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Effect of the Dutch Hip Fracture Audit implementation on mortality, length of hospital stay and time until surgery in elderly hip fracture patients; a multi-center cohort study

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ABSTRACT

Background: In 2040 the estimated number of people with a hip fracture in the Netherlands will be about 24,000. The medical care for this group of patients is complicated and challenging. Multidisciplinary approaches aim to improve clinical outcome. Quality indicators that gain insight in the treatment and outcome of hip fracture patients may help to optimize and monitor the standard of medical care. The Dutch Hip Fracture Audit (DHFA) is a new multidisciplinary quality indicator that is implemented in the Dutch hospitals in 2017.

Aim: The aim of this study was to determine the effect of the implementation of the DHFA on 30-day mortality, length of hospital stay and time until surgery in elderly with a hip fracture in the Netherlands.

Methods: A multicenter retrospective comparative cohort study was conducted and data were extracted from the Dutch Nationwide Trauma Registration (LTR). Included were patients aged 60 years and older with a hip fracture (femoral neck and trochanteric) and admitted in one of the ten participating hospitals registered in 2015 and 2017. Data from 2015, before implementation of DHFA, were compared with data from 2017, when the DHFA was implemented. The primary outcome was 30-day mortality; secondary outcomes were length of hospital stay and time until surgery. Multivariable regression models were used to compare outcomes between groups.

Results: 3808 patients were included, 1839 in the 2015 cohort and 1969 in the 2017 cohort. 29% was male; mean age 82 years. The multilevel analysis showed a positive non-significant difference between groups on the primary outcome30-day mortality (OR adjusted 1.23, 95%CI 0.93 - 1.63). The secondary outcomes length of hospital stay (adjusted effect estimates -0.002, 95%CI -0.03 - 0.03) and time until surgery (adjusted effect estimates 0.292, 95%CI -2.68 - 3.26) showed no differences between groups.

Conclusions: Implementation of the DHFA quality indicator does have a positive non-significant trend on 30-day mortality, but showed no impact on length of hospital stay and time until surgery. More research on relevant quality indicators seems therefore mandatory.

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Introduction

Hip fractures are common injuries in the elderly population and often caused by trauma, mostly a fall from the same height [1,2]. The number of elderlies in 2013 that were admitted with a hip fracture in the Netherlands was 13,000 (13%, incidence 9 out of 10,000) and is expected to almost double to 24,000 in 2040 [1,3–5]. In hip fracture patients the 30-day mortality may be as high as 10% and can be up to 30% after 1-year follow-up [6–8]. In view of the increasing incidence of hip fractures in the upcoming years [5,9], it is essential to optimize and improve medical care for this group of patients.

Multidisciplinary approaches, in which hip fracture patients are treated by a comprehensive multidisciplinary care team, have reported better outcomes in terms of mortality, length of hospital stay and time until surgery [7,10,11], compared to monodisciplinary usual care approaches [12–14]. As part of a multidisciplinary approach, a structural contribution of a geriatric team seems to reduce the in hospital and postoperative complications in hip fracture patients [15–17]. Though, further optimization seems mandatory, because there is still a one-year mortality rate of 23.2% in this population [13].

To further optimize treatment for hip fracture patients, the Dutch inspection of Healthcare has launched several quality indicators [18] that are mandatory to be measured and registered by health care professionals [19–22]. The aim of the quality indicators was to raise more awareness and the possibility of benchmarking, with consequently improving the care of hip fracture patients. More recently, in cooperation with the Dutch inspection for Healthcare, a new quality indicator registration tool, named The Dutch Hip Fracture Audit (DHFA) [23], was developed by trauma and orthopedic surgeons, clinical geriatrics and internists. This multidisciplinary quality registration, implemented in 2017, includes new items such as functionality (KATZ-6 ADL questionnaire), mobility (Pre fracture Mobility score; before admission), involved health care professionals (for example geriatrician, orthopedist, internist), present comorbidities at admission, complications after the operation (for example delirium, pneumonia, anemia, pressure ulcers, urinary tract infection)and monitoring the patients' outcome after discharge (KATZ-6 ADL questionnaire, mobility score after three months, survival status after three and twelve months, the present living environment, re-operation).

It is however unknown whether the implementation of the DHFA leads to an improvement of clinical outcome in hip fracture patients. Therefore, the aim of this present study is to determine the effect of the implementation of the DHFA on 30-day mortality, length of hospital stay and time until surgery in elderly patients with hip fractures in the Netherlands.

Methods

Study design

In this multicenter retrospective cohort study, data from the Dutch Nationwide Trauma Register (LTR) was used. The LTR includes data of all admitted trauma patients in the Netherlands (Appendix 1). For the present study registration data from ten hospitals in the Southwest of the Netherlands, counting one academic center and nine general hospitals, were used. Data from 2015, before implementation of the DHFA (Appendix 1) was compared with data from 2017, when DHFA was implemented. The DHFA was setup in April 2016 and fully operational in January 2017. The study was approved by the Medical Research Ethics Committee (MREC, Medische Ethische Toetsing Commissie (METC) in Dutch) of the Erasmus MC, University Medical Center Rotterdam (MEC-2018-1547).

Study population

Inclusion criteria for subjects in order to be included in the LTR database were defined as persons with an injury caused by trauma, presented at the Emergency Department (ED) within 48 h, due to the injury, admitted to the hospital or transferred to another hospital or died at the ED. Excluded are persons that are presented 48 h after trauma and are not admitted to the hospital by route of the ED. For the present study we included all patients from the LTR database, registered in 2015 and 2017. Patients were aged ≥ 60 years, with a hip fracture (femoral neck and trochanteric) Abbreviated Injury Scale 2005 (AIS) code 853161.3, 853162.3, 853151.3 or 853152.3 and admitted to one of the ten participating hospitals. Excluded were patients with a pathological hip fracture, bilateral hip fractures or peri prosthetic hip fracture, with a history of prosthesis or osteosynthesis at the fracture site and poly trauma patients. Also patients with additional injuries that might affect treatment or any of the clinical outcome measures will be excluded.

Study procedures and data collection

The LTR database registry was set up in 2007 and managed by the National Network of Acute Care (LNAZ). All hospitals in the region Southwest Netherlands selected patients that were considered eligible for the LTR and delivered the data to the Trauma Center Southwest Netherlands (TCZWN). The data managers of the TCZWN used, in order to complete all necessary LTR variables, patients' electronic medical records, radiology reports, ED registrations and medical correspondences, following the prescribed regulations of the LTR.

Registered patient characteristics include age (years) and sex (male/female). The American Society of Anesthesiology (ASA) classification, graded 1 to 5, was used as a measure of comorbidity and pre-operative diseases [24]. The anatomic type of hip fracture (femoral and trochanter) was also registered. In-hospital characteristics registered include Intensive Care Unit (ICU) length of stay and discharge destination ('own living environment', 'nursing environment', 'other hospital', 'died in the institution', 'other'). The Glasgow Outcome Scale (GOS) was used as a global scale for functional outcome that rates patient status, divided into one of the following five categories: 'dead', 'vegetative state', 'severe disability', 'moderate disability', 'good recovery' [25]. Additionally, level of hospital stay ('ED', 'nursing ward', 'operation room', 'medium care/high care unit', 'intensive care unit'), in-hospital mortality (yes/no), hospital name and hospital trauma level (one to three) were registered. For the present study the data managers of the TCZWN selected and exported the LTR data, from the years 2015 and 2017 of the patients that met the inclusion criteria, into a SPSS file.

Outcome

The primary outcome is 30-day mortality defined as: died within 30 days from the day and time of presentation on the ED. Follow-up visit after at least 30 days recorded as 'shown', was registered as not died within 30 days. The outcome was missing for those registered as 'unknown', when no report of death or follow-up visit beyond 30 days was registered.

The secondary outcome measures include length of hospital stay and time until surgery. Length of stay is defined as the total hospital stay in days from admission to discharge from hospital.

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Time until surgery is defined as time between presentation at the ED and the start time of the operation, expressed in hours.

Statistical analysis

Statistical analyses were performed in SPSS version 22 or higher and statistical significance is set at $p<0.05$. Descriptive statistics were used to describe the baseline and in-hospital characteristics of the 2015 and 2017 cohorts. Continuous variables are presented as means with standard deviations (SD) or if not normally distributed (Shapiro-Wilk test) as median with Inter Quartile Range (IQR). The categorical, nominal variables were presented as frequency counts with percentages.

Differences in characteristics between the two study groups were analyzed using a chi-square test for categorical variables, a parametric *t*-test for normally distributed continuous variables and a Mann-Whitney U test for not normally distributed continuous variables.

Shapiro-Wilk test was used to test the normality of data of the secondary outcomes. As a consequence, the secondary outcomes length of hospital stay and time until surgery were transformed for further analysis with a log transformation to obtained normality of data.

First, for the primary outcome, 30-day mortality, unadjusted logistic regression analysis was used to test the crude difference between study groups. Effects were expressed using Odds Ratios (OR) and Beta's with accompanied 95% Confidence Intervals (CI).

Multilevel regression analysis, with a random-effects logistic model, was used to estimate the magnitude of the effect of the group difference (cohort 2015 and 2017) with the individuals nested within each hospital on 30 day mortality, adjusted for sex, age and ASA classification. Confounders considered to be included in the multivariate analysis were sex and age (based on literature) and patient characteristics that differed between groups (cut-off $p<0.05$). Effects were expressed in OR with 95%CIs.

For the secondary outcomes, i.e. length of hospital stay and time until surgery, unadjusted analyses using linear regression were applied to test crude differences between study groups. Adjusted for sex, age, ASA classification a linear mixed model analysis was used to estimate the magnitude of the effects of the group difference (cohort 2015 versus 2017) on the secondary outcomes. Results were expressed as effect estimate (ES) with accompanying 95%CIs. All analyses were performed in SPSS version 22 or higher and statistical significance is set at $p<0.05$.

Results

A total of 10.248 trauma patients were registered in the LTR in 2015 and 10.239 in 2017. There were 3808 eligible hip fracture patients included in this cohort study, 1839 for the 2015 cohort and 1969 for the 2017 cohort.

Baseline characteristics of both cohorts are presented in Table 1. The total study population included 1115 (29%) males, had an average age of 82 (SD 8.9) years, 69% had a mild systemic disease and 56% had a femoral neck fracture.

Both populations significantly differed from each other on the ASA classification ($p < 0.001$). The post-hoc z-test on the adjusted residuals with Bonferroni correction showed a significantly higher percentage (73.8% cohort 2015 versus 63.6% cohort 2017; $p < 0.001$) for 'mild systemic disease' and 'severe systemic disease' (26.9% cohort 2017 versus 18.3% cohort 2017; $p < 0.001$).

As presented in Table 3, the primary outcome 30-day mortality was 7.4% ($n = 137$) in the 2015 cohort and 6.6% ($n = 130$) in the 2017 cohort. The adjusted generalized mixed model analysis showed a positive non-significant trend between study groups (OR adjusted 1.23, 95%CI 0.98 - 1.56).

The primary outcome status of 944 patients was 'unknown' and therefore defined as missing (429 in cohort 2015 and 515 in cohort 2017; a total of 24.8%). The group with a primary outcome available included significantly more males ($p = 0.02$), was slightly older ($p < 0.01$) and was significantly more admitted in a level 1 and 2 hospital ($p < 0.001$), compared to patients of which the primary outcome was missing (Appendix 2).

No differences were seen in length of hospital stay and time until surgery between cohorts; 8.0 (SD 4.9) versus 8.1 (SD 5.3) days for hospital stay, 22.2 (SD 21.1) versus 22.6 (SD 21.4) hours for the time until surgery (Table 3). Both crude and the adjusted linear mixed model analysis showed no differences between groups; ES −0.002, 95%CI −0.03 - 0.03 and ES 0.292, 95%CI −2.68 – 3.26, respectively.

The in-hospital characteristics between the two cohorts are presented in Table 2. There was a significant difference in the discharge destination ($p < 0.001$), with post-hoc z-test on the adjusted residuals with Bonferroni correction showing a significantly higher percentage (63.7% cohort 2015 versus 45.5% cohort 2017; $p < 0.001$) for 'nursing environment', 'rehabilitation center' (21.1% cohort 2017 versus 2.9% cohort 2015; $p < 0.001$) and 'other hospital' (2.8% cohort 2017 versus 1.3% 2015; $p = 0.009$). Further, the level of hospital stay showed a significant difference ($p = 0.002$) between study groups, with post-hoc z-test on the adjusted residuals with Bonferroni correction showing a significantly higher percentage (2.2% cohort 2017 versus 0.7% cohort 2015; $p < 0.001$) for 'Emergency Department'. The GOS also significantly differed between the cohorts ($p < 0.001$), post-hoc z-test on the adjusted residuals with Bonferroni correction showed a significantly higher percentage (5.8% cohort 2017 versus 2.2% cohort 2015; $p < 0.001$) for 'severe disability' and 'unknown' (0,9% cohort 2015 versus 0,2% cohort 2017; $p = 0.001$). The other in-hospital characteristics showed no significant differences between study groups.

Discussion

This study investigated the effect of the implementation of the performance quality indicator DHFA for the care of elderly hip fracture patients in the Netherlands, region Southwest. The study compared two cohorts of hip fracture patients before and after implementation of the multidisciplinary quality indicator, the DHFA. Differences between both study groups were found on the primary outcome 30-day mortality (7.4% versus 6.6%), which is comparable to mortality found in other studies ((7, 8, 17). No differences were found between the two cohorts on the secondary outcomes, i.e. length of hospital stay and time to surgery.

The development and expenditure of quality indicators (QI), in order to measure and improve quality of care of elderly hip fracture patients, has significantly increased the past years [19]. In the Netherlands, the DHFA is a mandatory QI and above this, hospitals have a financial obligation to the DICA (Dutch Institute for Clinical Audit) for entry to the DHFA registration. So, hospitals do not only have to invest time and manpower for the registry, but there is also an additional financial investment. It is therefore especially important to have evidence on the effectiveness of the registry of QIs for hip fracture patients. Though, studies that investigate the impact of an implementation of QIs, such as the DHFA, are rare; therefore knowledge is limited [20]. For that reason, the aim of this study was to examine if the DHFA could positively impact the 30-day mortality of hip fracture patients. This study showed that the DHFA registry has a positive, though non-significant, impact on 30-day mortality, with a 0.8% difference between groups.

To our knowledge, this is the first study comparing two cohorts of hip fracture patients before and after the implementation of a quality indicator registration. It is therefore hard to compare these results with available literature. Most studies per-

Table 1
Baseline characteristics of study population ($N = 3808$).

Characteristic	Total study population $N = 3808$	Cohort 2015 $n = 1839$	Cohort 2017 $n = 1969$	P-value
Sex (Male), n (%)	1115 (29.3%)	513 (27.9%)	602 (30.6%)	0.070
Age, mean ± SD	81.8 (8.9)	82.1 (8.9)	81.6 (9.0)	0.170
ASA classification, n (%)				<0.001
A normal healthy patient	212 (5.6%)	93 (5.1%)	119 (6.0%)	
A patient with mild systemic disease[a]	2612 (68.6%)	1358 (73.8%)	1254 (63.6%)	<0.001
A patient with severe systemic disease[a]	865 (22.7%)	336 (18.3%)	524 (26.9%)	<0.001
A patient with severe systemic disease, that is a constant threat to life	97 (2.5%)	45 (2.4%)	52 (2.6%)	
A moribund patient who is not expected to survive without an operation	–	–	–	
Unknown	22 (0.6%)	7 (0.4%)	15 (0.8%)	
Type of hip fracture, n (%)				0.125
Femoral Neck	2140 (56.2%)	1041 (56.6%)	1099 (55.8%)	
Trochanteric Intertrochanteric	1668 (43.8%)	798 (43.4%)	870 (44.2%)	

ASA, American Society of Anesthesiologists Physical Status classification.
[a] Significant difference ($p<0.05$) with a post-hoc z-test on the adjusted residuals with Bonferroni correction.

Table 2
In-hospital characteristics of study population ($N = 3808$).

Characteristics	Total study population $N = 3808$	Cohort 2015 $n = 1839$	Cohort 2017 $n = 1969$	P-value
ICU length of hospital stay (days), n (%)	421 (11.1%)	220 (12.0%)	200 (10.2%)	0.078
Discharge destination, n (%)				<0.001
Own living environment	980 (25.7%)	476 (25.9%)	504 (25.6%)	
Nursing environment[a]	2067 (54.3%)	1172 (63.8%)	895 (45.6%)	<0.001
Rehabilitation center[a]	470 (12.3%)	54 (2.9%)	416 (21.1)	<0.001
Other hospital[a]	80 (2.1%)	24 (1.3%)	56 (2.8%)	0.009
Died in the institution	130 (3.4%)	70 (3.8%)	60 (3.0%)	
Other	68 (1.9%)	33 (1.8%)	35 (1.7%)	
Unknown	13 (0.3%)	10 (0.5%)	3 (0.2%)	
GOS, n (%)				<0.001
Dead	131 (3.4%)	71 (3.9%)	60 (3.0%)	
Vegetative state	3 (0.1%)	1 (0.1%)	2 (0.1%)	
Severe disability[a]	156 (4.1%)	41 (2.2%)	115 (5.8%)	<0.001
Moderate disability	3407 (89.5%)	1655 (90.0%)	1752 (89.0%)	
Good recovery	91 (2.4%)	54 (2.9%)	37 (1.9%)	
Unknown[a]	20 (0.5%)	17 (0.9%)	3 (0.2%)	0.001
Level of hospital stay, n (%)				0.004
ED[a]	56 (1.5%)	13 (0.7%)	43 (2.2%)	0.002
Nursing ward	192 (5.0%)	92 (5.1%)	100 (5.1%)	
Operation Room	3133 (82.3%)	1510 (82.1%)	1623 (82.4%)	
MC/HC unit	158 (4.1%)	85 (4.6%)	73 (3.7%)	
ICU	262 (6.9%)	135 (7.3%)	127 (6.4%)	
Unknown	7 (0.2%)	4 (0.2%)	3 (0.2%)	
In-hospital mortality, n (%)	130 (3,4%)	70 (3.8%)	60 (3.0%)	
Hospital name, n (%)				0.084
Erasmus MC	79 (2.1%)	39 (2.1%)	40 (2.0%)	
Admiraal De Ruyter Hospital	611 (16.1%)	303 (16.5%)	308 (15.6%)	
Ikazia Hospital	416 (10.9%)	207 (11.4%)	209 (10.6%)	
Maasstad Hospital	498 (13.1%)	254 (13.8%)	244 (12.4%)	
Franciscus Hospital	321 (8.4%)	137 (7.4%)	184 (9.3%)	
Albert Schweitzer Hospital	660 (17.3%)	293 (15.9%)	367 (18.6%)	
Het Van Weel-Bethesda Hospital	261 (6.9%)	129 (7.0%)	132 (6.7%)	
IJsselland Hospital	378 (9.9%)	186 (10.1%)	192 (9.8%)	
ZorgSaam Zeeuws-Vlaanderen Hospital	247 (6.5%)	111 (6.0%)	136 (6.9%)	
Franciscus Vlietland Hospital	337 (8.8%)	180 (9.8%)	157 (8.1%)	
Hospital trauma level, n (%)				0.347
Trauma level 1	79 (2.1%)	39 (2.1%)	40 (2.0%)	
Trauma level 2	2090 (54.9%)	987 (53.7%)	1103 (56.0%)	
Trauma level 3	1639 (43.0%)	813 (44.2%)	826 (42.0%)	

Abbreviations: GOS, Glasgow Outcome Scale, a global scale for functional outcome that rates patient status into one of five categories; ED, Emergency Department; MC, Medium Care Unit; HC, High Care Unit; ICU, Intensive Care Unit.
[a] Significant difference ($p<0.05$) with a post-hoc z-test on the adjusted residuals with Bonferroni correction.

formed in hip fracture patients have investigated the effectiveness of multidisciplinary pathways and compared these with usual care [7,8,10,17]. These studies often showed an effect on process outcomes as length of hospital stay and time to surgery. However, the effects found on the outcome mortality (30 days or one year) were more various [7,8,17]. Given the fact that hospitals are more and more expected to register QIs and to financially invest in this registration, more research in the effectiveness seems mandatory in order to prove the effectiveness of these registrations on primary outcome as mortality and length of hospital stay.

A recent review on quality indicators of hip fracture care identified 97 unique quality indicators that were divided in structure, process and outcome indicators [20]. Of these, one structure and ten process indicators were correlated with various outcomes measures. Some of these, such as orthogeriatric management during admission and time to surgery within a specific time frame, are also included in the DHFA. Though, the authors do state that the

Table 3
Differences between the cohorts 2015 and 2017 on the primary[b] and secondary outcome measures.

	Cohort 2015 $n = 1412$	Cohort 2017 $n = 1453$	Odds Radio (95% CI)	P-value	Odds Radio (95% CI)[a]	P-value[a]
Primary outcome 30-day mortality, n (%)	137 (7.4%)	130 (6.6%)	1.096 (0.85 - 1.41)	0.476	1.23 (0.93 - 1.63)	0.139
	Cohort 2015 $n = 1839$	Cohort 2017 $n = 1969$	Beta (95%CI)	p-value	Effect estimate (95% CI)[a]	P-value[a]
Secondary outcomes Length of hospital stay (days), mean ± SD	8.1 (4.9)	8.1 (5.3)	−0.007 (−0.03 - 0.01)	0.407	−0.002 (−0.03 - 0.03)	0.868
	Cohort 2015 $n = 1731$	Cohort 2017 $n = 1807$	Beta (95%CI)	p-value	Effect estimate (95% CI)[a]	P-value[a]
Time until surgery (hours), mean ± SD	22.2 (21.1)	22.6 (21.4)	−0.009 (−0.04 - 0.02)	0.497	0.292 (−2.68 - 3.26)	0.826

[a] multilevel analysis (hospital name as level) with adjustment for sex, age and ASA classification.
[b] analysis of the complete cases dataset.

methodological quality of studies investigating QIs of hip fracture care was lacking. Perhaps even more important, there is a huge variability in definitions used for QIs [20,22]. As a consequence, it is difficult to decide how QIs should be defined in order to evaluate the quality care of hip fracture patients. Moreover, the value of QIs as instruments for the evaluation and improvement of hip fracture care has yet to be ascertained [20]. Therefore, more insight in QIs and its association with outcomes of interest is necessary, as this may contribute to a further optimized DHFA in order to improve quality of care.

Strengths and limitations

To the best of our knowledge, a study to investigate the effects of the implementation of the DHFA on 30-day mortality in hip fracture patients has not been done yet been. With the use of the LTR database we were able to identify more than 3800 hip fracture patients that were divided over two-year cohorts. With the applied mixed model multilevel analysis, we were able to present a first insight of the effects of the DHFA implementation. There were, however also limitations attached to this study design. First of all, data were collected from medical file records and we were therefore dependent on the quality of the administrative data delivered. As a consequence, there were confounding factors, such as specific comorbidities [11] that are known to impact the outcome of hip fracture patients, but not registered in the database.

Secondly, the two cohorts were comparable with respect to sex, age and type of fracture. However, a significant difference was found on the ASA classification. Patients in cohort 2017 had significantly more registered severe systemic diseases compared to patients from cohort 2015 (26.9% versus 18.3%). This difference in ASA classification may have been the result of more experience and knowledge in the registration process, as this was introduced in 2015. Though, all presented analysis was adjusted for this potential confounder.

Thirdly, if you look at the time between the 2015 cohort and the implementation of the DHFA, this is a relative short period. The first period of the implementation is characterized by monitoring and evaluation of the present care for hip fracture patients. After evaluation, a possible adjustment of care has to be implemented, what could affect the outcome. Also regarding the event rates, which are low, a power problem could have been introduced, so any reservations towards the results must be considered.

Finally, there was missing data on the primary outcome in almost 25% of the selected subjects. Though, sensitivity analysis using imputed data showed no differences on the primary outcome between the complete case analysis and pooled analysis using imputed data.

Recommendations for future research

Based on the findings of this study, more research seems mandatory on the association between quality indicators that are currently advocated in literature and clinical practice, and outcomes of interest such as mortality and length of hospital stay. This may contribute to a further improvement of care for hip fracture patients. For further research we will extend this study with the same design and with additive clinical outcomes. Moreover, future research, defined as cohort studies, should focus on individual and sets of patients' characteristics registered that do actually improve the outcome of patients. This may be possible by combing LTR data with medical file records of patients in order to get a better view on prognostic factors of patients.

Conclusion

This comparative cohort study has given a first insight in the effect of implementation of the DHFA on 30-day mortality in elderly hip fracture patients in the Netherlands. The case that the implementation of the DHFA presented a positive non-significant trend on this clinical outcome is a base for further research. This should focus on specific quality indicators and its association with relevant patient outcomes since knowledge on (relevant) quality indicators is limited.

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Declaration of Competing Interest

None.

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Appendix 1

Dutch Hip Fracture Audit (DHFA)

Inclusion

All adult patients, who are treated (conservative or operative) for a hip fracture in a hospital (also for a conservative treatment at the ED).

Exclusion

Patients with a pathological hip fracture (due to a metastasis of a maligned disease).

Patients with a peri–prosthetic hip fracture (fracture around the prothesis or osteosynthesis).

Appendix 2

Differences between patients ($N = 3808$) with a primary outcome (30-day mortality) available ($n = 2864$; 75.2%) versus patients of whom the primary outcome was missing ($n = 944$; 28.4%).

Characteristics	Primary outcome available $n = 2864$ (75.2%)	Primary outcome not available $n = 944$ (24.8%)	P-value
Sex (Male), n (%)	867 (30.3%)	248 (26.3%)	0.021
Age, mean ± SD	83.3 (8.9)	81.4 (8.9)	<0.001
ASA classification, n (%)			0.002
A normal healthy patient	169 (5.9%)	43 (4.6%)	
A patient with mild systemic disease	1965 (68.6%)	647 (68.5%)	
A patient with severe systemic disease	628 (22.0%)	237 (25.1%)	
A patient with severe systemic disease, that is a constant threat to life	86 (3.0%)	11 (1.2%)	
A moribund patient who is not expected to survive without an operation	–	–	
Unknown	16 (0.6%)	6 (0.6%)	
Type of hip fracture (Femoral Neck), n (%)	1588 (55.4%)	552 (58.5%)	0.104
Time until surgery (hours), mean ± SD	22.8 (21.5)	21.1 (20.7)	0.002
Length of hospital stay (days), mean ± SD	8.4 (5.3)	7.2 (4.4)	<0.001
ICU length of hospital stay (days), n (%)			<0.001
1 day	214 (7.5%)	38 (4.0%)	
2 days	97 (3.4%)	17 (1.8%)	
3 – 7 days	45 (1.6%)	8 (0.8%)	
8- 14 days	2 (0.1%)	–	
>15 days	–	–	
Discharge destination, n (%)			
Own living environment	777 (27.1%)	203 (21.5%)	<0.001
Nursing environment	1525 (53.2%)	542 (57.5%)	
Rehabilitation center	345 (12.0%)	125 (13.2%)	
Other hospital	34 (1.2%)	46 (4.9%)	
Died in the institution	130 (4.5%)	–	
Other	45 (1.7%)	23 (2.4%)	
Unknown	8 (0.3%)	5 (0.5%)	
GOS, n (%)			<0.001
Dead	131 (4.6%)	–	
Vegetative state	3 (0.1%)	–	
Severe disability	110 (3.8%)	46 (4.9%)	
Moderate disability	2558 (89.4%)	849 (89.9%)	
Good recovery	52 (1.8)	39 (4.1%)	
Unknown	10 (0.3%)	10 (1.1%)	
Level of hospital stay, n (%)			<0.001
ED	29 (1.0%)	27 (2.9%)	
Nursing ward	138 (4.8%)	54 (5.7%)	
Operation Room	2337 (81.7%)	796 (84.3%)	
MC/HC unit	141 (4.9%)	17 (1.8%)	
ICU	216 (7.5%)	46 (4.9%)	
Unknown	3 (0.1%)	4 (0.4%)	
Hospital name, n (%)			<0.001
Erasmus MC	64 (2.2%)	15 (1.6%)	
Admiraal de Ruyter Hospital	465 (16.2%)	146 (15.5%)	
Ikazia Hospital	315 (11.0%)	101 (10.7%)	
Maasstad Hospital	421 (14.7%)	77 (8.2%)	
Franciscus Hospital	229 (8.0%)	92 (9.7%)	
Albert Schweitzer Hospital	503 (17.6%)	157 (16.6%)	
Het Van Weel-Bethesda Hospital	229 (8.0%)	32 (3.4%)	
ZorgSaam Zeeuws-Vlaanderen Hospital	215 (7.5%)	32 (3.4%)	
IJsselland Hospital	185 (6.5%)	193 (20.4%)	
Franciscus Vlietland Hospital	238 (8.3%)	99 (10.5%)	
Hospital trauma level, n (%)			<0.001
Trauma level 1	64 (2.2%)	15 (1.6%)	
Trauma level 2	1618 (56.5%)	472 (50.0%)	
Trauma level 3	1182 (41.3%)	457 (48.4%)	

(*continued on next page*)

Abbreviations: ASA, American Society of Anesthesiologists Physical Status classification; ICU, Intensive Care Unit; GOS, Glasgow Outcome Scale, a global scale for functional outcome that rates patient status into one of five categories; ED, Emergency Department; MC, Medium Care unit; HC, High Care unit.

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