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Multiple chronic condition profiles and survival among oldest-old male patients with hip fracture

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ABSTRACT

To improve understanding of survival among very elderly male patients with surgically repaired hip fractures, this study applied classification techniques to multiple chronic conditions (MCC) then modeled survival by latent class. Veterans Health Administration (VHA)'s electronic medical records on male inpatients age 85–100 years (n = 896) with hip fracture diagnosis and repair were used. MCC defined by Charlson and Elixhauser disorders, medications, demographic covariates, and 5 years follow-up survival were included. Latent Class Analysis (LCA) identified three classes based on patterns of MCC, medications, and demographic covariates: Low-comorbidity (16%), High-longevity (55%), and High-comorbidity (29%). Overall, survival censored at 5 years post-op averaged 717 days. The Low-comorbidity group was more likely to be Hispanic, less disabled per VHA determination of eligibility for care, with less risk of postoperative emergency department (ED) visit, and taking no prescription medications. The High-longevity group had longer survival. The High-comorbidity group had more MCC, more prescription medications and shorter survival than the other two groups. Accelerated failure time (AFT) modeled associations between MCC and 5-year survival by class. In AFT models, fewer days until first postoperative ED visit was significantly associated with survival across the three classes. About one in male hip fractured veteran patients over the age of 85 had high levels of MCC and ED use and experienced shorter survival. Hip fracture patients with MCC may merit enhanced post-discharge management. Close investigation targeted to MCC and hip fractures is needed to optimize clinical practices for oldest-old patients in community healthcare systems as well as VHA.

1. Introduction

Hip fracture is one age-related and common multiple chronic conditions (MCC) in older adults. The annual incidence of hip fracture is expected to increase to 500,000 by 2040 as the United States population ages (Cummings, Rubin, & Black, 1990). Persons over the age of 85 years are 10 times more likely to suffer a hip fracture than those aged 65 to 69 years old (Samelson, Zhang, Kiel, Hannan, & Felson, 2002). Furthermore, age is a risk factor for one-year survival; thus, risk of mortality is much higher in patients aged 85 years and older than in younger counterparts (Kannegaard, van der Mark, Eiken, & Abrahamsen, 2010; Vestergaard, Rejnmark, & Mosekilde, 2007). In addition to age, fracture-related morbidity and mortality among older male adults appears to be higher than in older females (Holt, Smith, Duncan, Hutchison, & Gregori, 2008; Panula et al., 2011) and the prevalence of osteoporotic fractures in men is expected to increase dramatically (Center, Nguyen, Schneider, Sambrook, & Eisman, 1999). Kannegaard et al. found higher cumulative mortality at 12 months among male than female hip fracture patients (Kannegaard et al., 2010).

A recent systematic review also identified the characteristics of patients with a high risk of mortality after a hip fracture surgery (Smith,

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Pelpola, Ball, Ong, & Myint, 2014). Pre-operative indicators such as ethnicity (Lu-Yao, Baron, Barrett, & Fisher, 1994), functional capacity (Jamal Sepah, Umer, Khan, & Ullah Khan Niazi, 2010), number of co-morbidities (Grimes, Gregory, Noveck, Butler, & Carson, 2002; Jiang et al., 2005), number of medications (Holmes & House, 2000) were identified for the post-operative mortality outcome. For example, co-morbidities before fracture was a significant determinant of 1-year mortality in a population-based cohort study (Jiang et al., 2005) indicating greater mortality in those with higher incidence of co-morbidities. Furthermore, several clinical care delivery factors (e.g., duration between injury and surgery, post-operative delirium, timing of rehabilitation, surgical technique) were also significantly relevant to mortality following hip fracture (Crotty et al., 2010; Gottschalk, Hubbs, Vikani, Gottschalk, & Sieber, 2015; Kilci, Un, & Sacan, 2016; Smith et al., 2014; Simunovic, Deveraux, & Sprague, 2010). Oldest-old adults over the age of 85 years comprise 5.7 million persons (1.8%) in the United States, a number that is expected to increase to 14.1 million by 2040 (Administration of Aging A profile of older Americans, 2012). The rapidly aging population including this segment is already a major utilizer of healthcare and other supportive care (Cauley, Lui, & Barnes, 2009). Although age has been a significant risk factor for mortality following hip fracture, a couple of studies have shown that patients over 90 years old presenting for operative management for hip fracture are similar compared to younger cohort (Graver, Merwin, & Collins, 2015). This indicates age is not an independent factor of mortality. Furthermore, most previous studies have focused on short-term mortality (e.g., 30 days or 1 year mortality) among this patient group. Looking at long-term mortality following hip fracture in this population group has rarely been addressed. Critical to the development of effective healthcare services to reduce morbidity and increase life expectancy is a good understanding of factors associated with health outcomes for oldest-old adults.

Given previous studies and the demographic trends noted above, several research questions remain unanswered, including: What does long-term mortality rate on post-discharge look like among male oldest-old patients? What factors are associated with long-term survival among male oldest-old patients with surgically repaired hip fracture? Are there similarities and differences in risk factors for mortality across comorbidity groups of elderly male hip fracture patients? Therefore, this study aimed to detect survival rate for 5 years and identify factors associated with survival among male patients aged 85 years old and over with surgically repaired hip fracture in the Veterans Health Administration (VHA) applying latent classification techniques to MCCs.

2. Methods

2.1. Data source and sample

This study used administrative data from a study of Surgical Treatment Outcomes for Patients with Psychiatric Disorders (STOPP) derived from the VHA data repository at the Austin Information Technology Center including the Corporate Data Warehouse (CDW) (Cho, Copeland, & Stock, 2016; Copeland, Zeber, & Sako, 2015). The target patients of this study are the oldest-old, those age 85 years and older. Inclusion criteria were: (a) male veterans, (b) hip fracture repair during a qualifying inpatient stay in fiscal years 2005–2009 (October 2004–September 2009), (c) prior-year utilization generating diagnoses, (d) logical death and utilization dates, (e) age 85–100 as of index event. The index event was an inpatient stay for hip fracture per the International Classification of Diseases Ninth (ICD-9) diagnosis code, 820.xx, with Current Procedural Terminology (CPT) or ICD9A procedure codes for hip fracture repair (CPT: 27236, 27244, 27245, 27248, 27269; ICD9A: 78.55, 79.25, 79.35, 79.65).

2.2. Measures

The primary dependent variable in this study was mortality. *Mortality,* a dichotomous variable, was created for Cox proportional hazards models denoting death during follow-up (1 = died; 0 = survived) with the survived value signaling censored follow-up. Survival in days was calculated as number of days through 5 years after the index hip surgery. *Demographic characteristics* included age, sex, race, Hispanic ethnicity, marital status, and VHA priority status. Race was recoded as white, black, Asian, or missing. Hispanic ethnicity was captured as yes or no, and marital status was categorized to married, divorced, widower, never married. VHA priority status, composed of 8 categories, is a rating of eligibility for VA care based on severity of illness and socioeconomic status (Kazis et al., 1998). For instance, veterans with 50% to 100% disability by a condition related to their military service (service-connected disability) are identified as Priority 1 and have no copayments for care or pharmacy benefits. Priorities 2–6 include lower levels of disability, special military service circumstances, catastrophically disabled from non-service-connected condition, and impoverishment. Priority 7 and 8 identify veterans who do not meet above criteria and have agreed to copayments for care and prescription medications.

Multiple chronic conditions were defined by 19 Charlson and 30 Elixhauser conditions after eliminating overlapping diagnoses, which resulted in 34 unique medical conditions: acquired immune deficiency syndrome (AIDS), blood loss anemia, deficiency anemias, solid tumor or blood/lymph cancer, metastatic solid tumor, cardiac arrhythmias, cerebrovascular disease (stroke), congestive heart failure (CHF), coagulopathy, dementia, diabetes, fluid and electrolyte disorders, human immunodeficiency virus (HIV) without AIDS, hypertension, chronic kidney disease, cirrhosis or mild liver disease, hepatic failure, chronic obstructive pulmonary disease (COPD), pulmonary circulation disorders, myocardial infarct (MI), neurological disorders, obesity, paralysis − hemi/paraplegia, peptic ulcer disease, peripheral vascular disease, rheumatoid arthritis or collagen vascular diseases, rheumatologic disease, valvar disease, unintentional weight loss, alcohol abuse, drug abuse, psychoses depression, posttraumatic stress disorder (PTSD) [ICD-9 codes for each condition available upon request].

Healthcare service measures included number of medication classes and days to first post-discharge emergency department (ED) visit (maximum: 1,666 days). Several types of medications prescribed for treatment chronic diseases during the year prior to hip fracture repair and year following hip fracture repair were characterized as bone-strengthening medications or bone-depleting. In addition, drugs used to treat chronic conditions were identified by therapeutic class. The 11 medication classes were addictions, allergies, autonomic central nervous system agents, blood thinners, cardiovascular (including hypoglycemics, antihypertensives, antilipemics), psychotropics (including antipsychotics, antidepressants and benzodiazepines), gastrointestinal, genitourinary, hormones/steroids, anti-inflammatories, and pulmonary medications. After excluding topical formulations, the number of medication classes for chronic disorders was categorized into three groups: 0 classes, 1–3 classes, and 4+ classes. Days to ED visit were counted from discharge from the index hip fracture repair.

2.3. Analysis

Descriptive analyses included frequencies (percentages) and means (standard deviations, ranges) of demographic, MCC, and healthcare service measures overall and according to class identified by latent class analysis (LCA). LCA was applied to generate the latent classes of patients that could adequately account for the associations among observed measures. After a series of models were estimated for 1 to 5 classes, we assessed the model fit of LCA with likelihood-ratio G^2 statistic, Akaike's Information Criterion (AIC), Bayesian Information Criteria (BIC), and likelihood-ratio x^2 statistic. Following standard