



The relationship between different settings of medical service and incident frailty



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ABSTRACT

Background: Some studies have reported a potential association between usual source of health care and disability, but no one has explored the association with frailty, a state of early and potential reversible disability. We therefore aimed to explore the association between older persons' self-reported usual source of health care at baseline and the onset of frailty.

Methods: Information regarding usual source of health care was captured through self-report and categorized as 1) private doctor's office, 2) public clinic, 3) Health Maintenance Organization (HMO), or 4) hospital clinic/emergency department (ED). Frailty was defined using the Study of Osteoporotic Fracture (SOF) index as the presence of at least two of the following criteria: (i) weight loss $\geq 5\%$ between baseline and any subsequent follow-up visit; (ii) inability to do five chair stands; and (iii) low energy level according to the SOF definition. Multivariable Cox's regression analyses, calculating hazard ratios (HRs) with 95% confidence intervals (CIs), were undertaken.

Results: Of the 4292 participants (mean age: 61.3), 58.7% were female. During the 8-year follow-up, 348 subjects (8.1% of the baseline population) developed frailty. Cox's regression analysis, adjusting for 14 potential confounders showed that, compared to those using a private doctor's office, people using a public clinic for their care had a significantly higher risk of developing frailty (HR = 1.56; 95%CI: 1.07–2.70), similar to those using HMO (HR = 1.48; 95%CI: 1.03–2.24) and those using a hospital/ED (HR = 1.76; 95%CI: 1.03–3.02).

Conclusion: Participants receiving health care from sources other than private doctors are at increased risk of frailty, highlighting the need for screening for frailty in these health settings.

1. Introduction

As the population ages, the number of older people with frailty is expected to increase worldwide. Frail people are known to be at high risk for several deleterious outcomes, such as hospitalization, institutionalization and disability (Clegg et al., 2013), all conditions that contribute to increased costs for healthcare (McMillan and Hubbard, 2012).

Attention to frailty as a risk factor for deleterious outcomes highlights the importance of prevention, in order to attenuate the common progression from frailty to disability and then to death (Morley et al.,

2013). Promoting prevention requires a conceptual framework tailored to maximize function in older age through consistent assessment and intervention strategies (Beard and Bloom, 2015). Such a coherent approach is lacking in most current health care settings (Beard and Bloom, 2015). Most older and complex patients are not cared for by geriatricians or in special geriatric units. Moreover, these patients are likely to receive care from multiple providers, challenging coordination of care. It has been suggested that Health Maintenance Organizations (HMOs) have the opportunity to better coordinate care, and in fact may have financial and other incentives to do so (Gaynor et al., 2004). However, some other studies have shown that HMOs have not met this

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promise (Ware Jr. et al., 1996; Burton et al., 2002; Porell and Miltiades, 2001).

Reviews of the literature have concluded that, for the general population, HMO enrollees and non-enrollees with indemnity insurance receive roughly comparable quality of care assessed by process and outcome measures (Hellinger, 1998; Miller and Luft, 1994). On the other hand, focusing only on older people, the Medical Outcomes Study found a greater decline in physical health for older patients in HMOs than in fee-for-service plans (Ware Jr. et al., 1996; Burton et al., 2002). Similarly, Porell et al. showed that the risk for functionally independent people becoming disabled within a year was lower in Fee-For-Service Medicare (FFS) individuals than among HMO enrollees (Porell and Miltiades, 2001).

While others study investigated the potential relationship between usual source of care and disability onset (Ware Jr. et al., 1996; Burton et al., 2002; Porell and Miltiades, 2001), none of these examined frailty, but this could be of importance since frailty is the first and still reversible step for the transition to disability (Clegg et al., 2013).

Given this background, the aim of the present study is to investigate the association between self-reported usual source of care among old people and the onset of frailty in a large cohort of North Americans at risk for or who have osteoarthritis, over a follow-up of 8 years. Based on previous studies, we hypothesized that persons using services other than FFS care would be at higher risk of developing frailty over time.

2. Methods

2.1. Data source and subjects

Data were obtained from the freely available (<http://www.oai.ucsf.edu/>) Osteoarthritis Initiative (OAI) database. Within the OAI, potential community-dwelling participants were recruited across four clinical sites in the United States of America (Baltimore, MD; Pittsburgh, PA; Pawtucket, RI; and Columbus, OH) between February 2004 and May 2006. In this database, people were included if they: (1) had knee OA with knee pain for a 30-day period in the past 12 months or (2) were at high risk of developing knee OA (Felson and Nevitt, 2004). The data were collected during the baseline and in screening evaluations and in subsequent evaluations over the 8 year period. All participants provided written informed consent.

The OAI study was given full ethics approval by the institutional review board of the OAI Coordinating Center, at the University of California in San Francisco.

2.2. Health care provider (exposure)

As part of the baseline data collection, trained interviewers asked each participant: “Where do you usually go for health care or advice about your health care?”. The possible answers were: private doctor's office, public clinic, HMO, hospital outpatient clinic, emergency department (ED), or other. For the aims of this manuscript, data for ED and hospital clinics were merged.

2.3. Frailty (outcome)

In agreement with the Study of Osteoporotic Fracture (SOF) index (Ensrud et al., 2007; Veronese et al., 2017a) frailty was defined as the presence of ≥ 2 out of three of the following criteria:

- (1) weight loss $\geq 5\%$ taking place between baseline and the follow-up examinations (at the baseline examination, a body mass index, BMI of $< 20 \text{ kg/m}^2$, a common cut-off for identifying underweight people the elderly (Veronese et al., 2015), was used, since no information regarding weight changes were recorded);
- (2) chair stand: the inability to rise from a chair five times without arm support (hereafter referred to as inability to carry out chair stands);

and.

- (3) limited energy, based on the SF12 questionnaire response of either “a little of the time” or “none of the time” to the question “In the past 4 weeks, did you have a lot of energy?”

Assessment of the frailty outcome was made during the V01 (12 months), V03 (24 months), V05 (36 months), V06 (48 months), V08 (72 months) and V10 (96 months) evaluations compared to baseline.

2.4. Covariates

Multiple covariates were identified as potential confounding factors, including: body mass index (BMI); physical activity evaluated using the total score for the Physical Activity Scale for the Elderly scale (PASE) (Washburn et al., 1999); race; smoking history; educational attainment (college or higher vs. others); yearly income ($<$ vs. \geq \$50,000 or missing data); depressive symptoms assessed using the Center for Epidemiologic Studies Depression Scale (CES-D) (Lewinsohn et al., 1997); and a validated general health measure of self-reported comorbidities assessed using the modified Charlson Comorbidity Index score (Katz et al., 1996); total energy intake per day (in kcal); medical insurance (categorized as yes vs. no); and transitions in health care during follow-up period assessed at the same time of frailty status.

2.5. Statistical analyses

Data on continuous variables were normally distributed according to the Kolmogorov-Smirnov test. Data were presented as means and standard deviation values (SD) for quantitative measures, and percentages for all categorical variables. *p* values were calculated using the Analysis of Variance (ANOVA) test with the Bonferroni's correction for continuous variables and the logistic regression analysis for categorical ones, taking people with private doctors as reference since this group was the largest.

To assess the relationship between health care provider and incident frailty, a Cox's regression analysis was conducted in which incident frailty was defined as the discrete “outcome,” time-to-event was the temporal factor, and the health care provider was the “exposure”. Deceased people were censored. The basic model was adjusted for age and sex. The fully adjusted model included also the following covariates: race (whites vs. others); body mass index (as continuous); education (degree vs. others); smoking habits (current and previous vs. others); yearly income (categorized as \geq or $<$ 50,000\$ or missing data); Physical Activity Scale for Elderly score (as continuous); Charlson co-morbidity index; CES-D: Center for Epidemiologic Studies Depression Scale; total energy intake (as continuous); number of frailty indexes at baseline (one vs. none); medical insurance (yes vs. no); transitions in health care during follow-up period. Symptomatic knee OA (Veronese et al., 2017b) (i.e., the presence of painful knee and alterations suggestive for knee OA) was initially considered as covariate, but excluded since the prevalence was not difference across groups and was not associated with frailty at follow-up (*p*-value = 0.38 at the univariate analysis).

Multi-collinearity among covariates was assessed through variance inflation factor (VIF) (Miles, 2009), taking a cut-off of 2 as the criterion for exclusion. No covariates met this criterion and therefore none was excluded for this reason. Adjusted hazard ratios (HR) and 95% confidence intervals (CI) were calculated to estimate the strength of the associations between health care provider and incident frailty.

Several sensitivity analyses were conducted evaluating the interaction between health care provider and selected factors [i.e., age below or more/equal than 65 years, overweight/obese ($\geq 25 \text{ kg/m}^2$) vs. normal weight ($18.5 \text{ kg/m}^2 < \text{BMI} \leq 25 \text{ kg/m}^2$), yearly income, gender, race, education, smoking habits, yearly income, number of frailty index at baseline categorized as one vs. none) in the association with frailty, but no one emerged as moderator of our findings

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