Measurement and evaluation of hip fracture care

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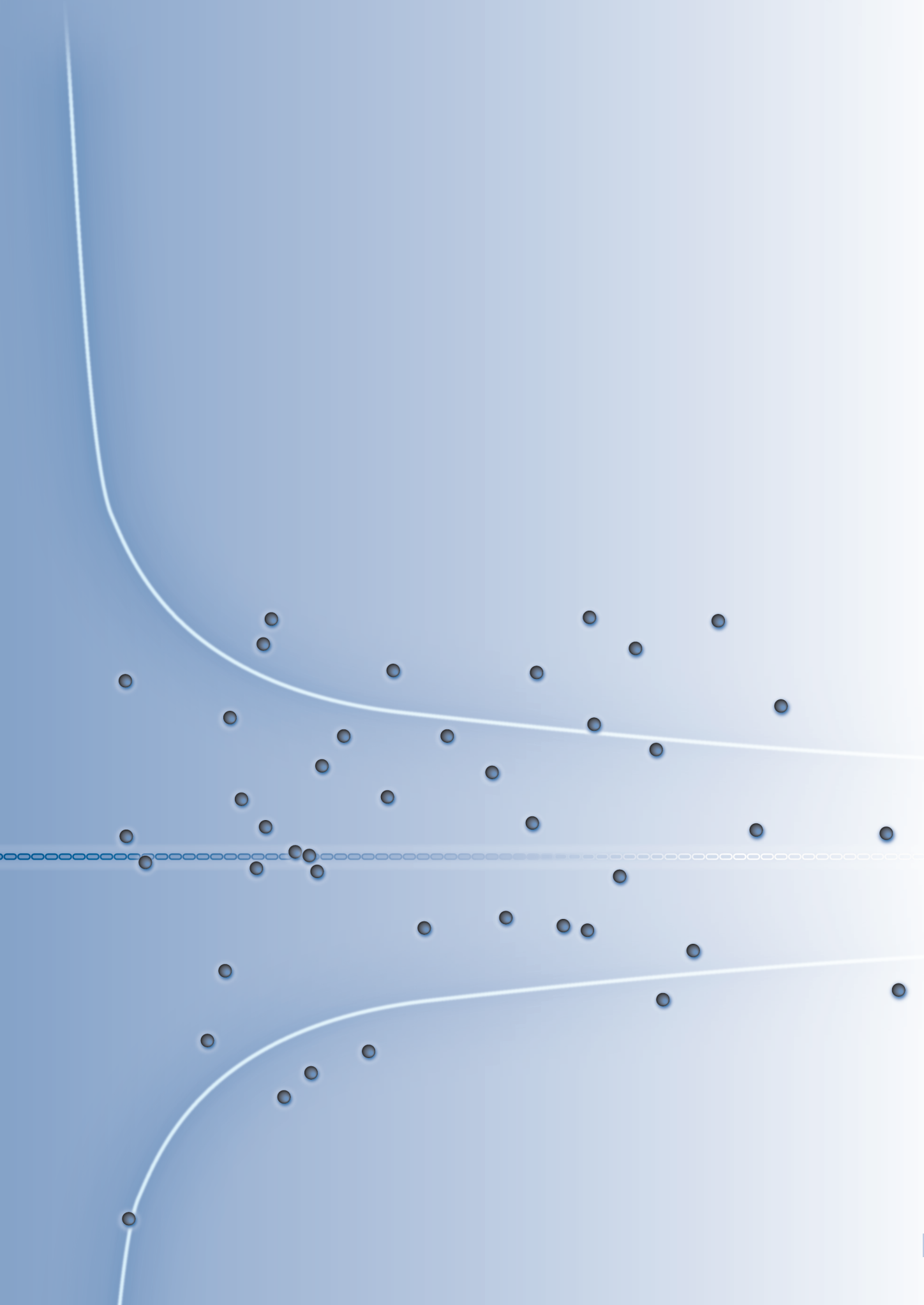
Introduction, aim and outline of the thesis



1.1 Introduction

Hip fractures are most common in frail elderly people [1-3]. In the Netherlands, 90% of the approximately 18,500 annual hip fracture patients are 60 years or older [4,5]. Hip fractures involve a long and intensive rehabilitation process, due to the fact that elderly patients generally lack physical reserves [6,7]. To achieve the best possible outcome for each patient, it is important to ensure a high quality of hip fracture care throughout the treatment process. Not only is a high standard of quality of care essential from the patient's perspective, stakeholders are also increasingly interested in the quality of hip fracture care. In addition, both patients and stakeholders demand that medical professionals are increasingly transparent about their performance. In the Netherlands, the two government institutions that decide what information needs to be transparent – the Health and Youth Care Inspectorate (*Inspectie Gezondheidszorg en Jeugd* – IGJ) and the National Health Care Institute (*Zorginstituut Nederland* – ZiNL) – focus only on a limited number of aspects regarding hospital stay and care processes [8,9]. The standards for good hip fracture care during the hospital stay have been defined in two evidence-based guidelines: the 'Proximal Femur Fracture' guideline, last revised in 2016, and the 'Multidisciplinary Treatment of Frail Elderly During Surgical Procedures' guideline, first published in 2016 [10,11]. The fact that guidelines, including recommendations, are in place and are endorsed by the associations of medical professionals does not mean that these guidelines are adhered to [12]. It is not known whether hospitals in the Netherlands treat patients according to the guideline recommendations, and whether and in what way there is practice variation among Dutch hospitals. To assess the quality of in-hospital hip fracture care, it is crucial to properly measure quality using valid instruments.

1.1.1 Quality measurement

Quality indicators

Quality indicators are generally used to assess the quality of care and are defined as "the measurable aspects of care that reflect the quality of care" [13]. The Donabedian framework for health care quality distinguishes three types of quality indicators: structure, process and outcome indicators [14] (see Box 1). Concerning structure and process indicators, it is assumed that a good structure and a good process will lead to a good end result of care [15]. Process indicators can be directly actionable from the care provider's perspective, as there is a clear link to quality improvement activities [16]. Outcome indicators can be seen as the ultimate measurement, as they directly reflect the end results of care. To enable fair comparison on outcome indicators among hospitals, relevant patient and treatment characteristics (case-mix factors) should be identified [17,18]. Also, for outcome indicators to be meaningful the event rate needs to be sufficient [16].

Box 1. The three types of quality indicators

Structure indicators measure whether the organizational circumstances at the hospital are optimal to deliver the desired quality of care. This type of indicator is measured at hospital level. An example of a structure indicator of hip fracture care is 'the availability of an in-hospital multidisciplinary hip fracture protocol'.
Process indicators reflect what is actually done for the patient. They describe the interaction between the care provider and the patient, for example 'time to hip fracture surgery'[15].
Outcome indicators measure the end results of care, in either the short or long term. For example: 'return to the place of residence within three months after hip fracture surgery'.

Ideally, every quality indicator should be developed according to a well-described methodological procedure [19,20]. Quality indicators differ in this respect from recommendations made in guidelines, as quality indicators are developed methodologically, and recommendations are not. A quality indicator can be considered adequate when it is clinically relevant, scientifically acceptable, feasible and usable [13,21,22] (see Box 2).

Box 2. The criteria for adequacy of quality indicators

Clinically relevant: the quality indicator has discriminative capabilities and represents an improvement opportunity. A discriminative quality indicator identifies variation by recognizing outperformers, average performers and underperformers.
Scientifically acceptable: the quality indicator is reliable and valid. For many quality indicators, it is uncertain whether they are scientifically acceptable.
Feasible: the data on the quality indicator is retrievable in practice.
Usable: the results of the quality indicator are understandable for the intended audience.

A quality indicator is reliable if it yields the same results for repeated measures. This is achieved when there is uniformity in data collection and calculation of the indicator and when the indicator definitions, such as inclusion/exclusion criteria and numerator/denominator of the quality indicator, are clear [23]. In addition, the event rate needs to be sufficient, as random variation increases with a low event rate. Differences in quality indicators can also reflect differences in a hospital's case-mix. To overcome this, a case-mix correction model is needed.

A quality indicator is valid if it actually measures what is intended to be measured: a good result for the quality indicator represents a high quality of care. Process indicators are often based on recommendations laid down in guidelines, but in many cases an association with outcomes of care has not been studied or proven [20].

Hip fracture quality indicators in the Netherlands

To monitor and regulate the quality of hip fracture care in the Netherlands, IGJ and ZiNL, together with the medical professionals, define quality indicators at hospital level. Hospitals are required to deliver these data annually, and the results of the quality indicators at hospital level are publicly disclosed. Insurance companies use the results of quality indicators in their purchasing policies, and the media use the results to rank and rate hospitals. For 2019, data on seven hip fracture quality indicators are reported: one structure indicator, three process indicators and three outcome indicators (see Table 1). However, the adequacy of the quality indicators used has not been studied.

	Indicator	Type of indicator	Requesting institution
1.	Number of patients registered in the DHFA per hospital	Structure	ZiNL
2.	Time to surgery	Process	ZiNL
3.	Treatment by a specialized hip fracture team (composite quality indicator)	Process	ZiNL
4.	Ability to score functional performance of hip fracture patients aged 70 and over three months after surgery	Process	IGJ / ZiNL
5.	Mean functional scores before fracture for all patients aged 70 and over	Outcome	ZiNL
6.	Percentage of patients reoperated within 60 days after initial surgery	Outcome	IGJ
7.	Percentage of patients with deep wound infection three months after surgery	Outcome	ZiNL

IGJ Health and Youth Care Inspectorate *(Inspectie Gezondheidszorg en Jeugd)*

ZiNL National Health Care Institute *(Zorginstituut Nederland)*

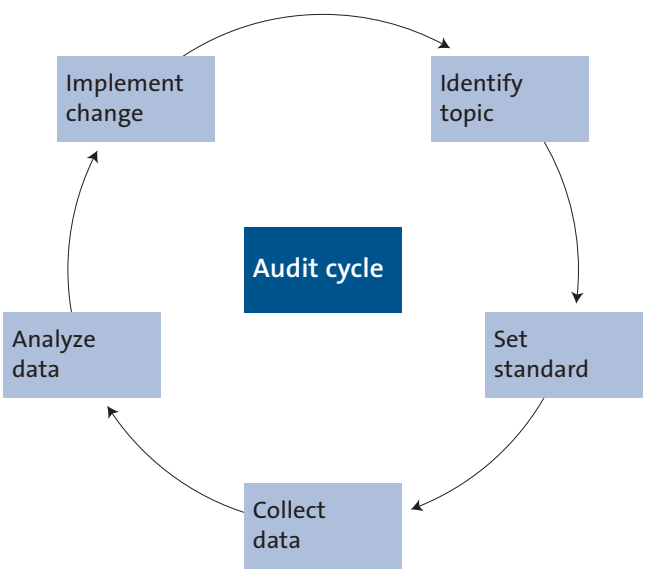
DHFA Dutch Hip Fracture Audit

1.1.2 Quality evaluation

Clinical audit

A clinical audit is an instrument to evaluate quality of care by combining quality measurement, monitoring of guideline adherence and quality assurance [24]. Ernest Amory Codman (1869 – 1940) was the first to advocate a clinical audit as a quality improvement tool, by systematically keeping notes on all patients' recoveries. Codman was a surgeon at Harvard University at the beginning of the twentieth century. His idea about the 'end results of health care' implies that health care professionals should follow each patient long enough to be able to establish whether the treatment was effective or not, and that the experiences gained on outcomes of care should be used to provide every future patient with the optimal treatment [25]. This idea formed the basis of the modern clinical audits which evolved into a continuous Plan-Do-Check-Act cycle (see Figure 1) [26]. In this virtuous audit cycle, health care professionals systematically register information on patient characteristics, treatment and outcomes of care. Current practice is constantly evaluated against explicit predefined criteria, the quality indicators and the guideline recommendations. The most suitable type of indicator depends on the development phase of an audit. In the start-up phase, more actionable feedback is required and a case-mix adjustment model is commonly not yet available [15]. Process indicators provide actionable feedback, and are less influenced by case-mix and random variation compared to outcome indicators [16]. In a later phase of the audit, when an appropriate case-mix model is in place, outcome indicators are the preferred type of quality indicator. Providing hospitals with continuous feedback on their current performance helps identify where targeted quality improvement changes can be made. Quality assurance is achieved by continuously monitoring whether implemented changes have actually enhanced the quality of care and whether these enhancements are sustainable.

Figure 1. The virtuous clinical audit cycle



Clinical auditing in the Netherlands

Although Codman advocated implementing clinical audits back in 1915, it was not until 2009 that the first clinical audit was initiated in the Netherlands by colorectal surgeons. They launched the nationwide Dutch Surgical Colorectal Audit (DSCA) [27]. To facilitate the initiation of similar nationwide clinical audits, the Dutch Institute for Clinical Auditing (DICA) was founded [28]. Over the years, DICA has gained the technical and methodological know-how required to run nationwide clinical audits, and now uses this expertise to support health care professionals aiming to start a new audit [29-34].

Clinical auditing and hip fracture care

Sweden was the first country to introduce a nationwide hip fracture audit in the form of a national registry of hip fracture patient care (Rikshöft), which was started in 1988 [35]. After the Rikshöft audit, nationwide hip fracture audits were initiated worldwide, and international comparisons have since been made [36,37]. In 2015, awareness also took hold in the Netherlands that a structured assessment of hip fracture care was needed, based on substantiated indicators of quality of care.

The acknowledgement of the need for a structured assessment of the quality of care for hip fracture patients forms the basis of this thesis. The focus is on how to measure the quality of hip fracture care, and how to evaluate hip fracture care through a nationwide hip fracture audit.

1.2 Aim and outline of the thesis

The principal aim of this thesis is to define how the quality of hip fracture care should be measured and evaluated through a nationwide clinical hip fracture audit. The thesis consists of two parts. Part I focuses on the measurement of the quality of hip fracture care and Part II on the evaluation of the quality of hip fracture care through a nationwide audit.

Part I: Measurement of the quality of hip fracture care

To measure the quality of hip fracture care, quality indicators are needed. As hip fracture audits are now running in several countries, various hip fracture quality indicators have been developed and are being used. **Chapter 2** provides a review of the literature, published hip fracture guidelines and websites of ongoing hip fracture audits worldwide. The aim of this review is to identify and summarize the existing quality indicators for hip fracture care, and to compose a set of methodologically sound quality indicators.

The optimal timing of hip fracture surgery is a topic of ongoing debate. Although this is used as a quality indicator in several hip fracture audits, the optimal timing is not defined in a uniform manner. The two government institutions supervising the quality of care in the Netherlands (IGJ and ZiNL) also use time to surgery as a quality indicator. The guidelines recommend that a hip fracture patient be operated on the day of admission to hospital or the following day. However, the evidence for this recommendation is considered to be weak. To evaluate existing data about time to hip fracture surgery, all available systematic reviews and meta-analyses on this subject are summarized in **Chapter 3**.

At the beginning of this century, the Dutch Association of Surgeons (*Nederlandse Vereniging voor Heelkunde* – NVvH) introduced the concept of certification for surgical subspecialties in the Netherlands. Nowadays, some operations may only be performed by surgeons who have been certified for that specific procedure. However, a surgeon does not need to have a specific certification to perform hip fracture surgery. This implies that every surgeon who feels capable of performing hip fracture surgery is allowed to do so. In addition to the ongoing discussion of certification of surgeons, there is also discussion about the relationship between hospital volume and outcome of care, and about minimum case load requirements for surgical procedures. **Chapter 4** explores the impact of surgeon certification, and of hospital and surgeon volume, on the outcome of hip fracture care.

A single quality indicator only measures one specific aspect of the care process, although the results of this single indicator are often considered as a reflection of the overall quality of care. A composite measure of multiple quality indicators may better reflect the overall quality of care. Such a composite measure may also help prevent hospitals from focusing on one single indicator rather than the whole process of care in optimizing their performance. In

Chapter 5, a composite measure of process indicators is studied to evaluate at patient level whether the quality of the overall process of care is associated with the quality of the outcomes of care.

Alongside the need for adequate quality indicators, the parameters used in the audit dataset need to be valid. The 'Standardized Audit of Hip Fractures in Europe (SAHFE)' project was the first in which an international expert group of hip fracture care professionals agreed on a core hip fracture audit dataset of 34 items [38]. In 2013, the Fragility Fracture Network, a global organization founded to create a multidisciplinary network of experts for improving treatment and secondary prevention of fragility fractures, adapted the SAHFE dataset into a Minimum Common Dataset, which captures only the key elements [39]. In its Minimum Common Dataset, the Fragility Fracture Network recommends using the Fracture Mobility Score to measure hip fracture patient mobility, although this score has never been validated [39]. Instead, the Parker Mobility Score is more often used to score hip fracture patient mobility, as studies have shown this to be a valid and reliable instrument [40-43]. To verify whether the Fracture Mobility Score is a methodologically sound tool for measuring hip fracture patient mobility, the Fracture Mobility Score is validated against the Parker Mobility score in **Chapter 6**.

Part II: Evaluation of the quality of hip fracture care

In April 2016, the multidisciplinary Dutch Hip Fracture Audit (DHFA) was started, with the overall aim of evaluating and improving the quality of hip fracture care in the Netherlands. Developing, initiating and implementing a new nationwide clinical audit is a challenging process. **Chapter 7** describes the initiation and development of the DHFA, evaluates the completeness (number of participating hospitals, case ascertainment and data completeness) of the audit dataset and whether there is interhospital practice variation in in-hospital hip fracture care processes at the start of the audit.

For a nationwide audit to be successful in evaluating and eventually improving the quality of care, it is important that it be as complete as possible. The completeness of an audit dataset includes the number of participating hospitals, case ascertainment and data completeness. In the literature, evidence is lacking regarding which facilitators and barriers actually influence hospital participation in new and ongoing audits. **Chapter 8** aims to identify factors experienced by hospital staff in the Netherlands as facilitators for and barriers to hospital participation in the DHFA.

In addition to being complete, the entered data must be accurate, because the data from the clinical audits is used to evaluate the quality of care and for medical and epidemiological outcome research. The completeness and accuracy of an audit dataset can be checked using

data verification. A systematic approach to data verification of nationwide audits has not yet been described. **Chapter 9** outlines the systematic data verification process at DICA and the results of the seven audits that were verified. At a later stage, data verification will also be performed in the DHFA.

Chapter 10 presents the general discussion and future perspectives related to the results of the studies presented in this thesis.

And finally, a summary of how hip fracture care should be measured and evaluated is provided in **Chapter 11.**

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