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# Measurement and evaluation of hip fracture care

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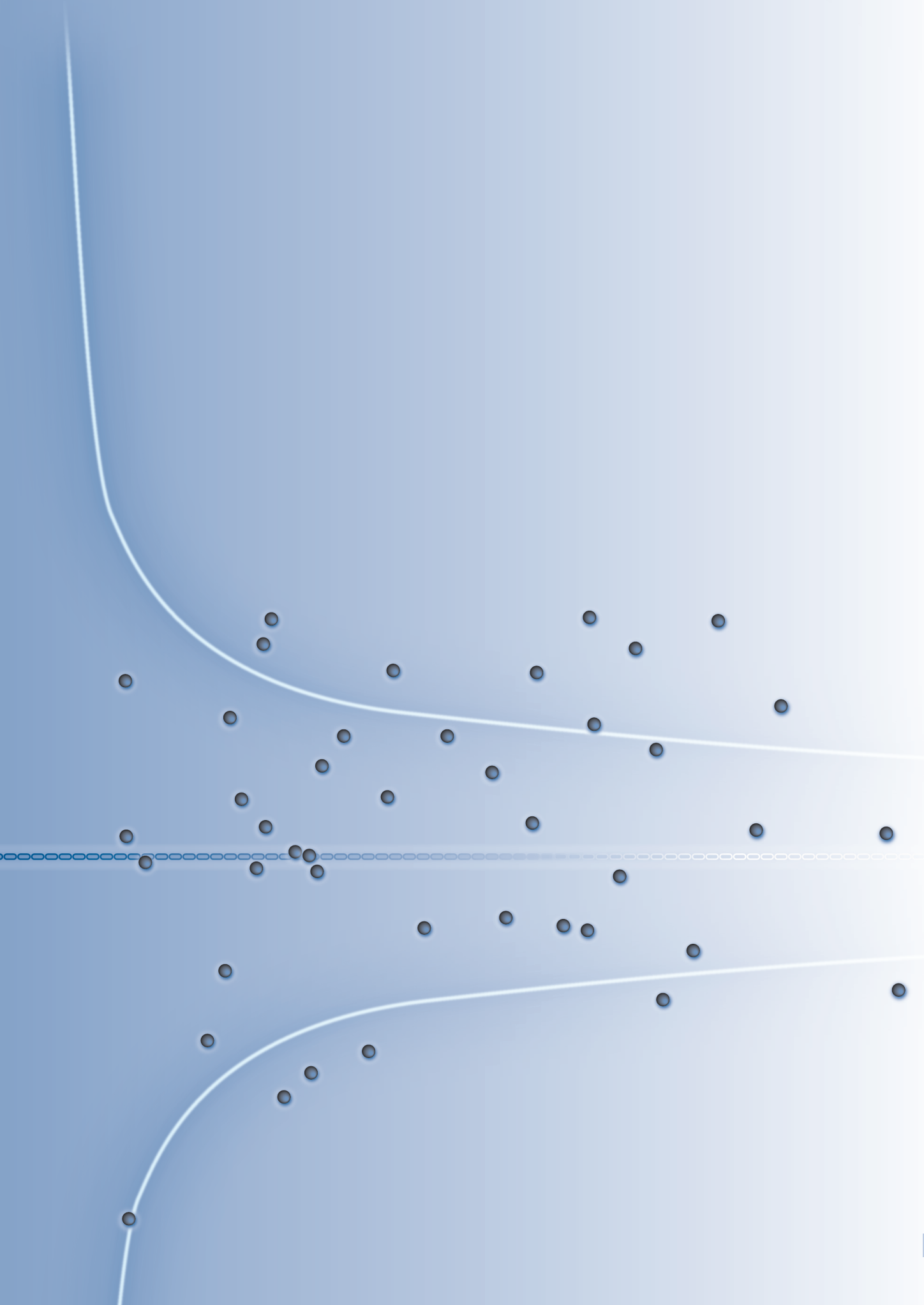
# 10

# General discussion, future perspectives and conclusion



## 10.1 General discussion

The ambition of the Dutch Federation of Medical Specialists (*Federatie Medisch Specialisten*) is that "in 2025 Dutch specialised medical care will have proven itself to be among the most innovative, efficient and high-quality in the world" [1]. To achieve this ambition, a properly functioning clinical hip fracture audit will help to improve the quality of hip fracture care. The general discussion of this thesis focuses on how the quality of hip fracture care can best be measured, and whether the Dutch Hip Fracture Audit (DHFA) in its present form is adequate to evaluate the quality of hip fracture care.

### 10.1.1 Measurement of the quality of hip fracture care

Quality indicators are used to measure the quality of care. There are three types of quality indicators (structure, process and outcome). A quality indicator can be considered adequate when it is clinically relevant, scientifically acceptable, feasible and usable [2-5] (for definitions, see Introduction, Boxes 1 and 2). **Chapter 2** provides an overview of all existing hip fracture quality indicators described in the literature, audits and guidelines. For hip fracture care, there are 97 unique quality indicators: 9 structure, 63 process and 25 outcome indicators. The extent to which these indicators meet the adequacy criteria is currently unknown. Based on the results of the review, nine quality indicators were recommended. Since the adequacy of these quality indicators could not be determined, this recommendation was based on quantitative rather than qualitative criteria. Before using these quality indicators, further research should be conducted into determining the adequacy of the existing quality indicators and their potential improvement.

In a clinical audit, detailed information is collected at patient level. Since structure indicators are measured at hospital level, these indicators are less useful for measuring the quality of care through a clinical audit. Particularly during the start-up phase of an audit, it is essential to have feedback that can be directly translated into quality improvement actions at patient level [6]. Contrary to structure and outcome indicators, process indicators provide such actionable feedback, and should therefore be the indicators of choice in the initial phase of an audit [7]. My recommendation is that process indicators should be used in the initial audit phase of hip fracture care. Once quality improvement projects, based on the results of process indicator analyses, have contributed to better hip fracture care, outcome indicators should become the preferred measures as they reflect the end results of care. Another argument for not using outcome indicators directly in the initial phase of an audit, is that they are more strongly influenced by a hospital's case-mix than process indicators. In the initial audit phase, a case-mix correction model is often not yet available, and outcome indicators are therefore not reliable [6].

The quality indicator most often described in the literature, audits and guidelines was the process indicator 'time to surgery within a specific timeframe' (**Chapter 2**). The use of this quality indicator in the Netherlands was studied in more detail in **Chapter 3**. Based on the findings in this chapter, 'time to surgery' as an individual quality indicator can be considered non-discriminative in detecting variation in quality of care between Dutch hospitals (*not clinically relevant),* although literature showed it to be *scientifically acceptable*. This quality indicator fails to identify hospital variation and is therefore not suitable for identifying hospitals that need to improve their time to surgery. None of the other recommended process indicators in **Chapter 2** met the criteria for being labelled as adequate.

A process indicator that is also used in the Netherlands to evaluate the quality of hip fracture care is operation by a certified (trauma) surgeon. **Chapter 4** describes that at patient level treatment by a certified surgeon is associated with fewer reoperations and surgical site infections compared to treatment by a general surgeon. Based on this finding, using certification of a surgeon as a quality indicator can be considered *scientifically acceptable (valid)*. However, 1,291 (94.2%) of the 1,371 patients included in the cohort study described in **Chapter 5** were treated by a certified surgeon, indicating that this process indicator is non-discriminative (*not clinically relevant*).

To overcome the lack of discriminative capability and scientific acceptability, individual process indicators can be aggregated into a composite process indicator. A composite quality indicator covers a larger part of the hip fracture care cycle compared to individual process indicators, and its results may therefore better reflect the overall quality of care. For the composite hip fracture process indicator (textbook process indicator) defined in **Chapter 5**, data from five hospitals showed that at patient level this composite measure was associated with outcomes of care (*scientifically acceptable*) and varied between hospitals (discriminative – *clinically relevant)*. The drawback of a composite quality indicator is that it does not show where individual hospitals can achieve targeted quality improvements.

As explained above, process indicators are most suitable to measure quality in the initial phase of an audit. The individual hip fracture process indicators identified to date do not meet the adequacy criteria of being clinically relevant and scientifically acceptable, whereas a composite process indicator does not show where targeted quality improvements can be achieved. In my opinion, the best way to measure the quality of hip fracture care in the initial phase of an audit is to use a composite process indicator and to focus on the underlying individual process indicators if the textbook process criteria are not met. Once the first quality improvements have been made and a case-mix correction model is available, outcome indicators can be better used to measure the quality of care.

### 10.1.2 Evaluation of the quality of hip fracture care in the DHFA

Extrapolation of the above discussion to the current situation in the Netherlands, with the DHFA in its start-up phase and no case-mix correction model available, the quality of hip fracture care can best be measured by both the composite indicator and its underlying individual indicators. But first and foremost, to use a clinical audit for quality evaluation, the dataset needs to be both complete and accurate, as these features influence the *scientific acceptability* of the quality indicators.

#### *Completeness of the DHFA dataset*

The completeness of a clinical audit dataset can be described at three levels: number of participating hospitals, case ascertainment and data completeness. **Chapter 7** describes that the dataset completeness of the DHFA in its first full year (2017) was 74% on hospital participation, 58% on case ascertainment and 77% on data completeness. The DHFA dataset completeness needs to be improved at all three levels:

- Participation. In Chapter 8, factors perceived by hospital staff to influence hospital participation in the DHFA were identified[8]. The only facilitator for active participation in the DHFA was data sharing with external parties. Surprisingly, the concept of the DHFA as a tool for improving the quality of hip fracture care was not found to be a facilitator. This might indicate that hospital staff either do not think the DHFA is useful for improving the quality of hip fracture care or do not know how to use the information from the DHFA as a quality improvement tool. To raise awareness of the DHFA as a tool to improve the quality of hip fracture care, it may help to organize national benchmark sessions in which hospitals share and compare results. This makes it possible to identify best practices so that hospitals can learn from one another and optimize their quality of care.

  The factor that the highest percentage of hospital staff agreed to influence participation in the DHFA was the organization of the data collection. To increase hospital participation, the registration load should be reduced. The best way to accomplish this is to automate the data collection process so that data is directly transferred from the local hospital Electronic Health Record (*Elektronisch Patiëntendossier* – EPD) into the DHFA database.

- *Case ascertainment.* In the DHFA, all hip fracture patients aged 18 and over need to be registered, except those with a pathologic or periprosthetic fracture. The annual caseload of 18,500 hip fracture patients in the Netherlands implies a high registration load[9]. On top of that, DHFA-specific data need to be recorded upon arrival at an often hectic emergency department. These two aspects might explain why the participating hospitals do not yet include all patients. Other hip fracture audits that now have a 100% case ascertainment did not achieve this level in their second year (**Chapter 7**). The

case ascertainment in the DHFA increased from 58% to 71% in the second full year of registration and is likely to further improve in the coming years. This is because the required hip fracture quality indicators (see Introduction, Table 1) are now automatically calculated from the DHFA data, and their results can be directly sent to the two government institutions supervising the quality of care in the Netherlands. These two aspects may encourage hospitals to strive for a 100% case ascertainment.

- *Data completeness*. Although overall data completeness was 77% in the first full year of registration, this was 91% for the hospital data and only 30% for the 3-month follow-up data (**Chapter 7**). Most hip fracture audits worldwide apply a maximum follow-up of 30 days instead of 3 months [10,11]. Therefore, it seems reasonable to focus on the completeness of the DHFA hospital data when comparing data completeness between audits. The 91% score is acceptable compared to other hip fracture audits [12-14].

  The low 3-month follow-up data completeness is most likely due to the fact that patient contact at three months is now rarely part of the regular follow-up for hip fracture patients in the Netherlands. It is more common to see patients six weeks after the operation, if at all necessary, and depending on the patient's condition. To collect all the DHFA data, hospitals would have to change the post-discharge follow-up procedure by adding either an outpatient clinical consult or a telephone consult three months after discharge. The follow-up procedure is highly unlikely to be changed from six weeks to three months, but if a 3-month follow-up visit is introduced, it should not be restricted to collecting only the DHFA follow-up data. The Health and Youth Care Inspectorate (*Inspectie Gezondheidszorg en Jeugd* – IGJ), in line with the 'Multidisciplinary Treatment of Frail Elderly During Surgical Procedures' guideline, initiated the 3-month follow-up and considers this an appropriate moment for monitoring other issues as well (e.g. realization of rehabilitation goals, osteoporosis screening, fall prevention, mental health and social work) [15,16]. It is debatable whether a 3-month follow-up by the operating hospital is necessary for all hip fracture patients. In my opinion, a 3-month follow-up is useful for patients who were living independently before the fracture and thus have no care coordinator, such as the elderly care physician in a nursing home. If restricted to this group, the 3-month follow-up would only be needed for 60% of all hip fracture patients **(Chapter 7)**.

The percentage of participating hospitals and the degree of case ascertainment achieved by nationwide hip fracture audits are shown in Table 1. This puts the DHFA dataset completeness in an international perspective. To the best of our knowledge, apart from the DHFA, twelve national hip fracture audits are currently conducted worldwide [17-28]. Based on the most recent annual reports available at the time of writing, five audits had a 100% hospital participation rate, and only two audits had a 100% case ascertainment (see Table 1). Six hip fracture

audits, all running longer than the DHFA, outperformed the DHFA on nationwide hospital participation and case ascertainment. They, too, did not have a 100% dataset completeness in their second year. Compared to the two other nationwide audits started in 2016, the DHFA scores better. This suggests that a start-up period is common and that the DHFA has made good progress in terms of dataset completeness, but further action is needed.

*Table 1. Overview of current nationwide hip fracture audits worldwide*

| | Name of hip fracture audit | Country | Audit period | Year of annual report | Hospital participation | Case ascertainment |
|---|---|---|---|---|---|---|
| 1 | Rikshöft [29] | Sweden | 1988 – current | 2017 | 48 / 53 (91%) | 85% |
| 2 | Scottish Hip Fracture Audit (SHFA) [30] | Scotland | 1993 – 2008, 2016 – current | 2018 | 19 / 19 (100%) | 6,669 (93%) |
| 3 | Hip Fracture Database of the Performance, Effectiveness and Cost of Treatment Episodes project [19] | Finland | 1999 – current | No annual report | - | - |
| 4 | Danish Multidisciplinary Hip Fracture Registry [31] | Denmark | 2003 – current | 2018 | 25 / 25 (100%) | 6,679 (100%) |
| 5 | Norwegian Hip Fracture Register [32] | Norway | 2005 – current | 2018 | 45 / 45 (100%) | 9,212 (90%) |
| 6 | National Hip Fracture Database [33] | United Kingdom minus Scotland | 2007 – current | 2018 | 175 / 175 (100%) | 66,668 (100%) |
| 7 | Kaiser Permanente Hip Fracture Registry [34] | United States | 2009 – current | 2017 | No nationwide coverage | Unknown |
| 8 | Irish Hip Fracture Database [35] | Ireland | 2012 – current | 2017 | 16 / 16 (100%) | 3,497 (95%) |
| 9 | Gruppo Italiano di Ortogeriatria (GIOG) [36] | Italy | 2015 – current | No annual report | - | - |
| 10 | Australian and New Zealand Hip Fracture Registry [37] | Australia and New Zealand | 2016 – current | 2018 | 56 / 118 (47%) | 9,407 (41%) |
| 11 | AltersTraumaRegister [38] | Germany | 2016 – current | 2018 | 59 (% of total unknown) | 9,460 (% of total unknown) |
| 12 | Dutch Hip Fracture Audit [39] | Netherlands | 2016 – current | 2018 | 66 / 75 (88%) | 13,177 (71%) |
| 13 | Spanish National Hip Fracture Registry [40] | Spain | 2017 – current | 2017* | 54 / 505 (11%) | 7,208 (% of total unknown) |

* Patients included between January and October 2017

### *Accuracy of the DHFA dataset*

Alongside completeness, the accuracy of clinical audit data is also important. To verify data accuracy, the DHFA applies a dual data verification process. Internal data verification is performed by the hospital itself and is integrated in the audit web-based survey, as described in **Chapter 7**. In **Chapter 9**, the systematic external data verification process of seven nationwide Dutch surgical audits is described. Most discrepancies (due to missing or incorrectly recorded data) were found for the ASA score and postoperative complications **(Chapter 9)**. In the first full year of the DHFA, the ASA score was also among the variables most often missing (15.1%) **(Chapter 7)**. In the National Hip Fracture Database (United Kingdom minus Scotland), the ASA score is used as a case-mix variable [41]. When the ASA score collection is inaccurate, the results on risk-adjusted outcome indicators are questionable, as these may have been insufficiently adjusted for the hospitals' case-mix. External data verification at local hospital level in both the National Hip Fracture Database (United Kingdom minus Scotland) and the Irish Hip Fracture Database highlighted the need for data verification in hip fracture audits [42,43]. External data verification on the DHFA has not yet been performed.

## 10.2 Future perspectives

This thesis focuses on how to measure and evaluate the quality of in-hospital hip fracture care. Currently, the care process, which starts from the moment of the patient's fall and ends once the patient has regained optimal functional performance, is highly fragmented. A smooth transition from one phase of the care process to the next and close cooperation among all parties involved are essential to provide the best quality of care in each phase. In light of this, measuring and evaluating the quality of hip fracture care should start at the accident scene and should not stop after hospital discharge. The challenge for the future is that hip fracture care is evolving into a transmural chain of care ('*ketenzorg*'), and that the quality of care is measured and evaluated during all phases.

### *Measurement*

The next step in the measurement of the quality of in-hospital hip fracture care in the Netherlands is to use adequate outcome indicators. Before benchmarking hospitals on outcome indicators, it should be determined whether the case-mix differs between hospitals, as well as between the different types of hospital: non-teaching, teaching and university hospitals and high, intermediate and low-volume hospitals. If the patient populations are heterogeneous, a case-mix adjustment model has to be developed for comparing outcomes between hospitals. In addition, in order for outcome indicators to be *clinically relevant*, the event rate needs to be sufficient. As the event rate of most outcome indicators is low, random variation is high. The outcome indicators currently used by the two supervisory organizations in the Netherlands focus on the short-term reoperation rate. However, given the overall number of reoperations within 60 days (187 in 2018) and the event rate per hospital (ranging

from 0 to 14), it is questionable whether an accurate risk adjustment model can be built [44]. From this perspective, the future use of a composite outcome indicator ('textbook outcome') will be more *clinically relevant*, as it provides a more balanced insight into the quality of hip fracture care than an individual outcome indicator does.

Quality measurement as described in this thesis focuses on the measurements from a health care perspective. However, quality should also be evaluated from the patient's perspective. With Patient Reported Outcome Measures (PROMs), patients can report their self-perceived outcome of treatment and quality of life. Adding PROMs to audits that include elderly, frail patients seems challenging, but the Norwegian Hip Fracture Register proved it to be possible [45]. They used the EQ-5D questionnaire to measure general health-related quality of life and a visual analogue scale to measure pain, as a hip fracture-specific PROM was, and still is, not available. Within the DHFA, a project was started in July 2019 to develop a hip fracture-specific PROM that must be short and understandable for the elderly and frail population. This PROM should be collected during the whole transmural chain of care, in order to measure the quality throughout the chain of hip fracture care.

### *Evaluation*

To improve hospital participation in the DHFA, the registration load needs to be lowered. Currently, health care providers must first collect all data from the Electronic Health Record (*Elektronisch Patiëntendossier* – EPD) and subsequently copy it into the DHFA database. One way to decrease the registration load might be direct data registration ('*registratie aan de bron*') in the local hospital EPD and subsequent automatic data transfer from the EPD to the DHFA. This requires uniform data collection and storage at all hospitals. To this end, a nationwide multidisciplinary hip fracture pathway, incorporating all DHFA-relevant data, should first be developed and made available in EPDs at all hospitals.

The aim of the DHFA is to improve the quality of hip fracture care, which can be done in several ways with the data collected in the DHFA. First, audit data can be used to evaluate the quality of hip fracture care by combining quality measurement, monitoring of guideline adherence and quality assurance [46]. By providing continuous feedback on hospital performance and by benchmarking hospitals, targeted quality improvements can be made. Quality assurance is achieved by continuously monitoring the effect of improvement changes and checking whether an improvement is sustained. Second, the data can be used in outcome research, which aims to recognize patients at risk for adverse outcomes, to reveal the underlying mechanisms, and to identify processes of care that produce better outcomes. Future outcome research should amongst others aim to compare (i) low- versus high-volume hospitals, (ii) certified trauma surgeons versus certified orthopaedic surgeons, (iii) textbook process versus textbook outcome, (iv) orthogeriatric management for all patients aged 70 or older versus orthogeriatric management on indication, and (v) fracture prevention

versus no prevention. Third, the data can be used to develop new, and validate existing, prediction models. Prediction models can be used in daily practice to inform patients about the outcomes of care and can be a helpful tool in daily shared decision-making, for example concerning whether or not to operate. Fourth, the clinical data of the DHFA can also be linked to financial data, in order to enhance cost efficiency and maximize the value for patients as an initial step towards value-based health care. The current reimbursement model in health care stimulates volume rather than quality. With value-based health care, hospitals compete on quality, i.e. achieving the best outcomes at the lowest cost [47].

## 10.3 Conclusion

The results of this thesis show that, among the many hip fracture quality indicators, process and outcome indicators are most suitable for measuring the quality of hip fracture care through a clinical audit. In the start-up phase of a clinical audit, process indicators are more appropriate, as they provide more actionable feedback and do not require case-mix correction. However, individual process indicators often lack a proven association with outcome(s) of care and are non-discriminative in terms of detecting hospital variation. To create a process indicator that is both scientifically acceptable and clinically relevant, individual process indicators can be combined into a composite process quality indicator. However, the composite process indicator does not show where targeted quality improvements can be made. Therefore, the underlying individual process indicators can best be used alongside the textbook process indicator.

To use the DHFA to its full capacity as a quality improvement tool, the data entered into the DHFA dataset need to be more complete and more accurate. The main obstacle to achieving this is the organizational context, as participation involves a considerable registration load for hospital staff. The way to reduce the registration load is automated data collection.

To optimize hip fracture care, it must evolve into transmural chain care and must be measured and evaluated at this level.

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