Self-reported Fall and Associated Risk Factors Among Korean American Adults In Washington State

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Abstract

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Falls are leading cause of injuries and mortality among older adults. With increasing life expectancies and continual rise in health care expense, prevalence and cost of falls will increase dramatically. Previous studies have identified multiple risk factors that contribute to falls and fall related injuries however, not all older adults equally share these risk factors. There is a lack of research on Asian American fallers and to date, no study has examined falls among Korean Americans. To fill this gap in research, this thesis aims to examine the prevalence of self-reported falls and to identify associated risk factors of falls among Korean Americans adults in Washington State. Using an existing dataset from a previous study, self-reported falls and medical care due to falls were analyzed. The data comes from a 2013 population-based, cross-sectional survey and included the responses of 261 Korean American adults, aged 50 and older, residing in Seattle metropolitan area. The outcome variable is participants' fall status within the past 12 months. Predictor variables are socio-demographic, health factors,

acculturation, financial concerns for medical care costs, and medical tourism. Relationships between variables were examined using chi-square, bivariate, and multivariate logistic regression. In multivariate modeling, including marital status, household income, and current health status were significantly associated with fall. Unmarried participants were 2.65 (95% CI: 1.09-6.41) higher odds of falling compared to married. Participants with household income of $20,000 up to $39,999 were 4.62 (95% CI: 1.38-15.42) higher odds compared to income less than $20,000 and to income $40,000 or more. Participants who reported their health as fair and poor were 3.13 (98% CI: 1.36-7.19) higher odds compared to participants with good and excellent health. Characteristics of KAs who sought care for their fall were female (46.4% vs. 30.0%), older (75±10.9 vs. 67±11.78). The findings indicates that low income and fair or poor self-reported health were one of the key risk factors for fall among Korean Americans and highlight the needs for race specific fall strategies to reduce the burden of falls in all race group.

Introduction

In the United States, falls are a leading cause of injuries and mortality among older adults (65 and older) (Barbour et al., 2014; Houry, Florence, Baldwin, Stevens, & McClure, 2015; Xu & Drew, 2016). One in three older adults reports falling annually. Fall is the number one cause of unintentional injury (accidental) deaths (Centers for Disease Control and Prevention, 2016b) accounting for 55% of all unintentional injury deaths among older adults from 2000 to 2013 (Kramarow, Chen, Hedegaard, & Warner, 2015). An estimated 2.5 million adults are treated in emergency department (ED) for fall related injuries, and more than 700,000 (28%) of these patients are hospitalized (Centers for Disease Control and Prevention, 2016a). From 2001 to 2013, there was annual 2% increase in ED treatment of fall related injuries and 4% increase in hospitalization due to falls (Houry et al., 2015).

Falls also lead to severe injuries such as fractures, traumatic brain injuries; these injuries impact loss of independence, higher rates of placement to nursing homes, and increase fear of subsequent falling (Ambrose, Cruz, & Paul, 2015; Choi, Hayward, & Langa, 2013). In fact, research shows that about 40% of older adults who fall restrict their activities of daily living (ADL) and reduction in activities results in decline in mobility, loss of physical fitness, isolation and depression, which in turn increases risk of falls (Ambrose, Paul, & Hausdorff, 2013; Centers for Disease Control and Prevention, 2013b).

Fall injuries also places economic strain on the U.S. health care system. Fall related medical cost has been steadily rising since 2008 where the cost was reported as $23.3 billion (Ambrose et al., 2013) to $34 billion in 2013 (Centers for Disease Control and Prevention, 2015a). This cost is projected to further increase to $101 billion by 2030 (Houry et al., 2015). With aging Baby Boomers and continual rise in health care expenses, the cost of fall will increase dramatically.

Since 2003, the number of older adults, aged 65 and older, has increased at a rapid speed of four times the rate (24.7%) compared to adults under age 65 (6.8%) (Administration for Community Living, 2015c). In 2013, older adults represented 14.1% of the U.S. population and this population is expected to reach 21.7% by year 2040 (Administration for Community Living, 2015b). Furthermore, by 2050 minority populations are expected to represent 39.1% of older populations, aged 65 and older (Ortman, Velkoff, & Hogan, 2014). Among minority groups, Asian population marked the fastest growing race group from 2000 to 2010; even faster than the rate of total U.S. population (Hoeffel, Rastogi, Kim, & Shahid, 2012). By 2030, the proportion of older Asian adults is projected to increase by 121%; while older non-Hispanic whites are estimated to increase only 50% (Administration for Community Living, 2015a). The Asian population is also expected to see a substantial increase in the proportion of older adults in their population; where by 2050, Asian groups will comprise the second oldest population group with 19.4% of its population at age 65 and older (Ortman et al., 2014). With increasing life expectancies and aging population, CDC's Injury Center anticipates dramatic increase in the number of falls among older adults in upcoming years (Houry et al., 2015).

This is a critical time for the public health community to recognize this growing demographic shift and take actions to tailor evidence-based interventions to reduce falls among older population. Even though it is commonly accepted that older adults are more likely to fall, there are multiple risk factors that contribute to falls and fall-related injuries. Therefore, understanding fall risk factors is critical to provide multi-factorial preventative strategies to aging populations.

Risk Factors for Falls

Risk factors for falls have been classified into intrinsic and extrinsic factors (Ambrose et al., 2013). Intrinsic risk factors include the characteristics of an individual such as demographics (e.g., age, gender, race), and health-related factors (e.g., general health status, comorbidities,

multiple medications, physical functions, depression, and history of falls) (Alamgir, Muazzam, & Nasrullah, 2012; Ambrose et al., 2013; Deandrea et al., 2010; Tzeng, 2011). Extrinsic risk factors are those outside of the individuals such as the characteristics of the home environment (e.g., loose rungs, tripping hazards, poor lighting) and unsafe footwear (Alamgir et al., 2012; Ambrose et al., 2013; Deandrea et al., 2010; Tzeng, 2011). Falls accidents tend to occur when environmental hazards are combined with accumulated effects of age and disease (Ambrose et al., 2015; Rubenstein, 2006).

Age: Studies consistently show that age is related to falls. Older adults are more susceptible to fall injuries due to a higher number of comorbidities, delay in functional recovery, and decline in physiological systems (e.g., slow protective reflexes, gait and balance weakness) (Rubenstein, 2006). Older adults tend to show stiffer gait pattern and slow protective reflexes; which could limit their ability to avoid a fall in an unexpected trip or slip (Ambrose et al., 2013; Rubenstein, 2006).

Gender: Findings from multiple studies show that women are at an increased risk of falls and fall-related injuries compared to men (Ambrose et al., 2013; Centers for Disease Control and Prevention, 2008; Deandrea et al., 2010). The increase in fall risk for women could be related to lower levels of physical activity, lower-body strength, bone mass, and circumstances surrounding the fall (Stevens et al., 2012). Also, women have a higher prevalence of osteoporosis which could lead to increase in falls and fall related injuries (Centers for Disease Control and Prevention, 2015b). Interestingly, fall mortality rates are higher among men (Alamgir et al., 2012; Ambrose et al., 2013). Researchers pose that men have higher number of comorbidities than women of the same age and therefore are more likely to die from a fall (Alamgir et al., 2012).

Health-related factors: Self-reported health status and comorbidity are common health indicator variables and, among older adults, poor health status is shown to elevate their risk for falls (Deandrea et al., 2010; Kelsey, Procter-Gray, Hannan, & Li, 2012). Older adults who

reported fair or poor health were more likely to report comorbidities such as hypertension, diabetes, and arthritis; which in turn could limit their physical functions (Banerjee, Perry, Tran, & Arafat, 2010). Furthermore, older adults with limited physical functions could face additional difficulty coping with their health.

Depression is another known risk factor for falls (Iaboni & Flint, 2013; Stevens et al., 2012). Previous study reports depression among older adults are associated with neurocognitive changes and their ability attend one's environment and to coordinate their motor output; which in turn increase their risk of falls (Iaboni & Flint, 2013).

Race: A limited number of studies has examined the relationship between race/ethnicity and falls. These studies have mainly focused on non-Hispanic Whites and non-Hispanic Blacks comparisons. Research has shown that older non-Hispanic Whites report the highest rate of falls (Alamgir et al., 2012) although older non-Hispanic Blacks have a greater number of fall risk factors such as poor health status and more chronic disease (Ellis, Kosma, Fabre, Moore, & Wood, 2012). However, they report lower prevalence of falls, recurrent falls, and fall mortality compared to non-Hispanic Whites (Nicklett & Taylor, 2014; Sun, Huang, Varadhan, & Agrawal, 2016). Previous research has been inconsistent in their findings. Nicklett and colleagues suggest that Non-Hispanic Whites show higher levels of outdoor and leisure activities which places them at higher risk of falls (Nicklett & Taylor, 2014). Furthermore, older non-Hispanic Blacks are less likely to live alone compared to non-Hispanic Whites and previous studies have noted older adults who live alone sustain more fall-related injuries (Schiller, Kramarow, & Dey, 2007). However, Sun and colleagues (Sun et al., 2016) examined physical performance status, physical activity level, and likelihood of living alone and was unable to adequately explain differences in fall between non-Hispanic Whites and non-Hispanic Blacks.

Findings from CDC's Web-based Injury Statistics Query and Reporting System (WISQARS) shows non-Hispanic Whites and Asian/Pacific Islanders had the highest unintentional fall injury rates (45.26% and 44.14%) and the highest proportion of fall mortality

(45.3% and 44.1%) (Alamgir et al., 2012). Despite these high rates of falls and fall mortality, there is a lack of research on Asian American fallers in relation to other racial/ethnic groups. To address the knowledge gap on racial and ethnic minorities, this thesis reports findings of falls and fall risk factors among one subgroup of Asian Americans, Korean Americans.

Korean Americans

Koreans Americans (KA) has experienced the one of the largest population growth with 88.6% increase, from 2000 to 2010, among the six largest Asian subgroups (Chinese, Filipino, Asian Indian, Vietnamese, Korean and Japanese) (Hoeffel et al., 2012). Previous studies consistently reports, KAs are less likely to have health insurance and access to care compared to all ethnic minority groups (Huh, DeLorme, Reid, & Kim, 2013; Kang, Kim, & Kim, 2015; Li et al., 2016). Li and colleagues reported that for KAs, health care utilization was mainly driven by health insurance status and a usual source of care (Li et al., 2016). The lack of health insurance among KAs is in part due to their inability to afford health insurance premiums (Huh et al., 2013; Shin, Song, Kim, & Probst, 2005) and to their level of acculturation (such as English use and proficiency) to the U.S. culture (Li et al., 2016). Acculturation is a transition process of adopting the norms, values, customs, beliefs, and behaviors of another culture (Abraido-Lanza, Armbrister, Florrez, & Aguirre, 2006; Li et al., 2016). Researchers have used length of stay in the U.S. and English proficiency as a proxy to examine levels of acculturation (Li et al., 2016) and compared to other Asian subgroups, KAs may be less acculturated as they have a relatively shorter U.S. immigration history (Li et al., 2016) and have highest limited English proficiency (LEP) of among Asian subgroups (G. Kim et al., 2010).

A study conducted by Ko and colleagues reported that KAs older adults with lower levels of acculturation are more likely to engage in medical tourism, where they travel to their home county to receive medical care (Ko et al., 2016). Medical tourism could place KAs at an elevated

risk for falls, as this behavior could further disconnect KAs from the U.S. health care system, limiting their opportunities to access fall prevention programs.

KA older adults also face economic insecurity due to high poverty rate found in this population. Compared to the general population of older adults, KAs were more than twice as likely to live below the federal poverty line (FTL) (Lee, Hong, & Harm, 2014). Moreover, 45% of older KAs reported income less than 200% FTL; which is the standard level of family income necessary to be self-sufficient (Huh et al., 2013; Lee et al., 2014). Previous research indicates that KAs exclusion from the labor market was one of the significant contributors to living in poverty (Lee et al., 2014). Research has shown, among adults aged 50 and older, that individuals with low-income reported greater risk of falls (Ellis et al., 2012). Vital and Health Statistics report that individuals with low income are at increased risk of poor health, chronic disease, and lower levels of physical activity (Schoenborn, Adams, & Peregoy, 2013); which are also risk factors for falls (Ellis et al., 2012). Additionally, the lower financial status could cause barriers to KAs to access and afford services that could help to reduce risks of fall.

Depression is a known risk factor for fall and older KAs report the highest percent of depressive symptoms among all ethnic groups in the U.S. (American Society on Aging, 2015; B. J. Kim, Linton, Cho, & Ha, 2016); which again places older KAs at higher risk for falls.

Despite such elevated risk of fall among Korean American older adults, to date, no study has examined falls among Korean Americans. This thesis aimed to fill this research gap. The goal of this study is to examine the prevalence of self-reported falls and to identify associated risk factors of falls among older Korean American adults in Washington State. The research questions are:

1. What is the self-reported prevalence of falls among Korean American older adults aged 50 and older residing in Seattle metropolitan area and associated risk factors ?
2. What are the related risk factors of falls among Korean American older adults aged 50 and older ?

3. What are the characteristics of Korean American older adults, age 50 and older, who sought care for their fall compared to those who did not seek care for their fall?

Conceptual Model

Figure 1 shows a conceptual diagram depicting the relationships between socio-demographics, heath factors, acculturation, and fall as well as receiving medical care due to fall.

METHODS

Study Design

This is a secondary analysis of data. Data comes from a cross-sectional observation study entitled *Korean Community Health Survey* (Parent Study; PI: Linda K. Ko, PhD*).* This study used survey questions that were adapted from the National Health Interview Survey (Centers for Disease Control and Prevention, 2013a). The parent study approached 382 participants living in Seattle Metropolitan area (Washington State), and collected survey data on 273 individuals. For this thesis research, we removed data from 12 participants as they are younger than 50 years old and therefore would not qualify the definition of "older KAs." The final sample consisted of information from 261 participants and the analysis is based on this sample.

Parent Study

Korean Community Health Survey was conducted to capture the overall health status of Korean American community and their health behaviors. This population-based survey was conducted in Snohomish, King, and Pierce Counties where high concentration of KA immigrants resides (Ko et al., 2016). The data collection was conducted between Augusts 2013 to October 2013. This study was approved from the Fred Hutchinson Cancer Research Center Institutional Review Board (IR # 8051).

The study's inclusion criteria were age 50 years and older, reside in the Seattle Metropolitan area, self-identify as Korean or Korean American. The survey was available in English or Korean, and it took participants 10–15 minutes to complete.

Recruitment

The study team partnered with community organizations and received permission to set-up a table during community events. Examples of community events included health fairs organized by Korean churches (e.g., church events), culture celebration night by the Korean American Associations (e.g., Korean cultural day), free meal programs organized by community organizations that provide social services, and health fairs organized by community health centers (e.g., health fairs). Participants were also recruited through advertisements in local Korean newspapers and through tear-tab fliers posted in community centers, Korean grocery stores, and Korean restaurants. Bilingual (Korean-English) study staff members also conducted door-to-door survey of Korean business. Participants from community events and door-to-door surveys received a gift bag with health promotion materials to thank them for their time.

Measures

Survey respondents who reported a fall during the past 12 months were identified as fallers and respondents who did not fall during the past 12 months were identified as non-fallers.

Outcome Variables

The outcome variable was participants' fall status. A dichotomized fall variable was created with falls defined as yes or no to the question, *"During the past 12 months, have you fallen to the ground more than once?"* A follow-up question was asked with participants who reported experiencing a fall, *"Did you get any medical care because of those falls?"* Responses were measured on as yes or no.

Predictor Variables

Socio-demographic Variables included age, gender, employment, marital, education, and household income. *Age* was measured as continuous variable, and it was calculated by using the participant's birth year and the year of the survey. *Gender* was assessed as female and male. *Employment status* was assessed as working full time, working part time, self-employed, unemployed, homemaker, retired, and unable to work due to poor health or disability. For analytic purposes categories were collapsed to three categories: working (working full time, working part time, and self-employed), not working (unemployed, homemaker, and unable to work due to poor health or disability) and retired. *Marital status* was assessed as currently married or living with a partner, separated, divorced, widowed, and never married. These categories were collapsed to three categories: married and unmarried (separated, divorced, widowed, and never married). *Education level* was collapsed, for analytic purposes, to 3 categories: less than high school, high school graduate or GED and some college and more (which included some college or technical or vocational school, college graduate, some graduate school, and graduate degree). *Annual household income* categories were also collapsed to: less than $20,000, $20,000 up to $39,999, $40,000 and more ($40,000 up to $59,999, $60,000 up to $79,999, $80,000 up to $99,999, $100,000 or more).

Health factors variables consisted of five variables that assessed participants' health status, number of comorbidities, having received medical care after a fall, insurance status, and having a place of usual care in US (Ko et al., 2016). *Self-rated current health status* was collected as excellent, very good, good, fair, and poor. For analytical purposes, categories excellent and very good were collapsed into excellent/very good and . *Number of comorbidities* was calculated by adding the number of chronic conditions and scores ranged from 0 to 9. The chronic condition categories were self-reported physician-diagnosed history of diabetes or sugar diabetes, heat disease, high blood pressure, cancer (type and age at diagnoses), arthritis, ulcer, hepatitis (type), high cholesterol and others. For analytic purposes, number of comorbidities was collapsed to five categories: 0, 1, 2, 3, and 4+. *Health insurance status* was assessed as private

insurance like Group Health, United Healthcare, or Blue Cross/Blue Shield; Medicare; Medicaid; Medicare and Medicaid; and don't have medical insurance. For analytic purposes, these categories were collapsed to three categories: private insurance, public insurance, and don't have medical insurance. *Having a place of usual medical care* was asked as *"Do you have a place in the U.S. where you usually go to when you need routine or preventive care, such as physical examination or check-up?"* Responses categories included yes or no.

Acculturation Variables included English proficiency, age at immigration, and years lived in the US. *English proficiency* was measured with one question, *"How well do you speak English?"* Response categories included very well, well, not well, and not at all. These categories were collapsed for analytic purposes and dichotomized as speak English well or not well. *Age at immigration* was measured with one question, *"How old were you when you came to the US?" Years lived in the US* was measured with one question *"In total, how many years have you lived in the US?"* Years lived in the US was calculated by using the year immigrated and the year of the survey.

Medical Care Cost was measured with two questions: *"How worried are you right now about not being able to pay medical costs for normal healthcare?"* and *"How worried are you right now about not being able to pay medical costs for serious illness or accident?"* Response categories for both variables were: very worried, moderately worried, not too worried, and not worried at all. These categories were collapsed for analytic purposes and dichotomized as "Not worried or moderately worried" or "Very worried".

Medical Tourism: Previous research have found KA's who reported lower levels of acculturation, lower levels of health insurance, and lower levels of having a usual place for medical care in US are more likely to travel to their home country to receive medical care [CITE KO 2016]. To assess medical travel, we asked the following question, *"In the past 5 years, how many times have you traveled outside of the U.S. to consult a doctor, undergo a medical test or procedure, or receive treatment?"* For analytic purposes, responses were dichotomized as yes

travel and no travel. Two additional questions were asked with participants who have traveled outside of US for medical care: *"When did you most recently traveled outside of the U.S. to consult a doctor, undergo a medical test or procedure, or receive treatment?"* Response categories included: a year ago or less, more than 1 year up to 2 years ago, more than 2 years up to 3 years ago, more than 3 years up to 5 years ago, and more than 5 years ago. Second follow-up question was: *"Which country did you travel?"* Responses were collected as an open answer.

Data Analysis

All analyses were restricted to individuals 50 years and older. SPSS (Version 23; IBM Corporation, Armonk, NY) was used to analyze all data. Two-tailed analyses were performed using a significant level of 0.05. Using descriptive statistics, frequencies were generated for categorical variables and means and standard deviations for continuous variables. Bivariate logistic regression was used to examine possible associations between predictor variables (socio-demographic variables, health factors variables, acculturation variables, and medical care cost variables) and falls. Multivariate logistic regression was conducted to identify predictor variables that were significantly associated with fall, adjusting for predictor variables that were previously found to be significantly associated with falls. Collinearity test was also performed for multivariate logistic regression.

RESULTS

SURVEY PARTICIPANT CHARACTERISTICS

Study participants characteristics are provided in Table 1. The mean age was 67 years with range from 50 to 96 years. More than half were female (67.3%), married (63.2%), and reported poor health (54.0%). Little under half were not insured (45.0%) and had some college education (42.5%), and had an income less than $20,000 (47.5%). About a third were working either full

time, part time, or self-employed (37.8%). Only 15% of participants were without chronic disease while 20% reported to have four or more diagnoses. The mean immigration age to US was 43 (±13.22) years old and average years living in the US was 24 years (±10.75). All participants reported being born outside of the US and most did not speak English well (76.3%). When participants were asked if they have fallen during the past 12 months, 28.0% reported yes, and of these 44.0% reported receiving medical care due to fall.

BIVARIATE RELATIONSHIP BETWEEN SOCIO-DEMOGRAPHICS, HEALTH FACTORS, AND ACCULTURATIONS AND FALLS.

There was a significant relationship between age, gender, marital status, education, annual income, current health status, health insurance status, age of immigration to the US, and occurrence of fall (Table 1).

Socio-demographics and Falls

Older participants were more likely to report a fall compared to younger participants (70.58±11.74 vs. 65.12±10.22; P<0.001). A greater percentage of women than men experienced a fall (33.9% vs 15.7%; P=0.002). Participants who reported being married were less likely to experience fall compared to unmarried (19.0% vs. 42.4%; P<0.001). More falls were reported by participants with less than high school education (48.7%) compared to high school graduate or GED (24.2%) and some college or more (16.2%; P<0.001). Employment status showed a trend towards significance. Participants who were working (20.2%) (full time, part time, and self-employed) were least likely to fall compared to not working (36.1%) and retired (27.8%; P=0.061). Among participants with health insurance, percent of fall and no fall were very similar (68.2% vs. 66.2%); whereas among uninsured notably less participants reported fall (19.3% vs. 80.7%; P=0.011).

Health Factors and Falls

Participants with fair and poor health were more likely to experience fall compared to participants with good and excellent health (38.5% vs. 14.8%; P<0.001). Variable number of diagnoses showed trend towards significance. A linear trend was noted in self-reported falls as the number of diagnoses increased from zero to four or more (Table 1).

Acculturations and Falls

Participants who have immigrated at older age were more likely to experience a fall compared to those who immigrated at younger age (47.66±15.31 vs. 40.23±11.86; P=0.002).

MULTIVARIATE RELATIONSHIP BETWEEN PREDICTORS AND FALLS

In the multivariate analyses, including Marital status, household income, and current health status were significantly associated with fall. Unmarried participants were 2.65 (95% CI: 1.09-6.41) higher odds of falling compared to married. Participants with household income of $20,000 up to $39,999 were 4.62 (95% CI: 1.38-15.42) higher odds compared to income less than $20,000 and to income $40,000 or more. Participants who reported their health as fair and poor were 3.13 (95% CI: 1.36-7.19) higher odds compared to participants with good and excellent health. Education status showed a trend towards significance; participants with less than high school education were 3.13 (95% CI: 0.95-10.33) higher odds of fall compared to high school graduate or GED and to some college and more. Other variables including age, gender, and number of diagnoses were not statistically associated with fall. Table 2 summarizes these results.

Predictor variable ‘number of diagnoses’ showed only a trend towards significance, in bivariate analysis yet, this variable was included in the multivariate analysis for this variable was shown to be associated with fall in previous studies (Choi et al., 2013; Deandrea et al., 2010; Nicklett & Taylor, 2014). However, in multivariate analysis number of diagnoses did not show statistically significant with fall (Table 2). Through collinearity test, variables ‘age immigrated to the US’ and ‘health insurance’ were not included in multivariate analyses.

MEDICAL CARE DUE TO FALL

Among fallers, 44.0% (N=29) received medical care after fall and higher percent of female received care (46.4% vs. 30.0%). Mean age for fallers who received medical care was higher than fallers who did not receive care (75.07±10.90 vs. 67.46±11.78). Fallers who were insured (52.4% vs. 31.6%; P=0.131) and had a place of usual care in US (48.0% vs. 33.3%; P= 0.316) were more likely to receive medical care after fall. Fallers who expressed worries about medical cost for general care and for serious illness were less likely to receive medical care after fall (34.2% and 38.6%). Table 3 displays these results.

Discussion

This study examined the percent of falls among KA adults aged 50 and older in a community sample, the relative risk factors of falls among KA adults, and characteristics of KA adults who sought care for their fall compared to those who did not seek care for their fall. The findings of this study shows that about one-fourth (28.0%) of participants experienced fall in the past 12 months and almost half of fallers (43.9%) received medical care due to their fall.

Risk factors for falls are often categorized as intrinsic (individual specific) and extrinsic (environmental) factor (Ambrose et al., 2013; Deandrea et al., 2010). In this study, intrinsic factor that showed significance to fall was self-reported health status. Self-reported health is a widely used measure of general health status and can be affected by socio-demographics factors (such as gender, education, and race/ethnicity) and socio-economic factors (such as income) (Banerjee et al., 2010).

Self-reported health status was the strongest predictor of fall; where participants with fair and poor health were more likely to experience a fall than those with good and excellent health. Annual household income was the second strongest predictor of fall; where KAs with annual income of 150% or less federal poverty level (FPL) were more likely to report fall than KAs with

higher income. In 2013, the median household income was reported as $54,184 (Administration for Community Living, 2015b) and over 67% of KAs in our study reported household income less than the national median.

Previous research has found individuals with low-income had elevated risk of falls (Ellis et al., 2012) as they may have increased risk of poor health status, more chronic conditions, and lower level of physical activity (Schoenborn et al., 2013). Our study's findings in household income reflects other studies reports of high poverty rate among older KAs (B. J. Kim et al., 2016; Lee et al., 2014). Older KAs living in poverty may face financial challenges to fall preventions such as regular eye exams, purchasing new glasses, purchasing appropriate footwear, enrolling in physical activity programs, and home modification to reduce fall risks (Ellis et al., 2012) which in turn places older KAs at higher risk of fall.

Marital status was another predictor of fall as unmarried participants were more likely to experience fall. Previous studies have noted older adults who live along sustain more fall-related injuries (Schiller et al., 2007) and being alone at the time of the fall places them at a higher risk for delayed recovery (Grisso, Schwarz, Wolfson, Polansky, & LaPenn, 1992). In this study, participant's living status was not assess however other studies report that older KAs are more likely to live alone or live only with their spouse (B. J. Kim & Ahn, 2013; B. J. Kim et al., 2016). Older adults who lives alone are at a higher risk of depression, another known risk factor for fall, as they could face additional burden of loneliness and hopeless (B. J. Kim et al., 2016). As noted before, older KAs report the highest percent of depressive symptoms among all ethnic groups in the U.S. (American Society on Aging, 2015) and studies continues to report high number of depression and psychological distress among older KAs (B. J. Kim et al., 2016; G. Kim et al., 2010).

Older age is a common known risk factor for fall and fall-related injuries (Ambrose et al., 2013; Grundstrom, Guse, & Layde, 2012; Verma et al., 2016). In bivariate analysis, there was an increase in the percentage of fall as age increased. However, in multivariate analysis age did

not show significance. This could be in part, with advancing in age and number of chronic conditions and its severity is likely to increase and results in poor general health outcomes (Banerjee et al., 2010); which was the strongest predictor of fall in this study.

Previous research suggests that women were more likely to report fall (Alamgir et al., 2012; Ambrose et al., 2013) and similar association was found in this study where women reported statistically significant higher percent of fall compared to men (Table 1). One of the reasons could be that, in general, women tend to have longer life expectancy than men and they are more frail than men (Stahl & Albert, 2015). Stahl and Albert also report that men who fell reduced their activities of household works; while for women who fell sustained similar level of household activities. Stahl and Albert explains this could be an attributing factor of older adults' gender role expectation, where women are more likely to be obligated to household chores and are more likely to be the caregiver (Stahl & Albert, 2015). Referring back to extrinsic factors of the home environment, women's continual activity of housework could place them in elevated risk of falls as they may have to reach above or use steps for housework. Therefore, it is even more so important to modify homes to prevent falls.

Limitations

Several study limitations must be acknowledged. First, the cross-sectional observational data obtained from the parent study are self-reported and there is possibility of recall bias. This study assessed fall during the period of past 12 months and individuals may not have recalled fall correctly. This recall bias could have lead to underestimation of falls; especially falls that did not resulted in an injury (Choi et al., 2013; Ganz, Higashi, & Rubenstein, 2005) (Verma et al., 2016). Many previous studies have used 12 months recall period (Stevens et al., 2012; Sun et al., 2016; Verma et al., 2016) and a systematic review shows strong specificity of falls in 12 months recall (Ganz et al., 2005). Second, this study used a convenience sample. Participant recruitment was targeted within faith-based and community-based organizations that provided

programs for older adults or hosted health events. This sampling method could have created selection bias where participants may represent adults who are more inclined to use services or to participate in these events. Also, nonresponse bias can be noted for individuals who did not participate could be older, more frail, and more likely to have fallen. However, in immigrant populations convenience sampling is often used as this group tends to be clustered in certain geographic areas (Ko et al., 2016).

Conclusion

The current study is the first to provide estimate of fall and medical care due to fall among Korean American adults aged 50 and older. The result of this study indicates income and self-reported health status as one of the key risk factors for fall among Korean American adults. Additionally, this study has identified marital status as a possible proxy for fall risk. Depression is another risk factor for fall which is highly prevalent among older Korean Americans. Depression was not measured in this study, however future studies should consider assessing depression and fall among this population. As the U.S. population ages occurrence of fall and fall related injuries will continue to escalade along with the financial burden of fall. It is even more so critical for public health to identify race specific risk factors and to develop and implement effective fall prevention strategies to reduce the burden of falls in all race group.

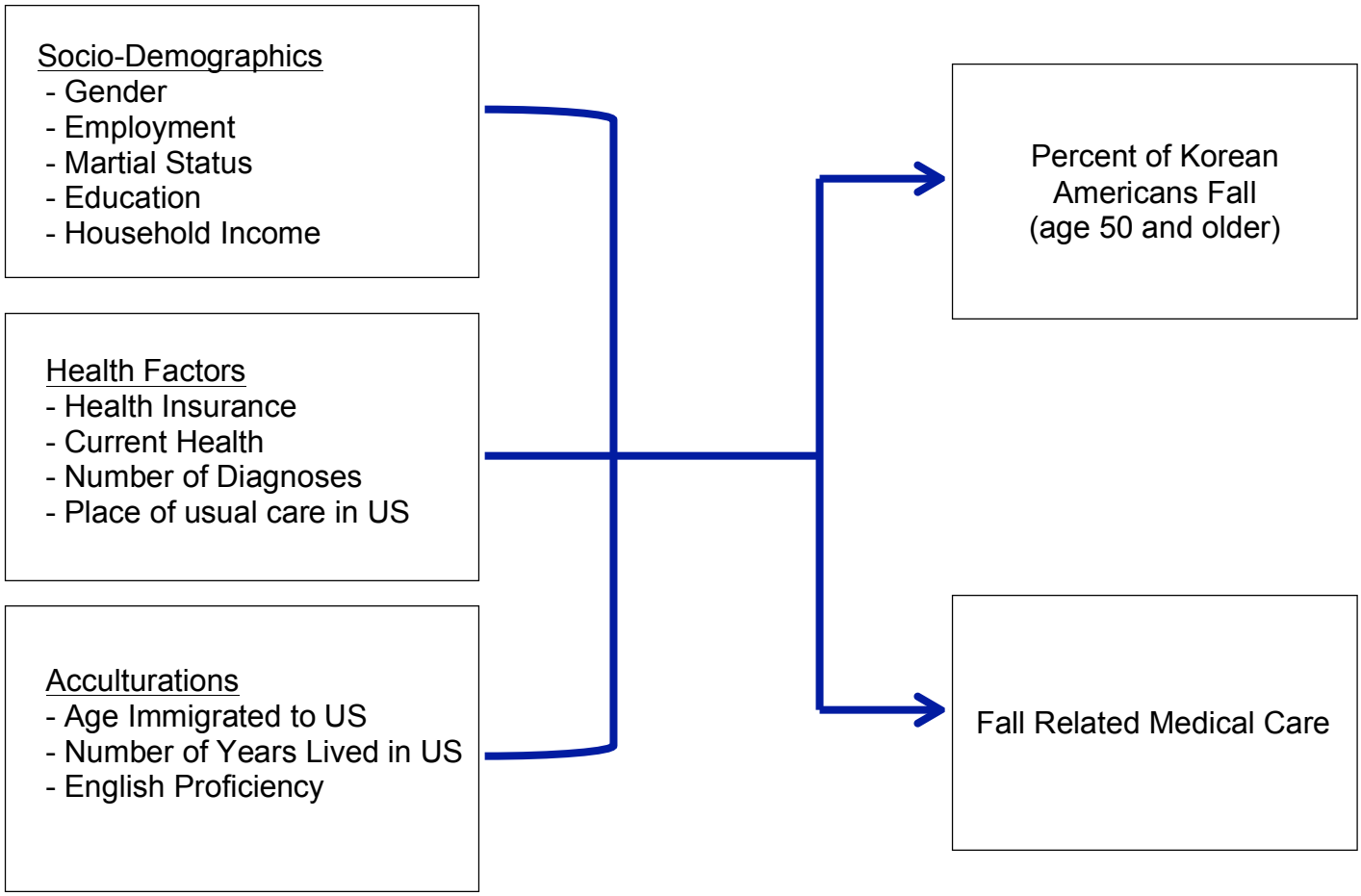

Figure 1: Conceptual model depicting relationships between the socio-demographics, health factors, acculturations, and fall and fall related medical care.

Table 1
Bivariate Relationship Between Predictors and Fall (N=261)

	Sample n (%)	No Fall n (%)	Fall n (%)	*P* value
Have fallen during past 12 months	254	183 (72.0)	71 (28.0)	
SOCIO-DEMOGRAPHICS				
Age In Years; Mean (SD)*	66.77 (10.98)	65.12 (10.22)	70.58 (11.74)	0.000
Gender				
Male	83 (32.7)	70 (84.3)	12(15.7)	
Female	171 (67.3)	113 (66.1)	56 (33.9)	0.002
Employment Status				
Working	94 (37.8)	75 (79.8)	19 (20.2)	
Not working	83 (33.3)	53 (63.9)	30 (36.1)	
Retired	72 (28.9)	52 (72.2)	20 (27.8)	0.061
Marital Status				
Married	158 (63.2)	128 (81.0)	30 (19.0)	
Unmarried	92 (36.8)	53 (57.6)	39 (42.4)	0.000
Education status				
Less than high school	76 (30.8)	39 (51.3)	37 (48.7)	
High school graduate or GED	66 (26.7)	50 (75.8)	16 (24.2)	
Some college and more	105 (42.5)	88 (83.8)	17 (16.2)	0.000
Household Income				
Less than $20,000	87 (47.5)	56 (64.4)	31 (35.6)	
$20,000 up to $39,999	36 (19.7)	23 (63.9)	13 (36.1)	
$40,000 +	60 (32.8)	54 (90.0)	6 (10.0)	0.001
HEALTH FACTORS				
Health Insurance				
Yes insurance	113 (55.0)	88 (66.2)	45 (68.2)	
Not insured	109 (45.0)	88 (80.7)	21 (19.3)	0.011
Current Health				
Good and excellent	115 (46.0)	98 (85.2)	17 (14.8)	
Fair or poor	135 (54.0)	83 (61.5)	52 (38.5)	0.000
Number of diagnoses				
0	39 (15.4)	33 (84.6)	6 (15.4)	
1	68 (26.8)	52 (76.5)	16 (23.5)	
2	57 (22.4)	42 (73.7)	15 (26.3)	
3	40 (15.7)	27 (67.5)	13 (32.5)	
4+	50 (19.7)	29 (58.0)	21 (42.0)	0.059
Place of usual care in US				
Yes	179 (71.9)	126 (70.4)	53 (29.6)	

No	70 (28.1)	53 (75.7)	17 (24.3)	0.401
ACCULTURATION				
Age immigrated to the US; Mean (SD)*	43.01 (13.22)	41.23 (11.86)	47.66 (15.31)	0.002
Years lived in the US; Mean (SD)*	23.90 (10.75)	23.80 (10.32)	24.08 (11.51)	0.855
English Speaking Proficiency				
Well	58 (23.7)	46 (79.3)	12 (20.7)	
Not well	187 (76.3)	129 (69.0)	58 (31.0)	0.128

***SD = Standard Deviation**

Table 2. Multi-variate Relationship Between Predictors and Fall

	OR (95% CI)	***p* value**
Intercept		0.029
Age	1.00 (0.95, 1.05)	0.972
Gender		
Male	1	
Female	2.14 (0.9, 5.07)	0.085
Martial Status		
Married	1	
Unmarried	2.65 (1.09, 6.41)	0.031
Education status		
Some college and more	1	
High school graduate or GED	0.82 (0.31, 2.18)	0.686
Less than high school	3.13 (0.95, 10.3)	0.061
Household Income		
$40,000 +	1	
$20,000 up to $39,999	4.62 (1.38, 15.42)	0.013
Less than $20,000	2.36 (0.77, 7.18)	0.132
Current Health		
Good and excellent	1	
Fair or poor	3.15 (1.38, 7.22)	0.007
Number of diagnoses		
0	1	
1	1.33 (0.37, 4.82)	0.661
2	0.93 (0.24, 3.54)	0.913
3	1.00 (0.23, 4.44)	1.000
4+	1.03 (0.24, 4.45)	0.969

Table 3
Bivariate Relationship Between Predictors and Received Medical Care After Falls (n=66)

	Sample n (%)	Did not received medical care n (%)	Did received medical care n (%)	*P* value
Medical care after fall	66	37 (56)	29 (44)	
Age In Years; Mean (SD)*	70.80 (11.93)	67.46 (11.78)	75.07 (10.90)	
Gender				
Male	10 (15.2)	7 (70.0)	3 (30.0)	
Female	56 (84.8)	30 (53.6)	26 (46.4)	0.335
Employment Status				
Working	17 (26.6)	13 (76.5)	4 (23.5)	
Not working	29 (45.3)	11 (37.9)	18 (62.1)	
Retired	18 (28.1)	11 (61.1)	7 (38.9)	0.033
Marital Status				
Married	27 (42.2)	19 (70.4)	8 (29.6)	
Unmarried	37 (57.8)	17 (45.9)	20 (54.1)	0.052
Education status				
Less than high school	34 (52.3)	14 (41.2)	20 (58.8)	
High school graduate or GED	15 (23.1)	10 (66.7)	5 (33.3)	
Some college and more	16 (24.6)	13 (81.3)	3 (18.8)	0.019
Household Income				
Less than $20,000	28 (62.2)	16 (57.1)	12 (42.9)	
$20,000 up to $39,999	12 (26.7)	8 (66.7)	4 (33.3)	
$40,000 +	5 (11.1)	4 (80.0)	1 (20.0)	0.583
HEALTH FACTORS				
Health Insurance				
Yes insurance	42 (68.9)	20 (47.6)	22 (52.4)	
Not insured	19 (31.1)	13 (68.4)	6 (31.6)	0.131
Current Health				
Good and excellent	16 (25.0)	12 (75.0)	4 (25.0)	
Fair or poor	48 (75.0)	23 (47.9)	25 (52.1)	0.059
Number of diagnoses				
0	5 (7.6)	5 (100.0)	0 (0.0)	
1	15 (22.7)	8 (53.3)	7 (46.7)	
2	15 (22.7)	6 (40.0)	9 (60.0)	
3	11 (16.7)	3 (27.3)	8 (72.7)	
4+	20 (30.3)	15 (75.0)	5 (25.0)	0.016
Place of usual care in US				
Yes	50 (76.9)	26 (52.0)	24 (48.0)	
No	15 (23.1)	10 (66.7)	5 (33.3)	0.316
ACCULTURATION				

Age immigrated to the US; Mean (SD)*	44.06 (16.65)	47.66 (15.31)	53.52 (12.45)	
Years lived in the US; Mean (SD)*	24.64 (10.53)	24.08 (11.51)	22.78 (12.83)	
English Speaking Proficiency				
Well	11 (16.9)	9 (81.8)	2 (18.2)	
Not well	54 (83.1)	27 (50.0)	27 (50.0)	0.053
MEDICAL COST				
Worries about medical costs for general care				
Worried	38 (63.3)	25 (65.8)	13 (34.2)	
Not worried	22 (36.7)	9 (40.0)	13 (59.1)	0.061
Worries about medical costs for serious illness				
Worried	44 (68.8)	27 (61.4)	17 (38.6)	
Not worried	20 (31.3)	9 (45.0)	11 (55.0)	0.221
MEDICAL TOURISM				
Number of times traveled outside of the US				
0	50 (79.4)	25 (50.0)	25 (50.0)	
1 and more	13 (20.6)	10 (76.9)	3 (23.1)	0.082

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