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RESEARCH ARTICLE

# Evaluation of the Present-on-Admission Indicator among Hospitalized Fee-for-Service Medicare Patients with a Pressure Ulcer Diagnosis: Coding Patterns and Impact on Hospital-Acquired Pressure Ulcer Rates

*Lee Squitieri, Daniel A. Waxman, Carol M. Mangione, Debra Saliba, Clifford Y. Ko, Jack Needleman, and David A. Ganz*

**Objectives.** To evaluate national present-on-admission (POA) reporting for hospital-acquired pressure ulcers (HAPUs) and examine the impact of quality measure exclusion criteria on HAPU rates.

**Data Sources/Study Setting.** Medicare inpatient, outpatient, and nursing facility data as well as independent provider claims (2010–2011).

**Study Design.** Retrospective cross-sectional study.

**Data Collection/Extraction Methods.** We evaluated acute inpatient hospital admissions among Medicare fee-for-service (FFS) beneficiaries in 2011. Admissions were categorized as follows: (1) no pressure ulcer diagnosis, (2) new pressure ulcer diagnosis, and (3) previously documented pressure ulcer diagnosis. HAPU rates were calculated by varying patient exclusion criteria.

**Principal Findings.** Among admissions with a pressure ulcer diagnosis, we observed a large discrepancy in the proportion of admissions with a HAPU based on hospital-reported POA data (5.2 percent) and the proportion with a new pressure ulcer diagnosis based on patient history in billing claims (49.7 percent). Applying quality measure exclusion criteria resulted in removal of 91.2 percent of admissions with a pressure injury diagnosis from HAPU rate calculations.

**Conclusions.** As payers and health care organizations expand the use of quality measures, it is important to consider how the measures are implemented, coding revisions to improve measure validity, and the impact of patient exclusion criteria on provider performance evaluation.

**Key Words.** Pressure ulcer, Medicare, hospital-acquired conditions, present-on-admission indicator

The U.S. health care system is currently experiencing rapid transformation under value-based payment reform and placing greater emphasis on leveraging information from large administrative datasets (Marr 2015). Over the past decade, payers and health care organizations have increasingly used hospital-acquired conditions (HACs) to monitor patient safety and assess quality of care. In 2008, The Centers for Medicare and Medicaid Services (CMS) introduced a claim-level payment penalty that denied increased reimbursement for discharge records that contained a documented HAC (Centers for Medicare and Medicaid Services [CMS] 2007; CMS 2015). Early results of this program demonstrated a reduction in adverse events and substantial cost savings in the acute inpatient setting, supporting expansion of HACs as a mechanism for value-based payment reform (The Agency for Healthcare Research and Quality [AHRQ] 2015). In fiscal year 2015, CMS implemented the HAC reduction program, which calculates a facility-level performance score to adjust reimbursed payment in addition to individual claim penalties applied under the 2008 HAC payment provision (CMS 2016a,b). The HAC reduction program calculates a composite HAC score for each acute inpatient facility and applies negative reimbursement adjustments to hospitals in the worst performing quartile (CMS 2016a,b).

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Hospital-acquired conditions eligible for inclusion in the original 2008 HAC payment provision were required to fulfill two of the following criteria: (1) high cost, high volume, or both; (2) result in higher hospital payment when present as a secondary diagnosis; and (3) can be reasonably prevented through the application of evidence-based guidelines (The Centers for Medicare and Medicaid Services 2015). Due to the substantial clinical and financial burden of pressure ulcers in the Medicare population, advanced stage (stage 3–4 and unstageable) pressure ulcers were among the first HACs to be implemented under the 2008 HAC payment provision and have subsequently been widely adopted as an important quality of care metric by payers and organizations across all clinical settings (Lyder et al. 2001, 2012; Lyder and Ayello 2009). However, unlike many other HACs that represent acute discrete events with clear diagnostic criteria and readily identifiable treatment/complication patterns, advanced stage pressure ulcers are more difficult to diagnose and accurately document.

Successful HAC monitoring and valid HAC score measurement require accurate documentation of a mandatory hospital-reported present-on-admission (POA) indicator to determine whether the complication diagnosis predated the patient's hospital stay or occurred during admission as a hospital-acquired complication (AHRQ 2006; Hughes et al. 2006; CMS 2008). A POA indicator value of "Yes" means that the complication occurred prior to hospitalization and does not warrant financial payment penalty. However, a POA indicator value of "No" means that the diagnosis occurred during the hospital admission and that hospitalization may be eligible for reimbursement penalties and may be included in overall quality performance measures for that facility. Mandatory reporting of POA indicators has been shown to increase the sensitivity and validity of HAC reporting by facilities, but it may be prone to biased documentation when associated with provider performance evaluation and payment adjustment (Bahl et al. 2008; Goldman et al. 2011, 2015; Dalton et al. 2013). Furthermore, the accuracy of POA indicator reporting varies significantly between different types of diagnoses and may be worse among conditions with poor diagnostic inter-rater reliability and conditions with low diagnostic sensitivity in administrative records (Bahl et al. 2008; Zrelack et al. 2015).

Previous studies evaluating the POA indicator for hospital-acquired pressure ulcers (HAPUs) have relied on manual chart abstraction from select hospital samples to verify accuracy and found that up to 35 percent of pressure ulcer admissions may be inappropriately labeled as POA (Bahl et al. 2008; Zrelack et al. 2015). Patient chart abstraction is labor-intensive and

impractical to implement on a national level for assessment of provider performance. As payers and organizations continue to expand the use of HACs under value-based payment reform, it is important to find practical ways to examine patterns of hospital-reported POA data on a national level with routinely collected data. The purpose of the current study was to compare hospital-reported POA indicator status to patient history in claims data and previously published data from patient medical records, among acute inpatient admissions with a pressure injury diagnosis. We also examined the impact of hospital-reported POA data on nationally measured HAPU rates.

## METHODS

### *Sample*

We used a 5 percent sample of fee-for-service (FFS) Medicare claims data from the 2010 and 2011 MedPAR (inpatient and skilled nursing facility encounters), carrier (independent provider claims), outpatient (outpatient facility claims), and denominator (beneficiary demographic information) files. We evaluated acute inpatient hospitalizations between January 1, 2011, and December 31, 2011, and identified admissions with a pressure ulcer using ICD-9 diagnosis codes 707.00–707.09 and 707.20–707.25. Admissions were categorized into three groups: (1) admissions without a pressure ulcer diagnosis, (2) admissions with a "new" pressure ulcer diagnosis, and (3) admissions with a previously documented pressure ulcer diagnosis. New diagnosis classification required that the admitted patient did not have any pressure ulcer ICD-9 diagnosis or CPT procedure code (15920–15999) in the MedPAR, outpatient, or carrier file for 365 days prior to admission. We limited our analysis to patients over 65 years old. All patients were required to have continuous Medicare part A and B FFS enrollment for 365 days prior to admission, making them at least 66 years old at the time of hospital admission. Our final study cohort included a 5 percent sample of Medicare FFS patients 66 years and older admitted to an acute inpatient hospital in 2011 with a full year of part A and B FFS enrollment prior to admission.

### *Measures*

Patient demographics (age, race, sex, and Medicaid dual eligibility) were obtained from the 2011 denominator file corresponding to the year of hospital admission. To assess patient comorbidity, we calculated weighted and

unweighted Elixhauser scores using all diagnoses from MedPAR, outpatient, and carrier file claims 365 days prior to and including hospital admission (Quan et al. 2005). Unweighted scores reflect the raw count of comorbidity categories (range 0–30), and weighted values represent the index score proposed by van Walraven et al. (2009). We also calculated each beneficiary's area deprivation index (ADI) as a measure of socioeconomic status, using the beneficiary's residential zip code listed in the denominator file for 2011 (Singh 2003). The ADI is a validated measure of neighborhood socioeconomic disadvantage composed of 17 U.S. census data elements regarding poverty, education, housing, employment, and living conditions (Singh 2003; Kind et al. 2014). Higher ADIs correspond with higher levels of socioeconomic disadvantage and are associated with greater 30-day hospital readmission rates and increased patient mortality (Singh 2003; Kind et al. 2014).

For each hospital admission, we used MedPAR data to determine the hospital length of stay and transfer status from another facility. Given the increased prevalence of pressure ulcers among nursing home patients, we identified probable nursing home residents by reviewing independent provider claims for 30 days prior to admission and identifying place of service codes and CPT procedure codes consistent with services rendered in nursing home facilities (Yun et al. 2010). We also reviewed all outpatient and MedPAR claims for 30 days prior to hospital admission to identify patients recently discharged from another facility.

Among hospitalizations with a pressure ulcer diagnosis, we obtained the pressure ulcer stage (ICD-9 diagnosis codes: 707.20–707.25) and POA status recorded in the MedPAR discharge record. Under the 2008 HAC payment provision, hospitals are required to report a corresponding POA indicator variable for each pressure ulcer diagnosis code: (1) Y, indicating that the diagnosis was present at the time of admission; (2) N, indicating that the diagnosis was not POA (i.e., hospital-acquired complication); (3) U, indicating insufficient documentation to determine POA status; or (4) W, indicating that the provider is unable to clinically determine whether the condition was POA (The Centers for Medicare and Medicaid Services 2008).

Under the 2015 HAC reduction program, HAPU rates are included in the total HAC score as part of the Agency for Health Research and Quality (AHRQ) Patient Safety and Adverse Events Composite (PSI 90) score (AHRQ 2016a; CMS 2016a,b). This score uses the AHRQ patient safety indicator 03 (PSI 03) to calculate HAPU rates as the total number of stage 3, stage 4, or unstageable secondary diagnosis pressure ulcers per 1,000 eligible hospital discharges among patients 18 years and older (AHRQ 2016b; The Agency

for Healthcare Research and Quality 2016a). The AHRQ PSI 03 uses administrative claims data at the hospital admission level and excludes cases meeting the following criteria: (1) if they have hospital length of stay less than 3 days, (2) if they have a principal diagnosis for pressure ulcer, (3) if their secondary pressure ulcer diagnosis is reported by the hospital as POA (POA indicator variable = "Y"), (4) if they are transferred from another facility, (5) if they are admitted for pregnancy, childbirth, or puerperium (Major Diagnostic Category 14), (6) if they are admitted for a skin disorder (Major Diagnostic Category 9), (7) if they have any diagnosis consistent with hemiplegia, paraplegia, spina bifida, or anoxic brain injury, and (8) if they receive a procedure for debridement or pedicle graft during their hospital stay. We used ICD-9 diagnosis codes listed on the hospital discharge record to identify admissions that fulfilled any of the above exclusion criteria.

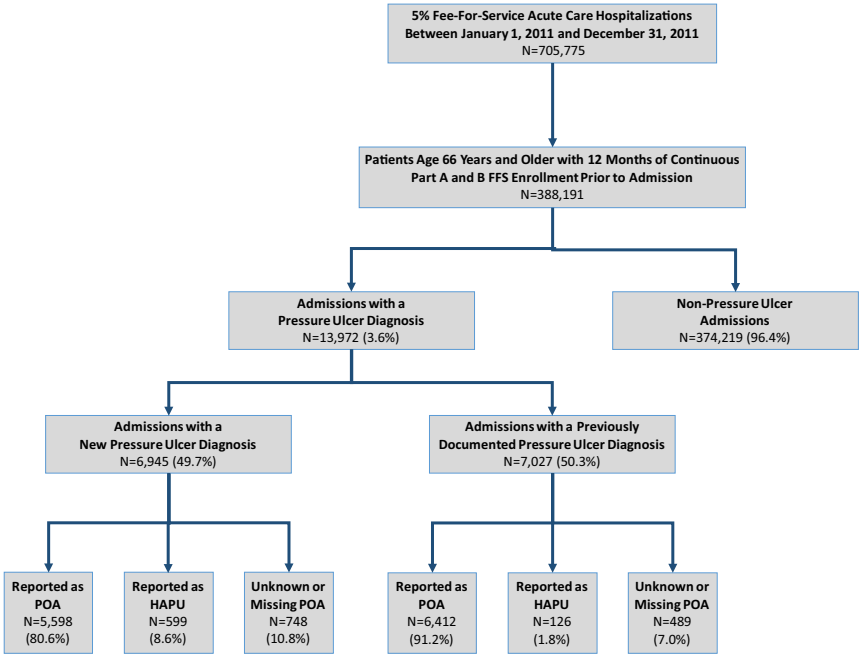
### *Statistical Analysis*

Consistent with current methods used by payers and health care organizations to evaluate HAPU rates, we used hospital admissions as the primary unit of analysis and allowed multiple admissions per patient (AHRQ 2016a,b). Descriptive statistics for patient demographics, admission characteristics, pressure ulcer stage, and POA reporting were compared between admissions with a new pressure ulcer diagnosis, admissions with a previously documented pressure ulcer diagnosis, and nonpressure ulcer admissions. Among hospitalizations with a pressure ulcer diagnosis, we stratified POA status by pressure ulcer stage to explore differences in POA reporting patterns potentially influenced by the diagnostic staging criteria in the HAC payment provision. We also identified the number and type of pressure ulcer admissions associated with each AHRQ PSI 03 patient exclusion category and examined the impact of these criteria on aggregate HAPU rates. All analyses were performed using *SAS*, version 9.4 (SAS Institute Inc., Cary, NC, USA).

## RESULTS

In our 2011 5 percent FFS Medicare sample ($N$ = 1,913,552), we identified 388,191 acute stay hospitalizations among patients aged 66 and above with 365 days of continuous Part A and B FFS enrollment prior to hospital admission (Figure 1). A total of 13,972 (3.6 percent) hospitalizations included a pressure ulcer diagnosis: 6,945 (49.7 percent) were classified as new diagnoses,

Figure 1: Tree Diagram Showing Distribution of Hospital Admissions [Color figure can be viewed at wileyonlinelibrary.com].




*Notes:* Our study sample was limited to 5 percent of acute inpatient hospitalizations in 2011 among patients aged 66 and above with continuous part A and B fee-for-service coverage for 365 days prior to admission.

and 7,027 (50.3 percent) had prior documentation of a pressure ulcer within 365 days of admission. Among admissions with a pressure ulcer diagnosis ($N = 13{,}972$), 5.2 percent ($N = 725$) were reported by the hospital as hospital-acquired (POA indicator = "N"), whereas 49.7 percent ($N = 6{,}945$) had a "new diagnosis" based on claims history. Of newly diagnosed pressure ulcers, 80.6 percent were reported as POA, despite the absence of a pressure ulcer claim in the MedPAR, carrier, or outpatient file for 365 days prior to hospital admission.

When comparing patient characteristics between admission populations, we found increasing levels of comorbidity, hospital use, and nursing home use with advancing pressure ulcer status from no pressure ulcer diagnosis, to new pressure ulcer diagnosis, to previously documented pressure ulcer diagnosis (Table 1). For example, nonpressure ulcer admissions had the lowest level of comorbidity with a mean unweighted Elixhauser score of

7.1, followed by admissions with a new pressure ulcer diagnosis (mean unweighted Elixhauser score of 8.6), and admissions with a previously documented pressure ulcer diagnosis had the highest level of comorbidity (mean unweighted Elixhauser score of 10.7). A similar pattern was also found in the proportion of patients residing in nursing homes, the proportion of patients directly transferred from another facility, and the proportion of patients discharged from an inpatient or skilled nursing facility within 30 days of admission (Table 1). Advancing pressure ulcer status was also associated with an increase in the proportion of black patients and patients with supplemental Medicaid coverage (Table 1). However, ADI scores did not differ significantly between the patient populations.

Given the association of advanced stage (3–4 and unstageable) pressure ulcers with financial payment penalties, we evaluated hospital-reported POA indicator status by stage category (Table 2). We found that advanced stage pressure ulcers were more frequently coded as POA than early stage pressure ulcers that are not associated with reimbursement consequences. This was true among admissions with newly diagnosed pressure ulcers (based on claims history) and admissions with previously documented pressure ulcers.

We observed a total pressure ulcer prevalence rate of 36 per 1,000 admissions for all pressure ulcers and 9.4 per 1,000 admissions for advanced stage pressure ulcers (Table 3). Based on patient claims history, we found a new pressure ulcer diagnosis rate of 17.9 per 1,000 admissions for all pressure ulcers and 2.9 per 1,000 admissions for advanced stage pressure ulcers. However, HAPU rates based on hospital-reported POA data were substantially lower with a rate of 1.9 per 1,000 admissions for all pressure ulcer stages and 0.2 per 1,000 admissions for advanced stage pressure ulcers.

Application of the AHRQ PSI 03 patient exclusion criteria resulted in elimination of 12,747 of 13,972 admissions with a pressure ulcer diagnosis (91.2 percent, Table 4). Of admissions qualifying for exclusion, 90.3 percent were due to hospital-reported POA data, and 47.4 percent of excluded admissions were classified as "new diagnosis admissions" based on patient claims history. We also found that 59.0 percent ($N = 8,246$) of admissions with a pressure ulcer diagnosis, 47.3 percent ($N = 3,286$) of new diagnosis admissions, and 28.1 percent ($N = 204$) of admissions with a hospital-reported HAPU (POA = "N") were excluded on the basis of other exclusion criteria (Table 4). Transfer status from another facility resulted in the elimination of 1,222 of 6,945 (17.6 percent) admissions with a new pressure ulcer diagnosis and 121 of 725 (16.7 percent) admissions with a documented HAPU using the POA indicator. Diagnosis of hemiplegia, paraplegia, spina bifida, or anoxic brain injury

Table 1: Admission Characteristics

| | *Admissions without a Pressure Ulcer Diagnosis, N = 374,219* | *Admissions with a New Pressure Ulcer Diagnosis, N = 6,945* | *Admissions with a Prior Pressure Ulcer Diagnosis, N = 7,027* | *p-Value Comparing Pressure Ulcer and Nonpressure Ulcer Admissions* | *p-Value Comparing New and Prior Pressure Ulcer Admissions* |
|---|---|---|---|---|---|
| Age (mean, SD) | 78.5, 7.8 | 81.3, 8.0 | 80.3, 8.1 | <0.0001 | <0.0001 |
| Gender | | | | | |
| Female | 216,523 (57.8%) | 4,001 (57.6%) | 4,059 (57.8%) | 0.6840 | 0.8547 |
| Race/ethnicity | | | | | |
| White | 322,953 (86.3%) | 5,678 (81.8%) | 4,981 (70.9%) | <0.0001 | <0.0001 |
| Black | 33,884 (9.1%) | 891 (12.8%) | 1,606 (22.9%) | | |
| Other | 17,382 (4.6%) | 376 (5.4%) | 440 (6.3%) | | |
| Supplemental Medicaid coverage | 70,933 (19.0%) | 1,833 (26.4%) | 2,568 (36.5%) | <0.0001 | <0.0001 |
| Area Deprivation Index (mean, SD) | 97.7, 19.8 | 97.7, 20.4 | 98.1, 20.3 | 0.2303 | 0.3005 |
| Elixhauser Score* | | | | | |
| Unweighted (mean, SD) | 7.1,3.5 | 8.6, 3.4 | 10.7, 3.5 | <0.0001 | <0.0001 |
| Weighted (mean, SD) | 16.8, 11.9 | 22.8, 11.9 | 27.7, 12.1 | <0.0001 | <0.0001 |
| Transfer from another facility | 35,040 (9.4%) | 1,222 (17.6%) | 1,608 (22.9%) | <0.0001 | <0.0001 |
| Nursing home resident† | 30,772 (8.2%) | 1,534 (22.1%) | 2,754 (39.2%) | <0.0001 | <0.0001 |
| Discharge from inpatient hospital within 30 days | 65,687 (17.6%) | 2,001 (28.8%) | 3,075 (43.8%) | <0.0001 | <0.0001 |
| Discharge from SNF within 30 days | 22,648 (6.1%) | 989 (14.2%) | 2,002 (28.5%) | <0.0001 | <0.0001 |
| Discharge from outpatient facility within 30 days | 162,593 (43.5%) | 2,613 (37.6%) | 3,014 (42.9%) | <0.0001 | <0.0001 |

*Continued*

Table 1 *Continued*

| | *Admissions without a Pressure Ulcer Diagnosis, N = 374,219* | *Admissions with a New Pressure Ulcer Diagnosis, N = 6,945* | *Admissions with a Prior Pressure Ulcer Diagnosis, N = 7,027* | *p-Value Comparing Pressure Ulcer and Nonpressure Ulcer Admissions* | *p-Value Comparing New and Prior Pressure Ulcer Admissions* |
|---|---|---|---|---|---|
| Pressure ulcer stage | | | | | |
| 1 | | 1,330 (19.2%) | 553 (7.9%) | | |
| 2 | | 2,650 (38.2%) | 1,874 (26.7%) | | |
| 3 | | 630 (9.1%) | 1,139 (16.2%) | | <0.0001 |
| 4 | | 178 (2.6%) | 1,080 (15.4%) | | |
| Unstageable | | 307 (4.4%) | 302 (4.3%) | | |
| Multiple stages | | 444 (6.4%) | 904 (12.9%) | | |
| Missing | | 1,406 (20.2%) | 1,175 (16.7%) | | |
| Present-on-admission status | | | | | |
| Yes | | 5,598 (80.6%) | 6,412 (91.3%) | | |
| No | | 599 (8.6%) | 126 (1.8%) | | |
| Unable to determine | | 35 (0.5%) | 16 (0.2%) | | <0.0001 |
| Multiple POA status | | 40 (0.6%) | 38 (0.5%) | | |
| Missing | | 673 (9.7%) | 435 (6.2%) | | |

*Elixhauser scores were calculated using all diagnoses from MedPAR, carrier, and outpatient claims 365 days prior to and including hospital admission (Quan et al. 2005). Unweighted scores reflect the raw count of comorbidity categories (range 0–30), and weighted values represent the index score proposed by van Walraven and colleagues (2009).

†Nursing home residents were identified by reviewing independent provider claims for 30 days prior to admission and identifying place of service codes and CPT procedure codes consistent with services rendered in nursing home facilities (Yun et al. 2010).

Table 2: Proportion of Admissions Reported by Hospitals as Present-on-Admission (POA Indicator = Yes) by Pressure Ulcer Stage Category

| | *Total Admissions with a Pressure Ulcer Diagnosis* | *Admissions with a New Pressure Ulcer Diagnosis Based on Claims History* | *Admissions with a Previously Documented Pressure Ulcer Diagnosis in Claims History* |
|---|---|---|---|
| Stage 1–2 | 82.8% | 80.3% | 87.0% |
| Stage 3–4 or unstageable | 93.8% | 87.8% | 96.5% |
| Missing stage | 81.2% | 75.3% | 88.4% |
| Total | 85.7% | 80.5% | 91.2% |

We eliminated 1,393 (10.0%) pressure ulcer admissions (469 new diagnosis admissions and 924 previously documented admissions) with multiple reported pressure ulcer stages or POA statuses, resulting in a total of 386,798 hospitalizations between January 1, 2011, and December 31, 2011. Data reported as the proportion of admissions with a pressure injury diagnosis and hospital-reported POA indicator = "Yes."

Table 3: Pressure Ulcer Rates per 1,000 Hospital Admissions

| *Numerator Inclusion Criteria* | *Pressure Ulcer Rate per 1,000 Admissions (All PU Stages)* | *Pressure Ulcer Rate per 1000 Admissions (Advanced Stage Only)* |
|---|---|---|
| All pressure ulcer admissions | 36.0 | 9.4 |
| Admissions with a new pressure ulcer diagnosis* | 17.9 | 2.9 |
| Admissions with a documented HAPU† | 1.9 | 0.2 |

*Newly diagnosed pressure ulcers were classified as pressure ulcer with no prior facility (inpatient, outpatient, or skilled nursing) or independent provider claim containing a pressure ulcer ICD-9 diagnosis or CPT procedure within 12 months prior to admission. All patients were required to have 12 months of continuous part A and B FFS enrollment for 12 months prior to admission.
†Data include admissions with pressure ulcer diagnosis and corresponding POA indicator of "N."

and procedure for debridement or pedicle graft also resulted in exclusion of 9.1 percent and 4.2 percent (respectively) of admissions with a new pressure ulcer diagnosis, and 9.0 percent and 4.4 percent (respectively) of admissions with a documented HAPU based on hospital-reported POA data.

## DISCUSSION

In this study, we observed a substantial discrepancy between hospital-reported POA data for pressure ulcers and patient history in claims data. We found that 5.2 percent of admissions with a pressure ulcer diagnosis were reported by

Table 4: Patient Exclusion Criteria

| *AHRQ PSI 03 Patient Exclusion Category** | *Excluded Admissions with a Pressure Ulcer Diagnosis, N (% Total Excluded)*[§] | *Excluded Admissions with a HAPU Using New Pressure Ulcer Diagnosis Classification*[†] | | *Excluded Admissions with a HAPU Using Documented POA Data*[‡] | |
|---|---|---|---|---|---|
| | | *N (% New PU Admissions)*[¶] | *HAPU Rate*** | *N (% HAPU Admissions)*[††] | *HAPU Rate*** |
| Length of stay less than 3 days | 1,592 (12.5) | 709 (10.2) | 22.6 | ≤10 (≤1.4)[§§] | 2.6 |
| Principal pressure ulcer diagnosis | 511(4.0) | 139 (2.0) | 17.6 | ≤10 (≤1.4)[§§] | 1.9 |
| Secondary pressure ulcer diagnosis coded as POA | 11,515 (90.3) | 5,461 (78.6) | 3.9 | 0 (0.0) | 1.9 |
| Transferred from another facility | 2,830 (22.2) | 1,222 (17.6) | 16.3 | 121 (16.7) | 1.7 |
| Major diagnostic category 9 or 14[¶¶] | 777 (6.1) | 294 (4.2) | 17.5 | ≤10 (≤1.4)[§§] | 1.9 |
| Diagnosis of hemiplegia, paraplegia, spina bifida, or anoxic brain injury | 1,666 (13.1) | 633 (9.1) | 17.0 | 65 (9.0) | 1.8 |
| Procedure for debridement or pedicle graft during their hospital stay | 870 (6.8) | 289 (4.2) | 17.3 | 32 (4.4) | 1.8 |
| All exclusion categories | 12,747 (100) | 6,047 (87.1) | 4.1 | 204 (28.1) | 2.4 |

*The 2015 AHRQ PSI 03 excludes cases from both the numerator and the denominator of the HAPU rate calculation: (1) if they have hospital length of stay less than 3 days, (2) if they have a principal diagnosis for pressure ulcer, (3) if their secondary pressure ulcer diagnosis is coded as POA, (4) if they are transferred from another facility, (5) if they are admitted for pregnancy, childbirth, or puerperium (MDC 14), (6) if they admitted for skin disorder diagnoses (MDC 9), (7) if they have diagnosis for hemiplegia, paraplegia, spina bifida, or anoxic brain injury, and (8) if they receive a procedure for debridement or pedicle graft during their hospital stay.

[†]Newly diagnosed pressure ulcers were classified as pressure ulcer with no prior facility (inpatient, outpatient, or skilled nursing) or independent provider claim containing a pressure ulcer ICD-9 diagnosis or CPT procedure within 12 months prior to admission.

[‡]Data include admissions with pressure ulcer diagnosis and corresponding POA indicator of "N."

[§]Data reported as number of excluded admissions with a pressure ulcer diagnosis (% of total excluded admissions).

[¶]Data reported as number of excluded admissions with a new pressure ulcer diagnosis (% of admissions with new pressure ulcer diagnosis).

**Data reported as HAPU rate including all pressure ulcer stages when including only the AHRQ PSI 03 patient exclusion criterion in the corresponding row.

[††]Data reported as number of excluded admissions with a documented HAPU using hospital-reported POA data (% of admissions with a documented HAPU using POA data).

[§§]To protect patient privacy, we did not display the results of data figures that were less than or equal to 10.

[¶¶]Major diagnostic category 9 corresponds to admissions with diseases and disorders of the skin, subcutaneous tissue, and breast. Major diagnostic category 14 corresponds to pregnancy, childbirth, and puerperium.

hospitals as HAPU using the POA indicator (POA = "N"). However, our review of patient history in claims data revealed a substantially higher "new diagnosis admission" proportion of 49.7 percent, which is more consistent with data published in previous retrospective chart reviews (POA proportion of 58–62 percent; Bahl et al. 2008; Lyder et al. 2012). We also found that 80.6 percent of admissions with a new pressure ulcer diagnosis (based on claims history) were reported by the hospital as POA, despite the absence of a pressure ulcer claim in the MedPAR, carrier, or outpatient file for 365 days prior to hospital admission. Taken together, these findings may indicate potential under-reporting of HAPUs when relying on hospital-reported POA data.

A previous national study of 51,842 randomly sampled FFS Medicare admissions between 2006 and 2007 found a pressure ulcer prevalence of 93 per 1,000 admissions using data verified from patient charts (Lyder et al. 2012). The same study determined that 58 per 1,000 admissions (62.4 percent) contained a pressure ulcer that was POA and cited a HAPU incidence rate of 45 per 1,000 admissions (Lyder et al. 2012). Compared to these estimates, our results reflect a 61.3 percent lower overall prevalence, a 46.6 percent lower prevalence on admission, a 62.2 percent lower incidence rate using new diagnosis classification, and a 93.3 percent lower incidence rate when relying on the hospital-reported POA indicator. Some of the observed discrepancy between the previously published results using 2006–2007 data and our analysis of admissions in 2011 may be due to adoption and success of pressure ulcer prevention and quality improvement programs. However, the fact that HAPU rates calculated with hospital-reported POA data were 89.4 percent lower than HAPU rates calculated based on new diagnosis classification and 93.3 percent lower than previously reported HAPU rates verified in patient charts raises concern regarding under-reporting of HAPUs in administrative claims data using the POA indicator.

Current coding guidelines for the POA indicator allow HACs to be coded as POA if the diagnosis is: (1) a possible, probable, suspected, or rule-out diagnosis condition at the time of discharge based on signs, symptoms, and findings at admission; (2) an impending or threatened diagnosis at the time of discharge based on signs, symptoms, and findings at admission; and/or (3) a chronic condition, even if not diagnosed until after admission (The Centers for Disease Control [CDC] 2011; CDC 2016). Under these conditions, it is plausible that 80 percent of newly diagnosed pressure ulcers may be correctly documented as POA, even if they were not directly examined and determined to be POA at the time of admission. Clinical distinction between stage 2 and stage 3 pressure ulcers is not always precise, and inter-rater reliability for pressure ulcer staging among health care professionals is poor (Russell 2002; Kottner et al. 2009).

Thus, coding patterns for HAPUs may be influenced by pressure ulcer staging difficulties and coding guidelines that are not specific enough to accurately identify POA status among chronic conditions.

We also found that other patient exclusion criteria included in the current AHRQ PSI 03 may result in inappropriate elimination of admissions with a new pressure ulcer diagnosis and admissions with a documented HAPU using the POA indicator. Transfer from another facility; diagnosis of hemiplegia, paraplegia, spina bifida, or anoxic brain injury; and procedure for debridement or pedicle graft during hospital stay resulted in the removal of 17.6 percent, 9.1 percent, and 4.2 percent (respectively) of admissions with a new pressure ulcer diagnosis. Furthermore, even when relying on hospital-reported POA data, the same exclusion criteria resulted in removal of 16.7 percent, 9.0 percent, and 4.4 percent (respectively) of admissions with a documented HAPU using the POA indicator. Taken together, these findings warrant further consideration regarding the potential impact of patient exclusion criteria on the sensitivity of detecting HAPUs in administrative claims.

As with any study utilizing administrative claims data, the internal validity of our analysis is limited by the accuracy and completeness of coding for each medical record assessed, and our results must be interpreted with caution. Examination of POA reporting patterns among diagnosed pressure ulcers depends on accurate and complete documentation of pressure ulcer diagnoses. However, the coding patterns for pressure ulcer diagnoses themselves are prone to poor sensitivity, geographic variation, and bias associated with payment incentives and financial penalties (Polancich, Restrepo, and Prosser 2006; Coomer and McCall 2013; Meddings 2015). Our method of using claims history to determine whether a pressure ulcer was present prior to admission is only valid if the pressure ulcer was evaluated and billed for by a provider prior to admission. Many early (stage I–II) pressure ulcers occur prior to hospital admission without any documentation in provider notes or claims until the patient is admitted to the hospital. This may be because patients in the outpatient setting do not routinely examine their own skin and may miss pressure ulcer development prompting medical attention.

Without chart-abstracted verification of this data, we were unable to measure the true coding sensitivity, accuracy, and reliability of claims-based pressure ulcer diagnoses and their corresponding POA indicators. However, chart-abstracted data examining pressure ulcer and POA coding have been shown to vary by facility and may not be accurate unless universally implemented, a task that is time-consuming, costly, and impractical (Goldman et al. 2011). It is also important to note that 10.8 percent of admissions with a new

pressure ulcer diagnosis and 7.0 percent of admissions among patients with a previously documented pressure ulcer had a missing or unknown POA status. We did not count these admissions as HAPUs, and our results may underestimate the true incidence of HAPUs in our study sample. Finally, we did not have access to home health agency claims, durable medical equipment claims, long-term nursing facility claims, or hospice facility claims, which may have limited our ability to detect pressure ulcer diagnoses and related procedures.

This is the first study to distinguish between newly diagnosed and previously documented pressure ulcers using patient-level administrative claims data linked across settings without relying on the hospital-reported POA indicator or manual chart abstraction. The distinction between admissions with a new pressure ulcer diagnosis and admissions with a previously documented pressure ulcer is important for evaluating accuracy of the POA indicator, understanding clinical risk adjustment, examining patient utilization across clinical settings, and evaluating patient outcomes. Adoption of this methodology may facilitate improved research for complex chronic secondary diagnoses using administrative claims data, an area of important research focus under value-based payment reform. Furthermore, the results of our study suggest potential under-reporting of HAPUs that may be addressed with revision of POA coding guidelines and patient exclusion criteria.

The adoption of HAPUs as a quality metric to adjust reimbursed payment has resulted in numerous pressure ulcer prevention programs that have improved the value of care for a clinically and financially burdensome secondary diagnosis that was previously underappreciated by many providers (Kottner et al. 2009). However, as payers and health care organizations expand the use of HACs and POA indicators, it is important to consider the ways in which these metrics are implemented and the potential impact of coding bias on performance evaluation. For patients with chronic conditions who frequently traverse multiple clinical settings, current POA coding guidelines may not be specific enough to accurately differentiate between preexisting comorbidities and hospital-acquired complications. Furthermore, patient exclusion criteria for chronic conditions should be carefully examined in the context of POA reporting to ensure that they do not result in elimination of actual HAC events.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the supporting information tab for this article:

Appendix SA1: Author Matrix.