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Defining Hip Fracture with Claims Data: outpatient and provider claims matter

Sarah D. Berry, MD, MPH^{1,2}, Andrew R. Zullo, PharmD, ScM, PhD³, Kevin McConeghy, PharmD, MS³, Yoojin Lee, MS, MPH, Lori Daiello, PharmD, ScM³, and Douglas P. Kiel, MD, MPH^{1,2}

¹Department of Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, 110 Francis St. Suite 1A, Boston, MA 02215

²Hebrew SeniorLife, Institute for Aging Research, Hebrew Rehabilitation Center, 1200 Centre Street, Roslindale MA 02131

³Department of Health Services, Policy, and Practice, Brown University School of Public Health, 121 South Main Street, Providence, RI 02912

Abstract

Purpose—Medicare claims data is commonly used in research studies to identify hip fractures, but there is no universally accepted definition of fracture. Our purpose was to describe potential misclassification when hip fractures are defined using Medicare Part A (inpatient) claims without considering Part B (outpatient and provider) claims and when inconsistent diagnostic and procedural codes occur at contiguous fracture sites (e.g., femoral shaft or pelvic).

Methods—Participants included all long-stay nursing home residents enrolled in Medicare Parts A and B fee-for-service between 1/1/2008 and 12/31/2009 with follow-up through 12/31/2011. We compared the number of hip fractures identified using only Part A claims to, 1) Part A plus Part B claims, and 2) Part A and Part B claims plus discordant codes at contiguous fracture sites.

Results—Among 1,257,279 long-stay residents, 40,932 (3.2%) met the definition of hip fracture using Part A claims, and 41,687 residents (3.3%) met the definition using Part B claims. 4,566 hip fractures identified using Part B claims would not have been captured using Part A claims. An additional 227 hip fractures were identified after considering contiguous fracture sites.

Conclusions—When ascertaining hip fractures, a definition using outpatient and provider claims identified 11% more fractures than a definition with only inpatient claims. Future studies should publish their definition of fracture and specify if diagnostic codes from contiguous fracture sites were used.

Corresponding author: Sarah D. Berry, MD MPH; Hebrew Rehabilitation Center; 1200 Centre Street; Roslindale, MA 02131; T-(617) 971-5355; F- (617) 971-5339; sarahberry@hsl.harvard.edu; orcid.org/0000-0002-3793-4187.

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Keywords

Medicare claims; hip fracture; contiguous site; misclassification

Introduction

Medicare diagnostic and procedural codes were created to facilitate patient care and reimbursement. Because these codes were not collected for investigative purposes, the Federal Drug Administration has urged investigators to ensure that all medical outcomes using administrative claims data are validated.¹ Few prior studies have assessed the validity of hip fracture ascertained via administrative claims data as compared with medical records.^{2,3} Nonetheless, studies of hip fracture increasingly rely on claims data as an efficient means to ascertain fracture. For large studies, it may be impractical and cost-prohibitive to ascertain fracture by any other means.

Despite the reliance on Medicare claims data to ascertain hip fractures, there is no universally accepted method for identifying fracture. Most researchers accept a definition of hip fracture identified from Part A (inpatient) claims alone. In theory, inpatient claims should capture most hip fractures because the majority of hip fractures are acutely managed in the hospital. However, some studies also include Part B (outpatient and provider) claims as part of the hip fracture definition. Further, discordance can occur between the procedural and diagnostic codes in claims data. For example, a procedural code for a fracture of the hip may be erroneously paired with a diagnostic code for a contiguous fracture site (i.e., femoral shaft or pelvic). The frequency of this occurrence has not been previously documented, and there is no consensus in the literature on how to handle discordance of diagnostic and procedural codes with contiguous fracture sites.

Our objective was to compare the number of hip fractures identified using only Part A claims to, 1) Part A plus Part B claims, and 2) Part A and B claims for hip fracture plus discordant diagnostic and procedural codes with contiguous fracture sites. We further described the effect of misclassification when hip fractures were ascertained using Part A diagnostic claims only versus alternative definitions of hip fracture with Part B claims.

Methods

Subjects

For our source population, Medicare claims were linked to nursing home resident assessments using unique, individual identifiers for all nursing home residents enrolled in a fee-for-service Medicare program.⁴ Details of our inclusion criteria have already been published.⁵ Our final study sample consisted of 1,257,279 persons that qualified as long-stay residents between the dates 1/1/2008–12/31/2009.

Hip fracture

We ascertained hip fracture in several ways using diagnostic and procedural codes from Medicare claims data. Diagnostic codes are included as International Classification of

Disease, Ninth Edition (ICD-9) codes in Part A and Part B claims. Procedural codes for management of hip fracture may include either ICD-9 codes (Part A and B claims) or Current Procedural Treatment, or CPT, codes (Part B claims). Procedural codes can be specific to the management of a hip fracture (e.g., total hip replacement) or they can be non-specific and refer to the management of any femur fracture (e.g., open reduction of fracture with internal fixation, femur). We used published fracture algorithms to identify potential procedural codes.^{3,6-9} We then asked three orthopedic surgeons to review the procedural codes to ensure selected codes were clinically appropriate. We removed all procedural codes related to casting or splinting (CPT 29010, 29015, 29020, 29025, 29035, 29040, 29044, 29046, 29305, 29325, 29345, 29355, 29358, 29365, 29505, 29520, 29799) because these procedures are not used to manage hip fractures in adults. We also removed procedural codes that are no longer active (27131, 29005). The final specific procedural codes for the management of a hip fracture include: ICD-9- 81.51, 81.52; CPT-4- 27125, 27130, 27230, 27232, 27235, 27236, 27246, 27248, 73530. Non-specific procedural codes include: ICD-9- 78.55, 79.05, 79.15, 79.25, 79.35, 79.65; CPT-4- 27238, 27240, 27244, 27245.

First, we defined hip fracture using Part A claims only. Initially we considered a hip fracture as any hospitalization with the primary or secondary (ICD-9) diagnostic code of 820.xx from Part A claims. We then restricted the definition to residents with a primary ICD-9 diagnostic code for hip fracture or an accompanying procedural code (ICD-9) for hip fracture repair.

Second, we expanded our definition of hip fracture to include any Part B diagnostic claim for hip fracture with an associated procedural code for hip or non-specific femur fracture on the same date. Third, we considered hip fracture using the above definition plus any diagnostic code for a contiguous fracture site [i.e., pelvic (808.xx) or femoral shaft fracture (821.xx)] in the Part B carrier file with a procedural code specific for hip fracture on the same date. To be sure that readmissions for complications of a fracture were not counted as a new fracture, we excluded fractures after admission if they occurred within 100 days of a previous hip fracture.

Other characteristics

In order to describe our population, we obtained information on age, sex, and self-reported race from the Medicare Enrollment file. We obtained information on functional status and cognition using the MDS assessment before the hip fracture and closest to the date of study entry. Functional status was measured by the Katz Activities of Daily Living Scale.¹⁰ Cognition was measured via the Cognitive Performance Scale.¹¹

Statistical Analysis

We described the number of residents that met the definition of hip fracture using Part A claims only, Part B claims only, and Part B claims with contiguous fracture sites. We used a Venn diagram to illustrate the overlap between the definitions of hip fracture using Part A and Part B claims. We then employed Cox proportional hazards regression models to describe the association between baseline age, sex, race, cognition, and functional status and

the risk of hip fracture, as defined using any diagnostic code for hip fracture in Part A claims, and an alternative definition that added Part B claims.

Results

The mean age (SD) of the 1,257,279 long-stay residents was 84.1 years (± 8 years) and 71.9% were female. Most residents were white (85.3%) or black (10.8%). Forty-five percent of residents had moderate cognitive impairment, and 13.3% had severe cognitive impairment.

During a mean follow-up time of 1.8 years, 40,932 residents (3.2%) were hospitalized with a hip fracture as defined by a diagnostic code for hip fracture in any position in Part A claims (Table 1). Ninety-five percent of Part A claims listed the hip fracture diagnosis code in the primary position. Eighty-nine percent of Part A claims included a procedural code for hip fracture. 1,045 hip fractures (2.6%) identified using a diagnostic code for hip fracture in a secondary position would not have been captured if a primary diagnostic code was required.

Using the Part B Carrier file we identified 41,697 hip fractures (3.3%), as defined by a diagnostic code for hip fracture in any position with a hip or non-specific femur fracture procedural code on the same date. 4,566 hip fractures (11.0%) identified using Part B claims would not have been captured using Part A claims. For 77.6% of those additional fractures, the procedural code was a CPT-4 code from Part B claims, whereas the remaining 22.4%, the procedural code was an ICD-9 code from Part A claims (Table 1).

After considering contiguous fracture sites, we identified an additional 227 fractures with a diagnostic code for pelvic or femoral shaft fracture and a procedural code specific for hip fracture. In 60.1% ($n=134/227$) of the additional cases the diagnostic code was for the femoral shaft fracture. In the remaining 39.9% (93/227) of cases the diagnostic code was for pelvic fracture. The total number of hip fractures identified using the Part A and Part B with contiguous fracture site definitions was 45,725 (3.6%). The absolute difference in the proportion of residents with fracture increased by 0.4% when Part B claims were added to the Part A definition of hip fracture.

There was little difference in the measures of association between baseline resident characteristics and hip fracture according to the definition of hip fracture. For example, using the definition of hip fracture from Part A claims only, the HR of black race (reference: white race) and hip fracture was 0.89 (95% CI 0.85, 0.93) as compared with a HR of 0.90 (0.86, 0.94) when Part B claims were added to the definition of hip fracture.

Discussion

In a nationwide sample of long-stay nursing home residents, we found that a definition of hip fracture using outpatient and provider claims identified 11% more hip fractures as compared with a definition that only included inpatient claims. Few additional fractures were gained by considering claims with inconsistent diagnostic and procedural codes at contiguous fracture sites.

In 1990, Fisher et al. reported that 9% of hip fractures would have been missed when using an inpatient only definition of fracture in a 5% random sample of Medicare beneficiaries in the year 1985.¹² Interestingly the authors found that the proportion of hip fractures identified using outpatient or provider claims only varied by state (range 0–32.8%) and by age (10.6% among ages 65–69 years versus 8.4% among ages 85 years or greater). In a separate analysis restricted to New England, the authors concluded that 6% of hip fractures would have been missed using an inpatient only fracture definition.¹³ In 1994, Baron et al. reported good concordance between provider and hospital claims for hip fracture in another 5% random sample of Medicare beneficiaries between 1986–1989.¹⁴ Of the 28,592 diagnostic codes for hip fracture, only 844 (3%) were identified using Part B claims alone. Our study suggests that as many as 11% of hip fractures would be missed without adding Part B claims to our fracture definition. We suspect that the larger proportion of outpatient fractures we observed may be explained because the earlier studies were conducted in an era before diagnostic codes were required as part of Medicare Part B physician claims, and also because we have restricted our analysis to nursing home residents.

To date, only a few existing studies have validated a claims-based definition of hip fracture with medical records.^{2,3} In the largest study of dual eligible adults in the U.S., an algorithm using Medicare claims to identify hip fracture had a positive predictive value of 98% as compared with chart review.³ Using only hip fractures identified through chart review, the authors estimate the claims definition of hip fracture had a sensitivity of 97%. Of note, this study was conducted in the early 1990s. Coding practices have changed considerably since that time, and there have been changes to the procedural codes used to ascertain hip fracture. Thus, it is unclear if a contemporary study would perform similarly. A more recent Canadian study comparing chart review with a definition of “hip or femur” fracture from inpatient and provider claims reported a PPV of 93%.² This study did not report the concordance of hip and femoral shaft fracture definitions separately, nor do they report what proportion of fractures were identified using only outpatient claims. No contemporary studies have validated a claims definition specific for hip fracture utilizing inpatient as well as outpatient and provider claims.

Our data suggests that in nursing home residents, and perhaps in other frail populations, provider and outpatient claims will yield an important increase in fractures as compared with fracture definitions that rely on inpatient claims only. This may have considerable consequence in health services research studies. For example, failure to include true fractures through Part B claims could diminish the power for investigators to demonstrate a reduction in hip fractures through preventative efforts in pragmatic trials. If fractures ascertained from Part B claims are true fractures, utilizing only inpatient claims may underestimate the overall public health impact of hip fractures. This would include estimates of morbidity, mortality, rehospitalization, and direct and indirect costs. For example, we previously estimated that 23,000 long-stay nursing home residents will fracture their hip every year using a definition of hip fracture from Part A claims only.⁵ Assume the average direct cost of a hip fracture in a nursing home resident is \$28,913.¹⁵ Even if the cost of “missed” cases of hip fracture identified using Part B (outpatient and provider) claims was one third of that for the Part A (inpatient) cases, a fracture definition including Part B claims

and contiguous sites would result in an additional 2,693 fractures and \$25 million in costs annually.

The modest relative increase in fractures we observed when including Part B claims data, translates to a small absolute increase in the number of residents that experienced hip fracture with the expanded definition (0.4%). Possible reasons for a hip fracture to be discovered using only Part B claims include non-hospitalized fractures and coding errors. Any resulting misclassification that is non-differential with respect to exposure status should bias effect estimates towards the null. However, misclassification may impact the sensitivity and specificity of the claims based algorithm. We suspect that adding outpatient claims to the fracture definition will have a modest effect on sensitivity, as previous studies that have included outpatient claims have demonstrated a similar sensitivity as compared with studies that used inpatient claims alone.^{2,16} Instead, including outpatient claims as part of the hip fracture definition probably worsens specificity, or the number of persons incorrectly categorized as having a hip fracture. Changes in the specificity of the hip fracture definition may have a bigger impact on effect estimates than changes in sensitivity.¹⁷ Future studies validating claims based algorithms for fracture should include a measure of specificity. Research studies with modest sample size or relatively rare risk factors or exposures may benefit from the increase in fracture cases using an expanded definition, provided that the specificity of a fracture definition that includes outpatient claims remains good.

Strengths of our study include the large, nationwide sample with multiple definitions of hip fracture considered. A limitation is that our study population was entirely comprised of nursing home residents, and it is possible that outpatient and provider claims contribute less to the definition of hip fracture in healthier, community dwelling populations. Additionally, this analysis does not include ICD-10 data, which should be available for research purposes soon, and it will include more digits, codes and severity parameters.¹⁸ Finally, we were unable to confirm how many of the additional hip fracture cases identified from Part B claims or from inconsistent diagnostic codes were accurately classified because we were not able to confirm such cases with medical records. Without medical record confirmation of potential false positive hip fracture cases, the true effect of adding hip fractures through outpatient and provider claims on relative measures of association is uncertain.

Nonetheless, we believe this work will be informative to other investigators that plan to ascertain hip fracture using claims data. We encourage investigators to publish the specific definition of hip fracture used, and to specify whether contiguous fracture sites are included.

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Table 1

Number of long-stay nursing home residents identified with hip fracture using Medicare Parts A and B claims.

Source of data used to identify hip fracture	N
Medicare Part A	
Diagnostic code in the first position	39,020
Diagnostic code in a secondary position	3,035
Diagnostic code in any position	40,932
Diagnostic code in first position + associated procedural code present	35,746
Diagnostic code in second position + associated procedural code present	1,685
Diagnostic code in any position + associated procedural code present	36,440
Medicare Part B ^a	
Diagnostic code in any position + associated procedural code (CPT-4) present during the encounter	3,544
Diagnostic code in any position + associated procedural code (ICD-9) present during the encounter	1,022
Diagnostic code for pelvic fracture + procedural code for hip fracture during the encounter	93
Diagnostic code for femoral shaft fracture + procedural code specific for hip fracture during the encounter	134

^a Reflects the number of residents with a hip fracture identified using Part B claims that were not identified using Part A claims.