Management of Hip Fractures in The Elderly: Timing of Surgical Intervention

Performance Measure

Technical Report

Adopted by the American Academy of Orthopaedic Surgeons

Board of Directors

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Contents

Executive Summary

This report presents one quality measure related to management of hip fractures in the elderly.

- Hip fractures: Timing of Surgical Intervention

This report presents the measure specifications and analytic results. Included are the rationale for each measure and the specific proposed technical approach to each measure.

BURDEN OF DISEASE

The economic burden of managing elderly hip fractures was estimated at $17-20 billion in 2010.[M1, M2]

A typical patient with a hip fracture spends US $40,000 in the first year following hip fracture for direct medical costs and almost $5,000 in subsequent years.

Costs to be considered include:

1. Direct Medical Cost
2. Long-term Medical Cost
3. Home Modification Costs
4. Nursing Home Costs

ETIOLOGY

Hip fractures in the elderly are the result of low energy trauma and often are associated with osteoporosis/low bone mass and other associated medical conditions that may increase the prevalence of falls.

INCIDENCE AND PREVALENCE

There was an estimated 340,000 hip fracture patients per year in United States in 1996 with most fractures occurring in women older than age 65 years, and an annual worldwide incidence of approximately 1.7 million.[M1, M7]

Between 1986 and 2005, the annual mean number of hip fractures was 957.3 per 100,000 (95% confidence interval [CI], 921.7-992.9) for women and 414.4 per 100 000 (95% CI, 401.6-427.3) for men.[M1]

With rising life expectancy, the number of elderly individuals and those with chronic health conditions is increasing and it is estimated that the prevalence of hip fractures will continue to increase. The number of people older than age 65 years is expected to increase from 37.1 million to 77.2 million by the year 2040, and the occurrence of hip fractures is expected increase concomitantly, with an estimated 6.3 million hip fractures predicted worldwide by 2050.[M7]

Work Group Composition

Solicitation of the work group members was done through medical societies and research organizations that have a relevant interest in the selected topic, commonly treat/interact with patients who receive the procedure, or have particular expertise in measure development. This project's workgroup consisted of seventeen individuals.

Roster

1. **Timothy Brox, MD - *Oversight Chair***

2. **Steven Olson, MD – *Chair***
   Orthopaedic Trauma Association

3. **David B. Carmack, MD**
   American Academy of Orthopaedic Surgeons

4. **Charles M. Davis III, MD**
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5. **Eitan Dickman, MD**
   American College of Emergency Physicians

6. **Daniel Ari Mendelson, MS, MD, FACP, AGSF, CMD**
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8. **Arvind D. Nana, MD**
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   American Academy of Orthopaedic Surgeons/ U.S. Bone and Joint Initiative

10. **Stephen L. Kates, MD**
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11. **James F. Kellam, MD**
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12. **Douglas W. Lundy, MD**
    Orthopaedic Trauma Association

13. **Kevin Means, MD**
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14. **Simon Mears, MD**
    American Academy of Orthopaedic Surgeons

15. **Colleen Walsh, DNP, RN**
    Representative of National Association of Orthopaedic Nurses

16. **Douglas M. White, DPT**
    Representative of American Physical Therapy Association

17. **Douglas G. Wright, MD**
    Representative of American Academy of Orthopaedic Surgeons

Methods

This measure was developed by following the American Academy of Orthopaedic Surgeons' performance measures methodology: https://www.aaos.org/uploadedFiles/PreProduction/Quality/Measures/PM%20Methodology%20Final%20-%20July%202017.pdf

Evidence Base

The quality measure in this document is based directly on the American Academy of Orthopaedic Surgeons Management of Hip Fractures in the Elderly Clinical Practice Guideline, published in 2014.

Prior to performing the literature search for this guideline, both patients and payors were surveyed for topics of interest related to the management of hip fractures in the elderly. These responses helped inform the PICO development by the workgroup. All PICO questions and inclusion criteria were developed a priori. AAOS staff trained in research methodology conducted a comprehensive systematic literature review, and final recommendations were developed by a panel of experts. The workgroup that created these final recommendations is separate from the one that evaluated these quality measures. All included articles underwent study design quality appraisal, which assessed risks of bias/confounders that may skew the study's results. Only the best available evidence was considered for inclusion in recommendations.

Requirements for the strength of recommendation are listed below as Table 1.

Table 1. Strength of Recommendation Descriptions

Strength	Overall Strength of Evidence	Description of Evidence Quality	Strength Visual
Strong	Strong	Evidence from two or more "High" quality studies with consistent findings for recommending for or against the intervention.	
Moderate	Moderate	Evidence from two or more "Moderate" quality studies with consistent findings, or evidence from a single "High" quality study for recommending for or against the intervention.	
Limited	Low Strength Evidence or Conflicting Evidence	Evidence from one or more "Low" quality studies with consistent findings **or** evidence from a single "Moderate" quality study recommending for against the intervention or diagnostic or the evidence is insufficient or conflicting and does not allow a recommendation for or against the intervention.	
Consensus*	No Evidence	There is no supporting evidence. In the absence of reliable evidence, the guideline work group is making a recommendation based on their clinical opinion. Consensus statements are published in a separate, complimentary document.	

Detailed methodology for guideline development can be found at: https://www.aaos.org/uploadedFiles/PreProduction/Quality/Guidelines_and_Reviews/guidelines/Guideline%20and%20Systematic%20Review%20Processes_v2.0_Final.pdf.

Hip Fractures: Timing of Surgical Intervention

Measure Specifications

2018 Options for Individual Measures:
Claims, EMR, Registry

Measure Type:
Process

Description:
Percentage of patients (65 years and older) who present to the emergency department with a hip fracture receive surgical intervention within 48 hours of admission to the hospital.

Instructions:
This measure is to be reported at **each denominator eligible visit** occurring during the reporting period for patients age 65 or older admitted to the hospital with a low energy hip fracture during the reporting period. This measure may be reported by eligible clinicians who perform the quality actions described in the measure based on the services provided and the measure-specific denominator coding.

Measure Reporting:
The listed denominator criteria are used to identify the intended patient population. The numerator quality-data codes included in this specification are used to submit the quality actions allowed by the measure. All measure-specific coding should be reported on the claim(s) representing the eligible encounter. This measure is designed to be reported at the group/practice, hospital/facility/agency, or regional level.

Denominator:
Number of patients age 65 or older admitted to the hospital with a low energy hip fracture

Denominator Criteria (Eligible Cases):
ICD-10-CM: S72.00, S72.001, S72.002, S72.009, S72.01, S72.011, S72.012, S72.019, S72.02, S72.03, S72.032, S72.033, S72.034, S72.035, S72.036, S72.04, S72.041, S72.042, S72.043, S72.044, S72.045, S72.046, S72.05, S72.051, S72.052, S72.059, S72.060, S72.09, S72.091, S72.092, S72.099, S72.136, S72.14, S72.141, S72.143, S72.144, S72.145, S72.1346, S72.2, S72.21, S72.22, S72.23, S72.24, S72.25, S72.26
OR
ICD-9-CM: 820.8, 820, 820.02, 820.03, 820.09, 820.2, 820.21, 820.22

Numerator:
Number of patients in the denominator who are operated on within 48 hours of admission to the hospital.

Numerator Criteria (Eligible Cases):

CPT: 27235, 27236, 27244, 27245, 27248, 27254, 27269

Exclusions:
Patients that can be classified as having the following: non-operative fractures, multiple injuries, periprosthetic fracture, high energy trauma, and or meet local criteria for multiple trauma designation

Evidence-Based Recommendation:
Moderate evidence supports that hip fracture surgery within 48 hours of admission is associated with better outcomes.

Rationale
Nine moderate strength studies evaluated patient outcomes in relation to timing of hip fracture surgery (Elliot et al 25, Fox et al 26, McGuire et al 27, Moran et al 28, Novack et al 29, Orosz et al 30, Parker et al 31, Radcliff et al 32, Siegmeth et al 33). In many of these studies the presence of increased comorbidities represented a confounding effect, and therefore delays for medical reasons were often excluded.

The majority of studies favored improved outcomes in regards to mortality, pain, complications, or length of stay (Elliot et al 25, McGuire et al 27, Novack et al 29, Orosz et al 30, Parker et al 31, and Siegmeth et al 33). Although several studies showed a benefit of surgery within 48 hours, one study showed no harm with a delay up to four days for patients fit for surgery who were not delayed for medical reasons (Moran et al 28). Patients delayed due to medical reasons had the highest mortality and it is this subset of patients that could potentially benefit the most from earlier surgery.

Risks and Harms of Implementing this Recommendation
There are no known harms associated with implementing this recommendation.

Validity

Validity testing focuses on systematic errors and bias. It involves testing agreement between the data elements obtained when implementing the measure as specified and data from another source of known accuracy. Validity of computed measure scores involves testing hypotheses of relationships between the computed measure scores as specified and other known measures of quality or conceptually related aspects of quality. A variety of approaches can provide some evidence for validity. The specific terms and definitions used for validity may vary by discipline, including face, content, construct, criterion, concurrent, predictive, convergent, or discriminant validity.

The validity of this measure comes from a combination of a strong basis in literature, by way of a systematic literature review conducted for a clinical practice guideline, and the face validity vote of a panel of experts. This independent clinician group consisted of the Evidence-based Quality, Value, and Safety Committee from the Orthopaedic Trauma Association, a distinct entity from the American Academy of Orthopaedic Surgeons. The committee was provided with the measure description, specifications, evidence-base, and included data elements, and asked the direct question: “Could a low computed performance measure score (i.e. time to surgery consistently exceeding 48 hours) be used to identify poor care and subsequently distinguish between appropriate and poor-quality care?” This committee affirmed face validity based on the provided materials.

Clinical Data

The Measure was specified to include all patients who present to the ED with a low energy hip fracture requiring operative care. The population is derived from the most recent year of the 5% carrier files from the 5 years of the patient files from The Cleveland Clinic. The Cleveland Clinic Data represents all the Hip Fracture Patients from 2012 through 2016 (Table 2).

Table 2. Description of Cleveland Clinic Data Files

Year	Cleveland Clinic Data	Size
2012	Hip Fracture Patients	N=447
2013	Hip Fracture Patients	N=469
2014	Hip Fracture Patients	N=425
2015	Hip Fracture Patients	N=470
2016	Hip Fracture Patients	N=528

Reliability

Reliability was calculated according to the methods outlined in a technical report prepared by J.L. Adams titled "The Reliability of Provider Profiling: A Tutorial" (RAND Corporation, TR-653-NCQA, 2009). In this context, reliability represents the ability of a measure to confidently distinguish the performance of one physician from another. As discussed in the report: "Conceptually, it is the ratio of signal to noise. The signal in this case is the proportion of variability in measured performance that can be explained by real differences in performance. There are 3 main drivers of reliability; sample size, differences between physicians, and measurement error."

According to this approach, reliability is estimated with a beta-binomial model. The beta-binomial model is appropriate for measuring the reliability of pass/fail measures such as those proposed.

Physician specific reliability is around .9 for each year, and thus can be considered to be good. Reliability scores vary from 0.0 to 1.0, with a score of zero indicating that all variation is attributable to measurement error (noise, or variation across patients within providers) whereas a reliability of 1.0 implies that all variation is caused by real difference in performance across accountable entities. There is not a clear cut-off for minimum reliability level. Values of 0.7, however, are considered sufficient to see differences between some physicians and the mean (see RAND tutorial, 2009). The Results of the Signal to Noise analysis can be found in Table 3 for Timing to Surgery.

Table 3. Reliability Statistics from the Signal to Noise Analysis: Timing to Surgery

Year	# of Physicians	Reliability Statistic from signal-to-noise analysis (95% Cl)
2012	69	.88 (.85,.91)
2013	69	.89 (.85,.92)

2014	59	.91 (.88,.95)
2015	59	.91 (.88,.93)
2016	52	.90 (.87,.93)

Performance Gap

This candidate measure shows a moderately high overall computed compliance rate in our sample dataset, derived from the Cleveland Clinic with individual physicians' means ranging from .89 to .94 for the years 2012-2016. Distributions can be found in table 4b.1.

In order to address the possibility for variance in care within that overall mean compliance rates, this group performed a secondary analysis, evaluating only practitioners who were not 100% compliant (4b.2). Within this secondary analysis, the gap increases by about 10% on average and the means range from .75 in 2012 to .81 in 2014. This secondary analysis combined with the expectation that the analyzed data were obtained from a high-quality academic research hospital with a compliance rate likely higher than the national norm lead this group to believe a reasonable performance gap exists.

Table 4b.1 Minimum to Maximum Ranges of Performances scores for All and Compliant Physicians

Year	Mean	SD	Max	99%	95%	90%	75%Q3	50% Median	25% Q1	10%	5%	1%	Min
2012	0.89483	0.198898	1	1	1	1	1	1	0.857143	0.7	0.666667	0	0
2013	0.901951	0.163173	1	1	1	1	1	1	0.830508	0.695652	0.666667	0	0
2014	0.939034	0.102608	1	1	1	1	1	1	0.888889	0.75	0.722222	0.666667	0.666667
2015	0.914594	0.166035	1	1	1	1	1	1	0.875	0.75	0.6	0	0
2016	0.885474	0.186951	1	1	1	1	1	0.98	0.828431	0.75	0.5	0	0

Table 4b.2 Minimum to Maximum Ranges of Performances scores for All and Compliant Physicians

Year	Mean	SD	Max	99%	95%	90%	75%Q3	50% Median	25% Q1	10%	5%	1%	Min
2012	0.749768	0.241827	0.947368	0.947368	0.941176	0.933333	0.875	0.823529	0.714286	0.333333	0	0	0
2013	0.758379	0.176302	0.923077	0.923077	0.9	0.888889	0.870833	0.8	0.722826	0.666667	0.5	0	0
2014	0.810685	0.090976	0.96	0.96	0.96	0.928571	0.888889	0.777778	0.75	0.666667	0.666667	0.666667	0.666667
2015	0.770955	0.20414	0.923077	0.923077	0.923077	0.916667	0.885714	0.833333	0.75	0.6	0.5	0	0
2016	0.770948	0.209804	0.96	0.96	0.95	0.947368	0.92	0.828431	0.75	0.5	0.5	0	0

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Disclaimer:

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Appendix A. Disclosures

William Timothy Brox, MD (This individual reported nothing to disclose); Submitted on: 01/28/2015

David B Carmack, MD Submitted on: 12/20/2014
OTA (I served on the OTA Health Policy Committee as a non-paid volunteer): Board or committee member ($0)

Charles M Davis III, MD Submitted on: 12/22/2014
AAOS: Board or committee member ($0) (Self)
American Association of Hip and Knee Surgeons: Board or committee member ($0) (Self)
Journal of Arthroplasty: Editorial or governing board ($0) (Self)

Eitan Dickman, MD Submitted on: 12/20/2014
Society for Academic Emergency Medicine Emergency Ultrasound Academy BOD: Board or committee member ($0) This is an unpaid position(Self)

Stephen L Kates, MD Submitted on: 10/26/2014
Sage Publications: Editorial or governing board ($0)
AAOS: Board or committee member ($0)
AO Foundation: Paid presenter or speaker ($0) Number of Presentations: 0
AO North America: Board or committee member ($0)
AOTrauma: Board or committee member ($0)
Orthopaedic Trauma Association: Board or committee member ($0)
Sage Publications: Publishing royalties, financial or material support ($0)
Surgical Excellence: Paid consultant ($0)
Synthes: Research support ($0)

James F Kellam, MD Submitted on: 12/19/2014
AO Foundation: Editorial or governing board ($0)
AONA: Editorial or governing board ($0)
Orthopaedic Trauma Association: Board or committee member ($0)

Douglas W Lundy, MD Submitted on: 11/18/2014
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American College of Surgeons: Board or committee member ($0)
Clinical Orthopaedics and Related Research: Editorial or governing board ($0) (Self) - journal reviewer
Georgia Orthopaedic Society: Board or committee member ($0) (Self) - Board of Directors
Journal of Orthopaedic Trauma: Editorial or governing board ($0) Associate editor(Self)
Journal of the Southern Medical Association: Editorial or governing board ($0) Reviewer(Self)
Livengood Engineering: Stock or stock Options Number of Shares: 100 (Self)
Orthopaedic Trauma Association: Board or committee member ($0) (Self) - Member-at-Large - Board of Directors Orthopedics: Editorial or governing board ($0) (Self) - journal reviewer

Kevin Means, MD Submitted on: 12/26/2014
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Douglas G Wright, MD (This individual reported nothing to disclose); Submitted on: 01/07/2015