct patient care, which includes eliminating unnecessary clinician burdens and promoting professional well-being. This thesis suggests a shift in the efforts of quality measurement—structured and simple steps when possible, such as the registry described above—and resources toward the more requiring patient-obtained data.

6.3.1 Patient Safety and Safety Culture

Each operation carries a risk of surgical complications, either by the technical procedure itself or by anesthesia. The major preoperative patient safety procedure in surgery is to select the right patients in a timely manner for the right procedures, and not to expose a patient with an unnecessary risk. Clinicians in their normal daily work do assessment of the patients and possible surgery constantly. The first aim, according to Hippocrates, is to do no harm. When the surgical risk exceeds the benefits, it is wiser to withdraw from the operation.

This thesis revealed some specific patient-derived risks for surgical complications that would be important to recognize preoperatively to carry out allocated actions. Those with a higher ASA class are already routinely screened by anesthesiologists, and preoperative planning and consideration of the operation in

general are routinely done already. Those with low nutrition levels would benefit from a special diet preoperatively, and the postponement of the operation should be considered when possible. Measuring the results of individual patient education and level of patient knowledge of the operation and postoperative care and providing support for those with special needs of education and empowerment might give better postoperative results.

There was an initial purpose to study the patients in Studies III and IV for surgical complications, parallel with the questionnaires and data from the new EMR registry. However, this was impossible due to safety procedures (encryption of patients). In the future, it would be interesting to simultaneously study factors that were found to have an association separately in these studies, for example, the patient's ASA class with those living alone (Study IV) and those with special needs for patient education (Study III) in relation to surgical complications and other outcomes.

Surgical care comprises a combination of decision-making, team performance, communication, and technical skills (Sarker & Vincent, 2005; Pannick et al., 2016). Healthcare is noted to have much to learn from aviation safety-related domains: checklists, training, staff resource management, investigation, and reporting of incidents, and organizational culture (Kapur et al., 2015). Some such safety procedures in surgical processes are already in use, for example check lists (Helmiö, 2013; Treadwell et al., 2014). Detecting surgical complications in an institution, as described in this thesis, is a good example of a safety procedure: institutional quality control and improvement will be difficult if the current state of performance is not followed.

Patient education is a good example of a patient safety procedure that can be studied through human factors: it requires professional staff, a good and supportive environment with structured work processes, standards, and feedback, actions to consider the special needs of patients, for example differences in culture, and resources (including staff recourse, patient education materials, and educating the new staff) (Johnson & Aggarwal, 2007; Kim, 2023). Staff knowledge in this area requires good leadership and staff education (Stone, 2008; Frith, 2019).

Safety culture is about good safety attitudes in people, but especially about good leadership and safety management established by organizations (Dankelman & Grimbergen, 2005; IOM, 2000). From the organizational view, 'psychological safety' at healthcare units predicts engagement in quality improvement work and leads to better performing healthcare teams (Nembhart et al., 2006). Along with technological solutions, human-centered efforts should be the core of safety and quality improvement: the interplay between patient safety and staff well-being should be considered (Benishek et al., 2023; Carayon et al., 2019). An article by the US National Patient Safety Foundation in 2009 argued that to truly transform the

safety of healthcare, there is a need to address care integration, restore joy and meaning in work and ensure the safety of the healthcare workforce and promote consumer engagement in healthcare and transparency across the continuum of care (Gandhi et al., 2018; Leape et al., 2009).

6.4 Methodological Considerations

The strengths and limitations of the present study are discussed in the following chapters.

6.4.1 Study Design

A comprehensive systematic methodology was employed throughout Study I to minimize bias and error in the study selection, data extraction, and quality assessment phases. However, the possibility of publication bias cannot be excluded, since many surgical complication registries may be used only for hospital quality management and may not have been reported in the literature.

The strength of the register presented in Study II lies in its fundamental principles: it is integrated with the daily routine, requires little financial investment, encompasses several surgical specialties, and is based on an existing patient records system. It produces numerical data for statistical purposes. Furthermore, the system's first results on complications and risk factors were consistent with the literature and showed that it can work. The validation of the process is not yet completed due to the low coverage rate (23%). This has been the challenge with all complication registers (Dindo et al., 2010). However, the overall complication rate of 17.6% in this report is in line with that of earlier reports (Tevis & Kennedy, 2013), which suggests that the potential selection bias has at least partly been compensated by the large size of the study population.

Although the Clavien–Dindo classification is a standardized system, it can be a little subjective, with an accuracy that ranges from 87% to 93%, according to the literature (Clavien et al., 2009). During the complication registry project in our hospital, some controversial and confusing topics arose among the staff, which were discussed as the process continued. The full potential of this type of register lies in the possibility of obtaining real-time data for a learning healthcare system. An ideal quality improvement registry would combine other quality measures with complications, such as administration data and PROMs.

6.4.2 Participants, Questionnaires, and Data Collection

There are some strengths and limitations related to the data, instruments, and data collection in Studies III and IV. The samples involved one public central hospital in Western Finland, and the inclusion criteria in both studies for patients' physical and mental ability to answer the questionnaires may have caused a selection bias. Studies III and IV were designed to be carried out in a ward setting. In retrospect, day surgery would have offered valuable data, since it is a growing aspect of surgery, and the role of patient education increases among day surgery patients.

The strength of Studies III–IV resides in different disciplines of surgical patients during a long period (8 months), and in the study population, which was demographically and geographically confined. Therefore, the data can be considered representative. The survey instruments in Study III have been validated in several studies, and their internal consistency is good (KEHP Cronbach´s α = 0.84–0.93, RKHP Cronbach's α 0.81–0.97, and total instrument Cronbach´s α 0.97). The quality survey instrument (GNCS-P) used in Study IV has been validated in several studies. It focuses on the quality of nursing and overall care in the unit.

The patient education in Study III was performed traditionally: it is not specifically validated or audited together with any university hospital, and there is no technological device used to make sure the patient has understood what they have learned. This can be considered a limitation, especially in a research setting. Further, in Study III, the drop-out rate was high: both questionnaires (KEHP and RKHP) were completed by only 258 patients, which is considered a limitation. The KEHP questionnaire was sent by the preoperational interviewer nurse, accompanied by a letter of invitation to the hospital, to non-ambulatory adult patients (n=1600). The patients who were willing to participate in the study returned them anonymously at the time of hospital admittance (n = 468). Out of the 468 patients 258 returned the RKHP, which implies that patients need to be motivated to answer patient surveys.

In Study IV, the GNCS-P was completed by 378 in-ward patients. Post-discharge complications were reported by the patients on the phone 30 days postoperatively. Patients' subjective reports of any harm (mainly wound problems, gastrointestinal problems, psychological problems) were accounted for as occurrence of a complication, and subsequently, they were not evaluated or graded by the healthcare staff. The response rate to the follow-up telephone call was quite high (323 out of the 378 patients who had completed the questionnaire, 85%). However, there were 55 patients not answering the telephone call either due to contextual factors (i.e., patients not answering the phone from an unknown number), or the patient's deteriorating health or even death. This would naturally affect the results of the study and is considered a limitation.

6.5 Future Prospects

6.5.1 Hospital-wide Surgical Complications Registering System

The hospital-wide registry described in this thesis represents a traditional study that relies on data that originates from one single source (EMR), being able to catch in-hospital surgical complications across subspecialties. It is argued in this thesis, that the most predictive patient-derived risk factor for any surgical complication is the ASA value. However, a personal risk for certain interventions might be soon calculated by ML and AI groundbreaking predictive solutions: modern technology already offers ML models that, for example, predict the occurrence of hospital-acquired complications, within distinct categories using temporal clinical data, such as genotype, phenotype, laboratory tests, and medication (Warner et al., 2016). The rising volume in data brings new challenges, such as privacy issues and "noisy data," that is, the information that is not valuable or meaningful will make it more difficult to detect and integrate the meaningful data contents in relation to a specific domain. AI does not give meaning or value to data, at least for the time being. It is therefore important to maintain and improve comprehension on which data and knowledge are important and relevant in research. Moreover, modern technology requires major investment. There are many countries in the developing world that still do not use even the simplest electronic medical records. From these perspectives, even in the future, it is important to carry out traditional data-collecting methods together with possible AI solutions.

There are also some practical restraints to technological solutions. As stated earlier, many complications occur after discharge from the hospital. For a long-term quality follow-up, the use of mobile devices can offer a tool to record minor post-discharge complications or patient-reported outcomes, such as quality-of-life studies, among well-functioning patients. There is still, however, a major group of patients who do not use any technical devices. Major post-discharge complications might be caught by data mining, but this process requires extra resources and cooperation among different healthcare providers and authorities.

To measure quality, the reliability of outcome measures would increase by using composite indicators that combine quality signals, such as outcomes from multiple or related procedures, length of stay, and reoperation rate (Merkow et al., 2013). Patient-reported experience and outcome measures (PREMs and PROMs) have emerged as essential parts of composite outcome measures. According to the literature, a future hospital network would consist of the patient, their caregivers, and the hospital devices, combining them to supply the relevant data while considering the whole patient process, from pre-hospital diagnostics and characteristics of the

operation to postoperative course and follow-up (Hannes et al., 2017). Before the future smart hospital network, an ideal *ad hoc* tool for measuring quality in a hospital could be created by combining and cross-linking costs, clinical data from the registry, administrative data (for example, readmissions), patient surveys, and data mining methods, with the ability to expand to reach non-surgical medical fields. Continuous feedback from such a tool in regular sessions would be beneficial for quality improvement in institutions and for investigating the complications to motivate the staff. In the future, it may be commonplace to show tranquility and report the outcomes and effectiveness of treatments in public hospitals in Finland as well.

6.5.2 Future Research

"The definition of quality may be almost anything anyone wishes it to be, although it is, ordinarily, a reflection of values and goals current in the medical care system and in the larger society of which it is a part" (Donabedian 1966).

Surgical techniques, anesthesia interventions, and systems of care have improved over the years, and patients have benefited from the use of less invasive techniques and the increasing availability of complex operations (Pronovost & Freischlag, 2010). This has brought new challenges: the efficacy of treatments, equity, and cost-effectiveness emerge as crucial quality issues in the era of insufficient resources. This also brings new insights to quality research in the surgical field: better-quality care alone is not the answer. The focus must be on better *value* for individuals and populations by ensuring that every individual achieves high personal value and that the right people reach the service at the right time, as well as recalling the overuse and underuse of resources, programs, and interventions (Gray, 2016).

7 Conclusion

Surgical complications can serve as a surgical quality measure, but there is no consensus on how they should be measured and reported. Hospital-wide surgical quality monitoring systems could offer equity and transparency for quality control, but such registers are rarely described. There is also a need for more comprehension of meaningful surgical quality assessments. This thesis focuses on understanding essential points within the ever-expanding quality data and describes an idea for real-time outcome measuring within the surgical field that could be generated and expanded to other medical specialties, with appropriate metrics and indicators. The described complication registering system is cost-efficient, easy to set up, and does not require changes in the clinical processes. With a minimal set of parameters, the system can produce valid online numerical ready-to-use data, allowing continuous monitoring of the hospital's surgical performance.

The surgical care process also encompasses domains that require the non-technical skills of the staff, which can contribute to the incidence of surgical complications and quality of care. In this thesis, patient education and experience on quality were studied as such surgical safety and quality measures. Safety culture is about good safety attitudes in people, especially good leadership and safety management established by organizations (Dankelman & Grimbergen, 2005; IOM, 2000).

There are optimistic predictions of how AI and big data technology will enhance the assessment of real-world effectiveness and complications of surgery. However, considering the prerequisite of having valid data, there has been very little progress from the year 1911, when Ernest Codman presented his motto. Therefore, the main conclusion of this thesis is that hospital-wide registering systems for surgical complications are an urgent need.

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Appendices

Appendix 1.

SATAKUNNAN SAIRAANHOITOPIIRI
-kumppanuudella terveyttä ja toimintakykyä-
Kirurgian vastuuyksikkö

____/____ _____
päiväys

Täytä tämä lomake ja tuo se mukanasi vastaanotolle

Nimi	Henkilötunnus
Puhelinnumero	Lähiomainen
Pituus_____Paino_____	Lähiomaisen puhelinnumero
Onko sinulla erityisruokavalio Ei ☐ Kyllä ☐ _____ mikä? Ruokajuoma: maito piimä vesi Muu: Kahvi maito/kerma musta Tee maito/kerma musta	Oletko allerginen Ei ☐ Kyllä ☐ _____ mille? Oletko saanut lääkkeistä haittavaikutuksia Ei ☐ Kyllä ☐ mitä oireita lääkkeet aiheuttivat?

Onko sinulla tekoniveliä ja/tai sydämentahdistin Ei ☐ Kyllä ☐

Onko sinulla lävistyksiä, tatuointeja tai rakennekynnet Ei ☐ Kyllä ☐ missä?

Käytätkö apuvälineitä Ei ☐ Kyllä ☐ mikä?
(esim. pyörätuoli, happilisälaite, kuulolaite, hammasproteesi, hammassilta)

Oletko raskaana Ei ☐ Kyllä ☐ raskausviikot___

Nykyisin käytössäsi olevat lääkkeet: **Jos mahdollista, ota lääkelista mukaan!**

Lääkkeen nimi	vahvuus ja annos	klo	Lääkkeen nimi	vahvuus ja annos	klo

Onko sinulle suoritettu aikaisemmin leikkauksia ja toimenpiteitä, joissa on käytetty nukutusta tai puudutusta?
Ei ☐ Kyllä ☐ leikkaus/toimenpide, milloin? _____

_____

_____

Onko aikaisempien nukutusten tai puudutusten yhteydessä tai niiden jälkeen ilmennyt ongelmia?
(pahoinvointia, oksentelua, kovaa kipua,muuta)?
Ei ☐ Kyllä ☐ mitä?_____

Käännä ➔

Alkoholin käyttö
0 = en koskaan
1 = kerran kuussa tai harvemmin
2 = 2 - 4 kertaa kuussa
3 = 2 - 3 kertaa viikossa
4 = 4 kertaa viikossa tai useammin

Tupakointi
Ei ☐
Kyllä ☐ kpl/vrk _____
Tupakointivuodet _____
Lopettanut vuonna _____

Arvio ravitsemustilasta
Laihtuminen edeltävän kolme kuukauden aikana Ei ☐ Kyllä ☐

Ruoan määrä edeltävällä viikolla
☐ syönyt normaalin määrä
☐ syönyt yli puolet
☐ syönyt noin puolet tai alle
☐ syönyt erittäin vähän

Mikä seuraavista vaihtoehdoista kuvaa parhaiten tämänhetkistä suorituskykyäsi?
Ympyröi sopivan vaihtoehto.

1. Lepo/vuodepotilas, sänkyyn autettava
2. Nousen istumaan, kävelen tuettuna, käyn autettuna WC:ssä
3. Kevyt työ istuen tai seisten (omatoiminen): kirjoittaminen, päätetyö, autolla ajo, kotityöt itsenäisesti, siivoaminen, puutarhatyöt rauhallinen kävely
4. Kohtalainen/reipas fyysinen aktiivisuus: reipas kävely (6-7km/h), kuntosaliharjoittelu, voimistelu, kevyt pallopeli, tanssi, lumityöt, halonhakkuu
5. Reipas fyysinen aktiivisuus/kestävyysurheilu: aerobinen voimistelu, juoksu, pallopelit

Sairastatko tai oletko sairastanut jotain seuraavista

Sydäninfarkti/sepelvaltimotauti	Ei ☐	Kyllä ☐
Sydämen vajaatoiminta	Ei ☐	Kyllä ☐
Valtimoverisuonten ahtauma/pullistuma	Ei ☐	Kyllä ☐
Krooninen keuhkosairaus (astma, COPD)	Ei ☐	Kyllä ☐
Diabetes (ei elinvaurioita)	Ei ☐	Kyllä ☐
Aivoverisuonisairaus (TIA)	Ei ☐	Kyllä ☐
Muistisairaus	Ei ☐	Kyllä ☐
Maha/pohjukaissuolihaava	Ei ☐	Kyllä ☐
Sidekudossairaus (reuma/LED)	Ei ☐	Kyllä ☐
Rasvamaksa	Ei ☐	Kyllä ☐
Aivohalvaus	Ei ☐	Kyllä ☐
Keskivaikea/vaikea munuaisten vajaatoiminta	Ei ☐	Kyllä ☐
Diabetes (elinvaurioita)	Ei ☐	Kyllä ☐
Syöpäkasvain todettu alle 5 v. sitten	Ei ☐	Kyllä ☐
Leukemia	Ei ☐	Kyllä ☐
Lymfooma	Ei ☐	Kyllä ☐
Maksakirroosi	Ei ☐	Kyllä ☐
Etäpesäkkeinen syöpäkasvain	Ei ☐	Kyllä ☐
AIDS	Ei ☐	Kyllä ☐

_____
allekirjoitus

1.2016

Appendix 2.

NRS 2002 -menetelmä vajaaravitsemuksen riskin seulonnassa[1]

Päiväys _____

POTILAAN PERUSTIEDOT

Potilaan nimi				Henkilötunnus
Pituus (cm)	Nykypaino (kg)	☐ punnitus ☐ ilmoitus	Painoindeksi BMI (kg/m²)	Paino (1–2) 3 kk sitten kg

1 ARVIO RAVITSEMUSTILASTA

BMI	Laihtuminen edeltävän 3 kuukauden aikana	Ruoan määrä edeltävällä viikolla
☐ Yli 20,5 = **0 p.**	☐ Ei ole laihtunut = **0 p.**	☐ Syönyt normaalin määrän = **0 p.**
	☐ 5–10 % = **1 p.**	☐ Syönyt yli puolet = **1 p.**
☐ 18,5–20,5 = **2 p.**	☐ 10–15 % (yli 5 % / 2 kk) = **2 p.**	☐ Syönyt noin puolet tai alle = **2 p.**
☐ Alle 18,5 = **3 p.**	☐ Yli 15 % (yli 5 % / 1 kk) = **3 p.**	☐ Syönyt erittäin vähän = **3 p.**
Merkitse tähän suurin pistemäärä kohdista BMI, laihtuminen tai ruoan määrä (0–3).		

2 SAIRAUDEN VAIKEUSASTE RAVITSEMUSTILANTEEN KANNALTA

	0 pistettä	1 piste	2 pistettä	3 pistettä	Pisteet
Vaikeusaste	**Normaali tilanne**	**Lievä**	**Kohtalainen**	**Vakava**	
		• heikentyneestä yleiskunnosta huolimatta jalkeilla oleva potilas • kroonisesti sairas potilas, jolla akuutti komplikaatio • krooninen haava alle 25 cm², painehaava II aste • dialyysihoito • paikallinen syöpä • lonkkamurtuma, reisiluun murtuma • krooninen keuhkosairaus esim. COPD vakaassa vaiheessa • maksakirroosi vakaassa vaiheessa • pienkirurgia tulossa tai vastikään tehty • Parkinsonin tauti, MS-tauti, motoneuronitauti kuten ALS • muistisairaus	• vuodepotilas • useita vaikeita kroonisia sairauksia, monivamma • osastohoitoa vaativa kroonisen sairauden pahenemisvaihe • äskettäinen tai suunniteltu laaja leikkaus, toistuvat leikkaukset • nielemishäiriö • levinnyt syöpä, hematologinen syöpä • vaikea suoliston tulehdussairaus • äskettäinen aivohalvaus • vaikea tulehdus, vaikea keuhkokuume • palovamma 20–30 % • painehaava III-IV aste, krooninen haava yli 25 cm² • hengitystukihoitoa tarvitseva potilas • vaikea spastisuus ja pakkoliikkeet kuten vaikea Parkinsonin tauti	• tehohoito • hyvin laaja leikkaus, tulossa lähiaikoina tai akuutti postoperatiivinen tila • pään alueen vamma • kantasolusiirto	
				Merkitse tähän tilanteen mukainen suurin pistemäärä (0–3).	

3 JOS IKÄ ON 70 VUOTTA TAI YLI LISÄÄ YKSI PISTE	
SEULONTAPISTEET YHTEENSÄ (laske yhteen pisteet kohdista 1, 2 ja 3).	0

SEULONNAN TULOS JA TOIMENPITEET ERI RISKILUOKISSA

☐ **0 pistettä: Ei vajaaravitsemuksen riskiä**
- Kirjaa seulontatulos.
- Tee uusi seulonta viikon välein tai sovitusti.

☐ **1–2 pistettä: Vähäinen vajaaravitsemuksen riski**
- Kirjaa seulontatulos.
- Motivoi potilasta hyvään ravitsemukseen.
- Tee uusi seulonta viikon välein tai sovitusti.

☐ **3–4 pistettä: Kohtalainen vajaaravitsemuksen riski**
- Kirjaa seulontatulos.
- Tee tarkempi ravitsemustilan arviointi ja ravitsemushoitosuunnitelma sekä tehosta ja seuraa ravitsemushoitoa moniammatillisesti (lääkäri, hoitaja, tarvittaessa ravitsemusterapeutti).
- Tee uusi seulonta viikon välein tai sovitusti.

☐ **5–7 pistettä: Vakava vajaaravitsemuksen riski**
- Kirjaa seulontatulos.
- Tee tarkempi ravitsemustilan arviointi ja ravitsemushoitosuunnitelma sekä tehosta ja seuraa ravitsemushoitoa moniammatillisesti (lääkäri, hoitaja, aina ravitsemusterapeutti).
- Tee uusi seulonta viikon välein tai sovitusti.

1 Jens Kondrup on hyväksynyt 25.2.2010 Tampereen yliopistollisen sairaalan alkuperäisestä NRS-2002 -lomakkeesta muokkaaman version käytettäväksi NRS-2002 -menetelmänä. Kela ja THL. Kansallinen koodistopalvelu (https://koodistopalvelu.kanta.fi/codeserver/pages/classification-view-page.xhtml?classificationKey=2483&versionKey=2763).

Appendix 3.

Turun yliopisto, Hoitotieteen laitos
Turun yliopistollinen keskussairaala
Potilasohjauksen tuloksellisuuden arviointi

Ensimmäiseksi pyydämme Teitä vastaamaan joihinkin **itseänne koskeviin tietoihin.**
Valitkaa rastittamalla Teille parhaiten soveltuva vaihtoehto tai kirjoittakaa vastauksenne sille varattuun tilaan.

1. **Ikänne** _____ vuotta

2. **Sukupuolenn**e _____ nainen _____mies

3. **Peruskoulutuksenne**
   kansakoulu (tai vähemmän) _____
   keski- tai peruskoulu _____
   ylioppilas _____

4. **Ammattikoulutuksenne**
   ei ammattikoulusta _____
   kouluasteen ammattitutkinto _____
   opistoasteen ammattitutkinto _____
   korkeakoulututkinto _____

5. Mikä seuraavista kuvaa parhaiten **pääasiallista toimintaanne**?
   Työssä _____
   Eläkkeellä _____
   Kotityössä _____
   Opiskelija _____
   Työtön/työnhakija _____
   Muu, mikä? _____

6. Oletteko koskaan työskennellyt **sosiaali- tai terveydenhuollossa**?
   Kyllä _____, missä tehtävässä _____
   En _____

7. Sairastatteko jotakin **pitkäaikaista sairautta**?
   Kyllä _____, mitä _____
   En _____

8. Mikä on **tämänkertaisen sairaalassaolonne/polikliinisen käyntinne syy**?
   Tutkimus _____
   Kirurginen toimenpide _____
   Hoito vuodeosastolla _____
   Polikliininen seurantakäynti _____
   Polikliininen hoitokäynti _____
   Muu, mikä? _____

9. **Millä tavalla** tällä kertaa tulitte sairaalaan?
   Suunnitellusti etukäteen _____
   Päivystyspotilaana _____

10. Oletteko ollut **aikaisemmin tässä sairaalassa** hoidettavana/tutkimuksissa/vastaanotolla?
Kyllä ____, montako kertaa _____
En ____

SAIRAALAPOTILAAN TIEDON TARVE –MITTARI (SPTT)

Seuraavassa Teille esitetään kysymyksiä koskien **omaa tiedon tarvettanne tullessanne tällä kertaa sairaalaan hoitoon tai tutkimuksiin.** Vastatkaa jokaiseen kysymykseen ympyröimällä omaa näkemystänne parhaiten vastaava vaihtoehto. Kysymyksiin ei ole olemassa oikeita tai vääriä vastauksia vaan tavoitteena on kartoittaa tilannetta **juuri Teidän kohdallanne**.

	Täysin samaa mieltä	Jokseenkin samaa mieltä	Jokseenkin eri mieltä	Täysin eri mieltä	Ei koske minua
	1	2	3	4	0
Tarvitsen tietoa					
1. Sairauteeni liittyvistä oireista	1	2	3	4	0
2. Milloin minun on syytä ottaa yhteyttä hoitopaikkaan oireiden pahentuessa	1	2	3	4	0
3. Minulle tehtävistä tutkimuksista	1	2	3	4	0
4. Miten minun pitäisi valmistautua tutkimuksiin	1	2	3	4	0
5. Miten saan tietoa tutkimuksen tuloksista	1	2	3	4	0
6. Erilaisista hoito-vaihtoehdoista	1	2	3	4	0
7. Hoitooni liittyvistä mahdollisista kompli-kaatioista	1	2	3	4	0
8. Miten voisin itse estää komplikaatioita	1	2	3	4	0
9. Miten voin toimia yksilöllisesti henkilö-kohtaisten tarpeitteni hoitamiseksi sairaalassa/ poliklinikalla	1	2	3	4	0

	Täysin samaa mieltä	Jokseenkin samaa mieltä	Jokseenkin eri mieltä	Täysin eri mieltä	Ei koske minua
	1	2	3	4	0
Tarvitsen tietoa					
10. Millaista liikuntaa voin harjoittaa	1	2	3	4	0
11. Miten paljon minun tulee levätä	1	2	3	4	0
12. Millainen on minulle soveltuva ruokavalio	1	2	3	4	0
13. Milloin voin peseytyä (esim. mennä suihkuun/ kylpyyn/saunaan)	1	2	3	4	0
14. Miten sairaus tai hoito mahdollisesti vaikuttaa eritystoimintaani (esim. hikoiluun, virtsaamiseen, ulostamiseen)	1	2	3	4	0
15. Mitä sairaus tai hoito mahdollisesti vaikuttaa kotona tapahtuviin järjestelyihin (esim. allergia-saneeraus, kotiapu)	1	2	3	4	0
16. Mistä saan tarvitsemiani hoidon apuvälineitä (esim. liikkumiseen, haavan hoitoon, syömiseen)	1	2	3	4	0
17. Minkälaisia tunteita sairauteni ja sen hoito mahdollisesti minulle aiheuttaa	1	2	3	4	0
18. Kenen kanssa voin keskustella sairauteeni ja sen hoitoon liittyvistä tunteista	1	2	3	4	0
19. Miten voin hyödyntää aikaisempia sairaalakokemuksiani nykyisessä hoidossa	1	2	3	4	0

	Täysin samaa mieltä	Jokseenkin samaa mieltä	Jokseenkin eri mieltä	Täysin eri mieltä	Ei koske minua
	1	**2**	**3**	**4**	**0**
Tarvitsen tietoa					
20. Miten voin osallistua hoitoani koskevaan päätöksentekoon	1	2	3	4	0
21. Miten voin saada hoidon aikana omat toiveeni kuuluville	1	2	3	4	0
22. Mitä oikeuksia minulla sairaalassa on	1	2	3	4	0
23. Mikä on oma vastuuni hoidon onnistumiseksi	1	2	3	4	0
24. Potilasasiamiehen toiminnasta	1	2	3	4	0
25. Miten eri hoitooni osallistuvien ammattiryhmien vastuualueet on määritelty	1	2	3	4	0
26. Miten minua koskevat tiedot pysyvät salassa	1	2	3	4	0
27. Kenelle minua koskevia tietoja annetaan	1	2	3	4	0
28. Miten voin itse tutustua potilasasiakirjoihini	1	2	3	4	0
29. Keneltä läheiseni saavat tietoa sairauteeni ja sen hoitoon liittyvissä asioissa	1	2	3	4	0
30. Miten läheiseni voivat osallistua hoitooni	1	2	3	4	0

	Täysin samaa mieltä	Jokseenkin samaa mieltä	Jokseenkin eri mieltä	Täysin eri mieltä	Ei koske minua
	1	**2**	**3**	**4**	**0**
Tarvitsen tietoa					
31. Mistä saan halutessani tukihenkilön sairaalassa olon jälkeen	1	2	3	4	0
32. Mistä saan mahdollisesti tarvittavan jatkohoitopaikan	1	2	3	4	0
33. Miten voin tavata sairaalapapin/-teologin	1	2	3	4	0
34. Potilasjärjestöjen toiminnasta	1	2	3	4	0
35. Kuntoutuksesta ja siihen liittyvistä kustannuksista	1	2	3	4	0
36. Sairauspäivärahoista	1	2	3	4	0
37. Vakuutusasioista	1	2	3	4	0
38. Sopeutumisvalmennuskursseista ja niiden kustannuksista	1	2	3	4	0
39. Jatkohoidon tai kotona tapahtuvan hoidon kustannuksista	1	2	3	4	0
40. Lääkehoidon kustannuksista	1	2	3	4	0

41. Seuraavassa on luettelo **sairauksiin mahdollisesti liittyvistä oireista**. Merkitkää nykyisiä oireitanne parhaiten kuvaava vaihtoehto tai vaihtoehdot. Jos listassa ei ole Teille tällä hetkellä soveltuvia oireita, lisätkää oma mahdollinen oireenne luettelon loppuun.

Minulla on seuraavia oireita	Erittäin paljon	Paljon	Vähän	Ei lainkaan
1. kipu	1	2	3	4
2. väsymys tai uupumus	1	2	3	4
3. heikkouden tunne	1	2	3	4
4. pahoinvointi tai oksentelu	1	2	3	4
5. ruokahaluttomuus	1	2	3	4
6. unettomuus	1	2	3	4
7. hengenahdistus	1	2	3	4
8. kutina	1	2	3	4
9. muu, mikä _____	1	2	3	4

42. Seuraavassa on luettelo **sairauksiin mahdollisesti liittyvistä tunteista**. Merkitkää nykyisiä tunteitanne parhaiten kuvaava vaihtoehto tai vaihtoehdot. Jos listassa ei ole Teille soveltuvia tunteita, lisätkää mahdollinen oma tunteenne luettelon loppuun.

Minulla on seuraavia tunteita	Erittäin paljon	Paljon	Vähän	Ei lainkaan
1. pelko	1	2	3	4
2. huoli	1	2	3	4
3. toivo	1	2	3	4
4. epätoivo tai toivottomuus	1	2	3	4
5. kärsimättömyys	1	2	3	4
6. suru	1	2	3	4
7. masennus	1	2	3	4
8. ahdistus	1	2	3	4
9. epävarmuus	1	2	3	4
10. muu, mikä_____	1	2	3	4

Appendix 4.

Turun yliopisto, Hoitotieteen laitos
Turun yliopistollinen keskussairaala
Potilasohjauksen tuloksellisuuden arviointi

Ensimmäiseksi pyydämme Teitä vastaamaan joihinkin tämänkertaista sairaalakäyntiänne koskeviin kysymyksiin. Valitkaa rastittamalla **Teille parhaiten soveltuva vaihtoehto** tai kirjoittakaa vastauksenne sille varattuun tilaan.

1. Miten kauan **tämänkertainen sairaalassaolonne kesti**? Laskekaa mukaan tulo- ja lähtöpäivä. Jos olitte polikliinisella hoitokäynnillä, ilmoittakaa kuinka monena päivänä kävitte.
   Olin yhteensä ___ päivää

2. **Mihin lähdette** sairaalasta?
   kotiin _____
   toiseen hoitolaitokseen _____

3. Toteutuiko sairaala-/poliklinikka käyntinne **odottamallanne tavalla**?
   kyllä _____
   ei _____, miksei?_____

SAIRAALAPOTILAAN TIEDON SAANTI –MITTARI (SPTS)

Seuraavassa Teille esitetään kysymyksiä koskien **tiedon saantianne tällä sairaalakerralla**. Vastatkaa jokaiseen kysymykseen ympyröimällä omaa näkemystänne parhaiten vastaava vaihtoehto. Kysymyksiin ei ole olemassa oikeita tai vääriä vastauksia vaan tavoitteena on kartoittaa tilannetta **juuri Teidän kohdallanne tällä sairaalakäynnillä.**

	Täysin samaa mieltä	Jokseenkin samaa mieltä	Jokseenkin eri mieltä	Täysin eri mieltä	Ei koske minua
	1	**2**	**3**	**4**	**0**
Sain tietoa					
1. Sairauteeni liittyneistä oireista	1	2	3	4	0
2. Milloin minun on syytä ottaa yhteyttä hoitopaikkaan oireiden pahentuessa	1	2	3	4	0
3. Minulle tehdyistä tutkimuksista	1	2	3	4	0
4. Miten minun olisi pitänyt valmistautua tutkimuksiin	1	2	3	4	0
5. Miten saan tietoa tutkimuksen tuloksista	1	2	3	4	0
6. Erilaisista hoito-vaihtoehdoista	1	2	3	4	0

	Täysin samaa mieltä	Jokseenkin samaa mieltä	Jokseenkin eri mieltä	Täysin eri mieltä	Ei koske minua
	1	**2**	**3**	**4**	**0**
Sain tietoa					
7. Hoitooni liittyneistä mahdollisista komplikaatioista	1	2	3	4	0
8. Miten voisin itse estää komplikaatioita	1	2	3	4	0
9. Miten voin toimia yksilöllisesti henkilökohtaisten tarpeitteni hoitamiseksi sairaalassa/ poliklinikalla	1	2	3	4	0
10. Millaista liikuntaa voin harjoittaa	1	2	3	4	0
11. Miten paljon minun tulee levätä	1	2	3	4	0
12. Millainen on minulle soveltuva ruokavalio	1	2	3	4	0
13. Milloin voin peseytyä (esim. mennä suihkuun/ kylpyyn/saunaan)	1	2	3	4	0
14. Miten sairaus tai hoito mahdollisesti vaikuttaa eritystoimintaani (esim. hikoiluun, virtsaamiseen, ulostamiseen)	1	2	3	4	0
15. Mitä sairaus tai hoito mahdollisesti vaikuttaa kotona tapahtuviin järjestelyihin (esim.allergiasaneeraus, kotiapu)	1	2	3	4	0
16. Mistä saan tarvitsemiani hoidon apuvälineitä (esim. liikkumiseen, haavan hoitoon, syömiseen)	1	2	3	4	0

	Täysin samaa mieltä	Jokseenkin samaa mieltä	Jokseenkin eri mieltä	Täysin eri mieltä	Ei koske minua
	1	**2**	**3**	**4**	**0**
Sain tietoa					
17. Minkälaisia tunteita sairauteni ja sen hoito mahdollisesti minulle aiheuttavat	1	2	3	4	0
18. Kenen kanssa voin keskustella sairauteeni ja sen hoitoon liittyvistä tunteista	1	2	3	4	0
19. Miten voin hyödyntää aikaisempia sairaalakokemuksiani tämänkertaisessa hoidossa	1	2	3	4	0
20. Miten voin osallistua hoitoani koskevaan päätöksentekoon	1	2	3	4	0
21. Miten voin saada hoidon aikana omat toiveeni kuuluville	1	2	3	4	0
22. Mitä oikeuksia minulla sairaalassa oli	1	2	3	4	0
23. Mikä on oma vastuuni hoidon onnistumiseksi	1	2	3	4	0
24. Potilasasiamiehen toiminnasta	1	2	3	4	0
25. Miten eri hoitooni osallistuvien ammatti-ryhmien vastuualueet oli määritelty	1	2	3	4	0
26. Miten minua koskevat tiedot pysyvät salassa	1	2	3	4	0
27. Kenelle minua koskevia tietoja annettiin	1	2	3	4	0

	Täysin samaa mieltä	Jokseenkin samaa mieltä	Jokseenkin eri mieltä	Täysin eri mieltä	Ei koske minua
	1	**2**	**3**	**4**	**0**
Sain tietoa					
28. Miten voin itse tutustua potilasasiakirjoihini	1	2	3	4	0
29. Keneltä läheiseni saavat tietoa sairauteeni ja sen hoitoon liittyvissä asioissa	1	2	3	4	0
30. Miten läheiseni voivat osallistua hoitooni	1	2	3	4	0
31. Mistä saan halutessani tukihenkilön sairaalassa olon jälkeen	1	2	3	4	0
32. Mistä saan mahdollisesti tarvittavan jatkohoitopaikan	1	2	3	4	0
33. Miten voin tavata sairaalapapin/-teologin	1	2	3	4	0
34. Potilasjärjestöjen toiminnasta	1	2	3	4	0
35. Kuntoutuksesta ja siihen liittyvistä kustannuksista	1	2	3	4	0
36. Sairauspäivärahoista	1	2	3	4	0
37. Vakuutusasioista	1	2	3	4	0
38. Sopeutumisvalmennuskursseista ja niiden kustannuksista	1	2	3	4	0
39. Jatkohoidon tai kotona tapahtuvan hoidon kustannuksista	1	2	3	4	0
40. Lääkehoidon kustannuksista	1	2	3	4	0

41. Seuraavassa on luettelo **sairauksiin mahdollisesti liittyvistä oireista**. Merkitkää **nykyisiä** oireitanne parhaiten kuvaava vaihtoehto tai vaihtoehdot. Jos listassa ei ole Teille tällä hetkellä soveltuvia oireita, lisätkää oma mahdollinen oireenne luettelon loppuun.

Minulla on seuraavia oireita	Erittäin paljon	Paljon	Vähän	Ei lainkaan
1. kipu	1	2	3	4
2. väsymys tai uupumus	1	2	3	4
3. heikkouden tunne	1	2	3	4
4. pahoinvointi tai oksentelu	1	2	3	4
5. ruokahaluttomuus	1	2	3	4
6. unettomuus	1	2	3	4
7. hengenahdistus	1	2	3	4
8. kutina	1	2	3	4
9. muu, mikä _____	1	2	3	4

42. Seuraavassa on luettelo **sairauksiin mahdollisesti liittyvistä tunteista**. Merkitkää **nykyisiä** tunteitanne parhaiten kuvaava vaihtoehto tai vaihtoehdot. Jos listassa ei ole Teille tällä hetkellä soveltuvia tunteita, lisätkää mahdollinen oma tunteenne luettelon loppuun.

Minulla on seuraavia tunteita	Erittäin paljon	Paljon	Vähän	Ei lainkaan
1. pelko	1	2	3	4
2. huoli	1	2	3	4
3. toivo	1	2	3	4
4. epätoivo tai toivottomuus	1	2	3	4
5. kärsimättömyys	1	2	3	4
6. suru	1	2	3	4
7. masennus	1	2	3	4
8. ahdistus	1	2	3	4
9. epävarmuus	1	2	3	4
10. muu, mikä_____	1	2	3	4

Turun yliopisto, Hoitotieteen laitos
Turun yliopistollinen keskussairaala

POTILAAN TYYTYVÄISYYS –MITTARI

Seuraavassa Teiltä pyydetään arvioitanne tämänkertaisesta toteutuneesta hoidosta sairaalassa. Valitkaa jokaisessa kohdassa omaa näkemystänne parhaiten kuvaava vaihtoehto.

	Erittäin tyytymätön	Tyytymätön	Tyytyväinen	Erittäin tyytyväinen	
1. Olen	1	2	3	4	hoidon tasoon tässä sairaalassa
2. Olen	1	2	3	4	saamani hoidon määrään
3. Olen	1	2	3	4	hoitohenkilökunnan yleiseen ammattitaitoon
4. Olen	1	2	3	4	henkilökunnan välittämään tietoon sairaalahoidon aikana
5. Olen	1	2	3	4	hoitohenkilökunnan tapaan lähestyä ja käsitellä minua sairaana ollessani
6. Olen	1	2	3	4	hoitohenkilökunnan kanssani viettämän ajan määrään
7. Olen	1	2	3	4	hoitohenkilökunnan tapaan selittää asioita minulle
8. Olen	1	2	3	4	mahdollisuuksiini valita hoitoa tarvitessani
9. Olen	1	2	3	4	tapaan, jolla hoitohenkilökunta valmisteli minut jäämään sairaalahoitoon
10. Olen	1	2	3	4	tapaan, jolla hoitohenkilökunta valmisteli minua lähtiessäni sairaalasta
11. Olen	1	2	3	4	tapaan, jolla hoitohenkilökunta valmisteli omaisiani lähtiessäni sairaalasta

Appendix 5.

TURUN YLIOPISTO
UNIVERSITY OF TURKU

20014 Turun yliopisto
Lääketieteellinen tiedekunta
Hoitotieteen laitos
Helena Leino-Kilpi
FINLAND
Puh. + 358 2 333 8404

HYVÄ HOITO –mittari
potilasosa

OHJEITA VASTAAJALLE

Pyydämme Teitä vastaamaan jokaiseen kysymykseen valitsemalla mielipidettänne parhaiten kuvaava vaihtoehto. Kysymyksiin ei ole oikeita tai vääriä vastauksia vaan olemme kiinnostuneita nimenomaan Teidän näkemyksistänne tällä sairaalakäynnillä.

Ensimmäiseksi pyydämme Teitä kertomaan muutamia asioita itsestänne. Vastaaminen tapahtuu **ympyröimällä/rastittamalla** Teitä parhaiten kuvaava vaihtoehto tai kirjoittamalla vastaus sille varattuun tilaan.

A POTILAAN TAUSTATIEDOT

001 Ikä (vuosina) _____ vuotta

002 Sukupuoli:
1 mies
2 nainen

003 Pohjakoulutus:
1 kansa-/peruskoulu
2 ylioppilas
3 ammatillinen tutkinto (myös ammattikorkeakoulu)
4 akateeminen tutkinto (yliopisto)

004 Oletteko tällä hetkellä:
1 työelämässä
2 työtön
3 eläkkeellä
4 kotiäiti/-isä
5 opiskelija

005 Asumismuoto
1 asun yksin
2 asun yhdessä jonkun kanssa

006 Tulin hoitoon
1 äkillisesti päivystyspotilaana
2 lähetteellä, aikaisemmin sovitun ajan mukaisesti
□ lääkärin valitsemaan hoitopaikkaan
□ itse valitsemaani hoitopaikkaan

007 Olisitteko hakeutuneet muualle hoitoon, jos se olisi ollut mahdollista?
1 kyllä, mihin_____
2 en

008 A) Onko tämä ensimmäinen kertanne sairaalahoidossa?
1 kyllä
2 ei, monesko kerta tämä on? _____

B) Onko tämä ensimmäinen kertanne tässä hoitopaikassa?
1 kyllä
2 ei, monesko kerta tämä on? _____

009 Tiedättekö nyt miten hoitonne tulee jatkossa etenemään?
1 en
2 kyllä

010 Montako päivää olitte hoitopaikassa tällä kertaa? _____
(laskekaa mukaan tulo- ja lähtöpäivä)

011 Mikä leikkaus teille tehtiin tämän hoitojakson aikana?
1 vatsanalueen leikkaus
2 suolistoleikkaus
3 polvileikkaus
4 lonkkaleikkaus
5 selkäleikkaus
6 verisuonileikkaus
7 rintojen korjausleikkaus
8 Virtsatie- tai munuaisleikkaus
9 muu, mikä? _____

012 Onko teillä jokin perussairaus (esim. diabetes, verenpainetauti, astma)
1 ei
2 kyllä, mikä?_____

013 Minkälainen on ravitsemustilanteenne tällä hetkellä omasta mielestänne?
1 erinomainen
2 hyvä
3 kohtalainen
4 huono

014 Miten olette sitoutuneet hoitoonne omasta mielestä?
1 erinomaisesti
2 hyvin
3 kohtalaisesti
4 heikosti

015 Miten kuvaatte vointianne tällä hetkellä, verrattuna normaaliin vointiinne?
1 erinomainen
2 hyvä
3 kohtalainen
4 huono

B HOITOHENKILÖKUNTA

Seuraavat väittämät koskevat teitä hoitanutta henkilökuntaa, heidän toimintaansa ja hoidon

		täysin samaa mieltä **4**	lähes samaa mieltä **3**	lähes eri mieltä **2**	täysin eri mieltä **1**	en osaa sanoa **0**
17	Hoitohenkilökunta on suhtautunut minuun **ystävällisesti**	☐	☐	☐	☐	☐
18	Hoitohenkilökunta on ollut **huolellinen** suorittaessaan hoitooni liittyneitä toimenpiteitä	☐	☐	☐	☐	☐
19	Hoitohenkilökunta on **osannut vastata**, kun olen heiltä jotain kysynyt	☐	☐	☐	☐	☐
20	Hoitohenkilökunta on ollut **palvelualtis**	☐	☐	☐	☐	☐
21	Hoitohenkilökunta on ollut minulle **rehellinen**	☐	☐	☐	☐	☐

toteutuksesta. Valitkaa **rastittamalla** sopivin vaihtoehto.

C HOITOON LIITTYVÄT TOIMINNOT

Seuraavat väittämät koskevat sairaalahoitonne aikana tapahtuneita erilaisia toimintoja eli mitä

		täysin samaa mieltä **4**	lähes samaa mieltä **3**	lähes eri mieltä **2**	täysin eri mieltä **1**	en osaa sanoa **0**
22	Minulle on riittävästi **selvitetty hoitooni liittyneitä asioita**	☐	☐	☐	☐	☐
23	Hoitooni sisältyneet toimenpiteet on suoritettu **ammattitaitoisesti**	☐	☐	☐	☐	☐
24	Minua on neuvottu **itse seuraamaan** omia oireitani ja tuntemuksiani ja kertomaan niistä hoitohenkilökunnalle	☐	☐	☐	☐	☐
25	Minua on **kuunneltu**, kun olen halunnut puhua asioistani	☐	☐	☐	☐	☐
26	**Asioistani on otettu** pyynnöstäni **selvää**	☐	☐	☐	☐	☐
27	Minua on **rohkaistu ja henkisesti tuettu** hoitoni aikana	☐	☐	☐	☐	☐

hoitonne aikana on tapahtunut? Valitkaa **rastittamalla** sopivin vaihtoehto.

D HOIDON EDELLYTYKSET
Seuraavat väittämät koskevat asioita, jotka ovat edellytyksiä hoidon toteuttamiselle. Valitkaa

		täysin samaa mieltä **4**	lähes samaa mieltä **3**	lähes eri mieltä **2**	täysin eri mieltä **1**	en osaa sanoa **0**
28	Hoitohenkilökunnan **tiedot ja taidot** ovat olleet ajan tasalla	☐	☐	☐	☐	☐
29	Hoitohenkilökunta on käyttänyt hoidossani **tutkittua tietoa**	☐	☐	☐	☐	☐
30	Sairaalassa on ollut riittävät **resurssit** hoitoni toteutukseen	☐	☐	☐	☐	☐
31	Minun **etuni** on haluttu asettaa ensisijaiseksi	☐	☐	☐	☐	☐
32	Hoitajien **ammattikokemus** on ohjannut heidän työskentelyään	☐	☐	☐	☐	☐

rastittamalla sopivin vaihtoehto.

E HOITOYMPÄRISTÖ
Seuraavat väittämät koskevat sairaalaa/yksikköä hoitoympäristönä. Valitkaa **rastittamalla** sopivin

		täysin samaa mieltä **4**	lähes samaa mieltä **3**	lähes eri mieltä **2**	täysin eri mieltä **1**	en osaa sanoa **0**
33	Olen kokenut oloni sairaalassa/yksikössä kaikin tavoin **turvalliseksi**	☐	☐	☐	☐	☐
34	Olen voinut potilashuoneessa säilyttää **henkilökohtaisen koskemattomuuteni**	☐	☐	☐	☐	☐
35	Hoitohenkilökunta on toiminnallaan ehkäissyt **infektioiden leviämistä**	☐	☐	☐	☐	☐
36	Hoitohenkilökunta on toteuttanut **lääkehoitoni virheettömästi**	☐	☐	☐	☐	☐
37	Hoitohenkilökunta on **tarkistanut henkilöllisyyteni** toimenpiteiden yhteydessä	☐	☐	☐	☐	☐

F HOITOPROSESSIN ETENEMINEN

Seuraavat väittämät koskevat pääsyänne hoitoon, tuloa sairaalaan ja sieltä lähtöä. Valitkaa **rastittamalla** sopivin vaihtoehto.

		täysin samaa mieltä **4**	lähes samaa mieltä **3**	lähes eri mieltä **2**	täysin eri mieltä **1**	en osaa sanoa **0**
38	**Pääsin hoitoon** tällä kertaa riittävän nopeasti	☐	☐	☐	☐	☐
39	Minun tapauksessani eri hoitopaikat (esim. terveyskeskus, yksityislääkäri, sairaala) **toimivat joustavasti yhdessä**	☐	☐	☐	☐	☐
40	Olen saanut mielestäni **viipyä sairaalassa/yksikössä** paranemiseni kannalta riittävän kauan	☐	☐	☐	☐	☐
41	Sain **tiedon kotiin pääsystä** riittävän varhain järjestääkseni siellä asiani kuntoon	☐	☐	☐	☐	☐
42	Tiedän mahdollisten kotona tulevien **komplikaatioiden** (lisäoireiden) tunnusmerkit, mitä tehdä niiden ilmestyessä ja mihin ottaa yhteyttä	☐	☐	☐	☐	☐
43	Tiedän, mitä minun on **lupa tehdä kotona** ottaen huomioon nyt minulle tehty toimenpide/toteutettu hoito	☐	☐	☐	☐	☐

G POTILAAN OMAT SELVIYTYMISKEINOT
Jokaisella ihmisellä on sairastuessaan ja joutuessaan sairaalaan tiettyjä asioita, jotka edistävät hänen paranemistaan ja helpottavat sopeutumista tilanteeseen. Valitkaa **rastittamalla** sopivin vaihtoehto.

Paranemistani on edistetty…

		täysin samaa mieltä **4**	lähes samaa mieltä **3**	lähes eri mieltä **2**	täysin eri mieltä **1**	en osaa sanoa **0**
44	hyödyntämällä aikaisempia **sairaalakokemuksiani**	☐	☐	☐	☐	☐
45	varmistamalla, että **tiedän hoidostani**, sen mahdollisuuksista ja erilaisista vaihtoehdoista riittävästi	☐	☐	☐	☐	☐
46	antamalla minulle mahdollisuus **toimia itse** mahdollisimman paljon	☐	☐	☐	☐	☐
47	ottamalla huomioon minun omat **mielipiteeni**	☐	☐	☐	☐	☐
48	mahdollistamalla **avoin ja luottamuksellinen suhde** hoitajiin ja lääkäreihin	☐	☐	☐	☐	☐
49	varmistamalla, että olen **tietoinen** minulle kuuluvista **taloudellisista velvoitteista ja etuuksista**	☐	☐	☐	☐	☐
50	siten, että olen **voinut halutessani kysyä** sairaudestani ja sen lääketieteellisestä hoidosta	☐	☐	☐	☐	☐

H YHTEISTYÖ OMAISTEN KANSSA

Seuraavat väittämät koskevat yhteistyötä omaisten (muut läheiset) kanssa ja mahdollisuutta osallistua hoitoonne. Valitkaa **rastittamalla** sopivin vaihtoehto.

	kyllä	**ei**
Minulla on omaisia	☐	☐
Haluaisin, että omaiseni voisivat osallistua hoitooni	☐	☐
Omaiseni ovat osallistuneet hoitooni	☐	☐

Jos vastauksesi viimeksi mainittuihin väittämiin oli kyllä, vastaa myös seuraaviin väittämiin.

		täysin samaa mieltä **4**	lähes samaa mieltä **3**	lähes eri mieltä **2**	täysin eri mieltä **1**	en osaa sanoa **0**
51	Omaiseni ovat saaneet **riittävästi tietoa** hoitooni liittyvissä asioissa	☐	☐	☐	☐	☐
52	Omaiseni ja minä olimme **riittävästi mukana** hoitoni suunnittelussa	☐	☐	☐	☐	☐
53	Hoitoani **arvioitiin yhdessä** minun ja omaisteni kanssa	☐	☐	☐	☐	☐
54	Omaiseni **tulivat kuulluiksi**, kun he halusivat puhua hoitooni liittyvistä ongelmista	☐	☐	☐	☐	☐
55	Omaistani **kannustettiin ja henkisesti tuettiin** hoitoni aikana	☐	☐	☐	☐	☐
56	Hoitohenkilökunnalla oli **riittävästi aikaa** omaisilleni	☐	☐	☐	☐	☐

Kiitos vastauksistanne ja ajastanne!

Turun yliopisto

Turun yliopisto, hoitotieteen laitos

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