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Modifiable risk factors for nursing home admission among individuals with high and low dementia risk

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ABSTRACT

Background: Strategies to prevent or delay nursing home admission in individuals with cognitive impairment are urgently needed. We hypothesized that physical inactivity, not consuming alcohol (as opposed to moderate alcohol use), and having a history of smoking predict nursing home admission among individuals with normal cognitive function, but these behavioral factors would have attenuated associations with nursing home admission among individuals with impaired cognition.

Methods: We performed a prospective cohort study among 7631 Health and Retirement Study participants aged 65+ at baseline. Baseline dementia risk (high versus low, based on brief psychometric assessments and proxy reports) and modifiable risk factors (physical inactivity, ever smoking, and not consuming alcohol) were used to predict nursing home admission in pooled logistic regression models. We evaluated whether estimated effects of modifiable factors varied by dementia risk, comparing both relative and absolute effects using interaction terms between dementia risk and each modifiable risk factor.

Results: Low dementia probability was associated with lower nursing home admission risk (RR = 0.49; 95% CI: 0.41, 0.59). Physical inactivity (RR = 1.27; 95% CI: 1.15, 1.41), ever smoking (RR = 1.12; 95% CI: 1.01, 1.25), and not consuming alcohol (RR = 1.28; 95% CI: 1.13, 1.45) predicted increased relative risk of nursing home admission regardless of cognitive status. The relative effects of modifiable risk factors were similar for those with low and high dementia risk.

Conclusion: Although cognitive impairment associated with incipient dementia strongly predicts nursing home admission, this risk can be partially ameliorated with modifiable risk factors such as physical activity.

1. Introduction

Spending on nursing home care in the United Stated is projected to exceed $167 billion in 2015 (Keehan et al., 2015). In addition to its high cost, placement in a nursing home has been associated with many adverse outcomes including questionable quality of care for the patient and emotional distress for the caregiver (Institute of Medicine (U.S.). Committee on Improving Quality in Long-Term Care, Wunderlich, & Kohler, 2001; Kane, 2001; Schulz et al., 2004). The vast majority of elderly individuals would prefer to remain in their homes as they age (National Council on Aging, 2012). The combination of high costs, negative health outcomes, and consideration of preferences to "age in place" has resulted in efforts to identify factors associated with nursing home placement with the hope of developing interventions to delay nursing home placement. Cognitive impairment strongly predicts risk of nursing home admission (Gaugler, Duval, Anderson, & Kane, 2007; Luppa et al., 2010), more than doubling the risk of nursing home admission according to a large *meta*-analysis (Gaugler et al., 2007). Given the strong association between cognitive function and risk of nursing home admission, there is a growing interest in finding factors which may delay nursing home placement even among those with cognitive impairment.

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Prior research among dementia patients has focused mostly on demographics, co-morbidities, depressive symptoms, presence of functional limitations, and caregiver characteristics as potential predictors of nursing home placement (Luppa, Luck, Brahler, Konig, & Riedel-Heller, 2008). Evidence for other modifiable behaviors, such as alcohol consumption, smoking, or physical activity is limited. Studies in the general population suggest that smoking status and alcohol consumption influence the risk of nursing home admission (Deng et al., 2006; Kaplan et al., 2014; McCallum, Simons, Simons, & Friedlander, 2007; Valiyeva, Russell, Miller, & Safford, 2006; Wang, Mitchell, Smith, Cumming, & Leeder, 2001; Warner, McCammon, Fries, & Langa, 2013). For example, although high levels of alcohol consumption is harmful to health (Stahre, Roeber, Kanny, Brewer, & Zhang, 2014), some studies have observed that moderate alcohol consumption is associated with a reduction in the risk of nursing home placement (Kaplan et al., 2014; McCallum et al., 2007). One study showed that this association persisted even after adjusting for socioeconomic factors (Kaplan et al., 2014). Physical function affects nursing home admission independent of cognitive function (Luppa et al., 2010), so smoking status and alcohol consumption may also impact the risk of nursing home admission among those with cognitive impairment through their impacts on physical functioning. Evidence for the effect of physical activity on the risk of nursing home placement in either the cognitively normal or the cognitively impaired is much more limited. Although low physical activity levels predict functional limitations in the general population (Stuck et al., 1999) and among those with cognitive impairment (Blankevoort et al., 2010) and functional limitations are strongly associated with the risk of nursing home placement in both the general population and among those with dementia (Gaugler et al., 2007; Gaugler, Yu, Krichbaum, & Wyman, 2009), evidence for the effect of physical activity on nursing home admission risk in the general population is mixed. Studies among those with cognitive impairment or dementia have often focused on the effect of exercise training on fitness, physical function, cognitive function and positive behavior (Heyn, Abreu, & Ottenbacher, 2004), but have not assessed the effect of physical activity on the risk of institutionalization.

Although there are no effective treatments to cure dementia, physical activity, smoking, and alcohol consumption can all be modified, and accurate information about the likely impact of such behaviors on nursing home risk is important for patients, caregivers, and clinicians. These modifiable risk factors may provide opportunities to reduce the risk of institutionalization even among those with cognitive impairment. On the other hand, cognitive impairment may so dramatically increase nursing home admission that none of the modifiable factors are relevant. In other words, among individuals with cognitive impairment, no other factors may offset or exacerbate risk. Distinguishing these possibilities will help design and target effective interventions to reduce or delay nursing home admissions.

Using data from the Health and Retirement Study (HRS), we examined the effect of cognitive status and modifiable risk factors on the risk of nursing home admissions. We also evaluated interactions between cognitive status and each risk factor to determine if the relative or absolute impact of each modifiable factor differs based on the individual's cognitive status. We hypothesized that physical inactivity, not consuming alcohol, and ever smoking would predict an increase in risk of nursing home admission among individuals with normal cognitive function, but effects of these risk factors would be attenuated in both relative and absolute terms among individuals with impaired cognition.

2. Methods

Briefly, the HRS is a nationally representative cohort of Americans aged 50 years or older and their spouses (Heeringa, 1995; Juster & Suzman, 1995). These analyses were restricted to those participants who were aged 65 years or older in 2000 because cognitive assessments were performed biennially only for those aged 65 years or older.

HRS was approved by the University of Michigan Health Sciences Human Subjects Committee.

2.1. Outcomes assessment

Our primary outcome was a binary indicator of first self-reported nursing home admission defined as a facility which provides all of the following services for its residents: dispensing of medications, 24-h nursing assistance and supervision, personal assistance, room and meals. In the case of decedents or other participants who are not able to respond, information on nursing home admission was provided by proxy informants (typically a spouse or other close family member). For respondents who were alive at the time of the interview, using data from RAND (St. Clair et al., 2010), we determined whether the participant or their proxy reported any nursing home stay since the previous interview wave (i.e. in the past two years) or if the respondent or their proxy reported currently living in a nursing home or other health care facility at the time of the interview. For respondents who were not alive at the time of the interview, we used information from the HRS Exit interviews with proxy respondents to determine if the respondent was living in a nursing home at the time of his or her death. Individuals who reported nursing home stays or currently living in a nursing home in 1998 or 2000 were excluded from all analyses. We assessed outcomes through the 2012 interview wave.

2.2. Cognitive assessment

Our measure of cognitive impairment was imputed dementia probability score which has been described in detail previously (Wu et al., 2013). Briefly, direct and proxy-assessed cognition were calibrated against dementia diagnoses according to DSM-III-R and DSM-IV criteria in a sub-sample of HRS participants (C statistic = 94.3%). The theoretical range of the imputed score was from 0 (no chance this person has dementia) to 1 (individual certain to have dementia) with an actual range of 0.51×10^{-13} to 0.99 for the individuals included in these analyses. We divided dementia probability score at each wave into two categories (high and low dementia probability) based on the 90th percentile of the dementia probability in 2000 (90th percentile of dementia probability = 0.197). Those below the cutpoint were used as the reference group for all analyses (they represent "normal" cognitive function). Imputed dementia probabilities were not available for Hispanics so they were excluded from these analyses.

2.3. Risk factors for nursing home admission

The risk factors considered in this analysis were physical inactivity, not consuming alcohol, and ever smoking. We slightly modified the RAND version (St. Clair et al., 2010) of these variables to create dichotomous variables consistent with our previous work (Nandi, Glymour, & Subramanian, 2014; Rist, Capistrant, Wu, Marden, & Glymour, 2014). We dichotomized physical activity as active (vigorous activity 3 or more times per week) versus inactive (vigorous activity less than 3 times per week). We classified alcohol consumption as heavy drinking ($\geq$2 drinks/day), moderate drinking (more than zero and fewer than two drinks per day), and not drinking (reference). To calculate drinks per day, the number of drinks consumed on days the participant drinks was multiplied by the number of days per week the participant reported drinking and the result was divided by seven. Ever smoking status was a binary variable (yes/no). We used values of