

# Patient- and Hospital-Level Factors Associated with Receipt of Bone Densitometry (DXA) in Male Veterans Hospitalized for Hip Fracture

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## FINDINGS

### CONTEXT

- Department of Veterans Affairs (VA) recommends that men ages 50 and older with hip fracture be evaluated for osteoporosis.
- Bone densitometry with DXA is considered a hallmark of high quality care. DXA quantifies the severity of bone disease and can be used to evaluate treatment response in patients who initiate pharmacotherapy.

### OBJECTIVE

To identify patient and hospital factors associated with osteoporosis evaluation, as measured by receipt of dual-energy X-ray absorptiometry (DXA), among male Veterans ages 50 and older treated for hip fracture in VA inpatient settings.

### METHODS

**Design.** Retrospective cohort study.

**Data Sources.** National VA and Medicare administrative data accessed through the VA Informatics and Computing Infrastructure (VINCI).

**Patient Selection.** Male patients ages 50 and older who were treated for hip or pelvis fracture were identified from VA inpatient claims (CY 2009-2012, N=5827). Exclusions were made for patients engaged in hospice or palliative care (n=188); Paget's or osteomalacia (n=71); spinal cord injury (n=143), DXA within two years prior to the fracture DXA (n=467), prior OP diagnosis (n=957), or prior OP-related pharmacotherapy (n=561). Sensitivity analysis using patients age 65 and older incorporated diagnoses and procedures from outside the VA using CMS claims.

### Variables:

Outcome: Receipt of DXA after VA inpatient fracture encounter.

**Patient Characteristics:** Demographic (e.g. race, age, rural residence, dual eligibility in VA and CMS etc.), clinical (i.e., comorbid conditions), and assigned VA healthcare facility.

**Analysis.** First, the relationship between patient characteristics and receipt of DXA were examined with univariate methods (i.e. Chi-square or Fisher's exact where appropriate) and using Kaplan-Meier curves. Second, multivariable Cox proportional hazards models with random effects for the assigned hospital (i.e., frailty models) were used to estimate hazard ratios (HR) associated with patient clinical and demographic characteristics. Receipt of osteoporosis medications or an osteoporosis diagnosis after fracture were included as time-dependent covariates in the Cox models. Censoring events included death and end of the observation period. Finally, analyses were repeated using patients age 65 and older, and included DXA received outside the VA. Analyses were conducted using SAS Enterprise Guide version 7.1 on the VA VINCI network (SAS Institute, Inc).

**Table 1. Patient Characteristics and Unadjusted DXA Rates (n, %)**

|   | Overall |       | Number, % DXA Recipients |       | p-Value |
|---|---------|-------|--------------------------|-------|---------|
|   | 4,602   | 100%  | 497                      | 10.7% | <0.001  |
| Age at Time of Fracture (mean, SD)        | 76.6    | 11.1  | 73.4                     | 10.4  | <0.001  |
| VA-CMS Dual Eligibility                   | 3,010   | 65.4% | 330                      | 11.0  | 0.65    |
| Race                                      |         |       |                          |       | 0.77    |
| White                                     | 3,541   | 76.9% | 385                      | 10.9% |         |
| Black                                     | 485     | 10.5% | 52                       | 10.7% |         |
| All Other                                 | 339     | 7.4%  | 39                       | 11.5% |         |
| Missing                                   | 237     | 5.2%  | 21                       | 8.9%  |         |
| Rural Residence (RUCA)                    |         |       |                          |       | 0.19    |
| Isolated                                  | 234     | 5.1%  | 16                       | 6.8%  |         |
| Small Rural                               | 335     | 7.3%  | 35                       | 10.5% |         |
| Large Rural                               | 449     | 9.8%  | 41                       | 9.1%  |         |
| Urban                                     | 3,247   | 70.6% | 366                      | 11.3% |         |
| VA Means Category                         |         |       |                          |       | 0.85    |
| Service Connected                         | 1,525   | 33.1% | 166                      | 10.9% |         |
| Low Income                                | 1,751   | 38.1% | 193                      | 11.0% |         |
| All Other                                 | 1,326   | 28.8% | 138                      | 10.4% |         |
| Miles to nearest primary care (mean, SD)  | 1)11.6  | 11.4  | 11.0                     | 11.3  | 0.16    |
| Miles to VA Hospital (mean, SD)           | 25.0    | 34.8  | 23.7                     | 26.7  | 0.40    |
| Common Comorbidities (out of 34 measured) |         |       |                          |       |         |
| Alcohol Abuse                             | 425     | 9.2%  | 64                       | 15.1% | <.001   |
| Back Pain                                 | 2,228   | 48.4% | 279                      | 12.5% | <.001   |
| Cancer, Metastatic                        | 79      | 1.7%  | 8                        | 10.1% | 1.00    |
| Cancer, Non- Metastatic                   | 811     | 17.6% | 102                      | 12.6% | 0.08    |
| COPD                                      | 1,253   | 27.2% | 123                      | 9.8%  | 0.20    |
| Congestive Heart Failure                  | 832     | 18.1% | 66                       | 7.9%  | <.001   |
| Diabetes                                  | 1,433   | 31.1% | 144                      | 10.1% | 0.28    |
| Fluid or Electrolyte Disorder             | 678     | 14.7% | 53                       | 7.8%  | <.001   |
| Hypertension                              | 2,810   | 61.1% | 300                      | 10.7% | 0.77    |
| Neurological Disorder                     | 596     | 13.0% | 43                       | 7.2%  | <.001   |
| Parkinson's Disease                       | 360     | 7.8%  | 29                       | 8.1%  | 0.09    |

**Table 2. Patient Characteristics Associated with Receipt of DXA in Multivariable Cox Frailty Regression Models**

|                              | Hazard Ratio | 95% CI Hazard Ratio | p-value |       |
|------------------------------|--------------|---------------------|---------|-------|
| Age at Time of Fracture      | 0.97         | 0.96                | 0.98    | <0.00 |
| Cancer, Non-Metastatic       | 1.30         | 1.03                | 1.64    | 0.02  |
| Dual VA/CMS Eligibility      | 1.33         | 1.03                | 1.71    | 0.02  |
| Lymphoma                     | 2.39         | 1.22                | 4.71    | 0.01  |
| Neurologic Disease           | 0.66         | 0.47                | 0.92    | 0.01  |
| Osteoporosis Diagnosis       | 0.54         | 0.43                | 0.72    | <0.00 |
| Osteoporosis Pharmacotherapy | 0.48         | 0.36                | 0.65    | <0.00 |

**Table 3. Sensitivity Analysis Using CMS and VA Data for Veterans Age 65 and Older (n=3161): Multivariable Cox Regression Models**

|                              | Hazard Ratio | 95% CI Hazard Ratio | p-value |       |
|------------------------------|--------------|---------------------|---------|-------|
| Age at Time of Fracture      | 0.96         | 0.94                | 0.97    | <0.00 |
| Back Pain                    | 1.27         | 1.02                | 1.58    | 0.03  |
| Coagulation Disorder         | 1.96         | 1.26                | 3.04    | 0.00  |
| Distance to CBOC             | 0.98         | 0.97                | 1.00    | 0.04  |
| Fluid Disorder               | 0.63         | 0.45                | 0.89    | 0.00  |
| Osteoporosis Diagnosis       | 0.57         | 0.44                | 0.75    | <0.00 |
| Osteoporosis Pharmacotherapy | 0.50         | 0.36                | 0.68    | <0.00 |

### Cohort Characteristics and DXA Incidence

In the primary analysis of 4602 men (Table 1), the mean age at time of fracture was 76.6 years. A majority were white, and resided in urban areas. Only 10.7% (n=497) received DXA during the follow-up period. Receipt of DXA was lower among men with back pain, congestive heart failure, fluid or electrolyte disorder, or neurological disorder, and it is higher among those with alcohol abuse or obesity. Among men who received DXA the average time to DXA was 258 days.

### Receipt of DXA after VA Inpatient Hip Fracture

In multivariable frailty models (Table 2), increasing age, receipt of osteoporosis medication, osteoporosis diagnosis, or presence of neurological disease were associated with a reduced likelihood of receiving DXA. Dual VA/CMS eligibility, lymphoma, and non metastatic cancer were associated with increased likelihood of post-fracture DXA.

In sensitivity analysis of patients age 65 and older that incorporated CMS data (Table 3), age at time of fracture, osteoporosis pharmacotherapy, and osteoporosis diagnosis remained key variables in predicting DXA use. Additionally, increasing distance to assigned VA community based outpatient clinic (CBOC), and fluid disorder decreased the likelihood of DXA, whereas coagulation disorder and back pain increased DXA likelihood.

### LIMITATIONS

We cannot ascertain whether DXA receipt was directly related to the inpatient encounter. While we were able to identify post-fracture DXA in CMS claims, it is possible that some men received DXA in other settings.

### DISCUSSION and PRACTICE IMPLICATIONS

We found that a majority of men with VA inpatient hip fractures remained in the VA for their osteoporosis care, however a small proportion received DXA. The role of pharmacotherapy and diagnosis in reducing the likelihood of DXA confirms the importance of healthcare delivery systems in managing OP care after sentinel events.

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