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Frailty index to predict all-cause mortality in Thai community-dwelling older population: A result from a National Health Examination Survey cohort

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ABSTRACT

Background: Frailty is a clinical state of increased vulnerability from aging-associated decline. We aimed to determine if a Thai Frailty Index predicted all-cause mortality in community-dwelling older Thais when accounting for age, gender and socioeconomic status.
Methods: Data of 8195 subjects aged 60 years and over from the Fourth Thai National Health Examination Survey were used to create the Thai Frailty Index by calculating the ratio of accumulated deficits using a cut-off point of 0.25 to define frailty. The associations were explored using Cox proportional hazard models.
Results: The mean age of participants was 69.2 years (SD 6.8). The prevalence of frailty was 22.1%. The Thai Frailty Index significantly predicted mortality (hazard ratio = 2.34, 95% CI 2.10–2.61, $p < 0.001$). The association between frailty and mortality was stronger in males (hazard ratio = 2.71, 95% CI 2.33–3.16). Higher wealth status had a protective effect among non-frail older adults but not among frail ones.
Conclusions: In community-dwelling older Thai adults, the Thai Frailty Index demonstrated a high prevalence of frailty and predicted mortality. Frail older Thai adults did not earn the protective effect of reducing mortality with higher socioeconomic status. Maintaining health rather than accumulating wealth may be better for a longer healthier life for older people in middle income countries.

1. Introduction

Frailty is a clinical state of increased vulnerability resulting from aging-associated decline in multiple systems (Xue, 2011). It is associated with adverse clinical outcomes such as falls, delirium, immobility, institutionalization and increased mortality in older persons (Clegg, Young, Iliffe, Rikkert, & Rockwood, 2013; Shamliyan, Talley, Ramakrishnan, & Kane, 2013). It is not surprising that the prevalence of frailty is expected to rise along with the increased number of older persons worldwide (Dent, Kowal, & Hoogendijk, 2016).

Despite the importance of this clinical syndrome, an internationally accepted definition of frailty has not been reached (Morley et al., 2013). A number of criteria for frailty have been proposed (Bouillon et al., 2013; Dent et al., 2016). The frailty phenotype and frailty index (FI) are the most commonly applied and validated (Bouillon et al., 2013; Clegg et al., 2013). Frailty index counts the number of accumulated physical, psychological and functional deficits and is expressed as the proportion of age-related health deficits an individual has accumulated (Mitnitski, Mogilner, & Rockwood, 2001). A greater number of deficits in a person is expressed as a higher frailty index score, causing that person to be more vulnerable to adverse health outcomes. In older people, this continuous FI was shown to be a significantly better discriminator of risk of death compared with frailty phenotypes (Kulminski et al., 2008). A standard procedure for constructing FI was subsequently proposed (Searle, Mitnitski, Gahbauer, Gill, & Rockwood, 2008) and has been adopted in epidemiology studies (Peña et al., 2014; Perez-Zepeda et al., 2017).

There is limited data about frailty in Thailand. Knowing more about frailty is of value for an upper middle income country like Thailand which has increasing number of older people (Knodel, Teerawichitchainan, Prachuabmoh, & Pothisiri, 2015) More importantly, no diagnostic criterion exploring the outcome of mortality associated with frailty has ever been developed and validated in the Thai population. Accordingly, we aimed to develop the Thai Frailty Index (TFI) to determine whether it would predict mortality in the community-dwelling Thai older population. We also aimed to explore

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gender- and socioeconomic status-specific associations between frailty and mortality due to evidence in Thailand that there is gender difference in life expectancy. Previous studies reported that women have longer lifespan with mobility limitation comparted to men (Apinonkul, Soonthorndhada, Vapattanawong, Aekplakorn, & Jagger, 2015) and the results on the moderating effect of socioeconomic status on mortality in frail older people are inconclusive (Armstrong et al., 2015; Gu, Yang, & Sautter, 2016; Theou et al., 2013).

2. Methods

We followed the participants recruited in the fourth Thai National Health Examination Survey (NHES-IV) conducted in 2009. NHES-IV was a nationally representative cross-sectional survey using a multi-stage, stratified sampling of the Thai population. The details of sampling methods are described elsewhere (Aekplakorn et al., 2011). We focused on 9208 participants aged 60 years and older. Mortality data was retrieved until May 2016 from the Thai vital registration system, Bureau of Registration Administration, Ministry of Interior.

2.1. Data collection and measurement

Semi-structured interview using standardized questions was used to collect the data in The NHES-IV including demographic, socioeconomic and health data such as age, gender, smoking, medication used, history of falls, hearing problem, dental problem and medical comorbidities such as stroke and chronic obstructive pulmonary disease. Data about activities of daily living (ADLs) for both basic ADLs (B-ADLs) and instrumental ADLs (I-ADLs) were also obtained by interviewing. Overall health status and quality of life (QOL), which included questions regarding mood and sleeping difficulty, were elicited using the Health State Descriptions applied in WHO SAGE project (Kowal et al., 2012). Cognitive impairment was defined according to score from Thai Mini Mental State Examination Thai version – 2002 with cutoff points adjusted for education level.

Diabetes and chronic kidney disease were ascertained by enquiring about the relevant history and blood examinations (Aekplakorn et al., 2011). Hypertension was defined as a systolic blood pressure ≥140 mmHg, a diastolic blood pressure ≥90 mmHg or the use of antihypertensive agents. Both body weight and height were measured by standardized procedures, and body mass index (BMI) was calculated. Grip strength was measured by digital dynamometer. Participants were asked to wear comfortable shoes to walk at a usual pace to measure gait speed. Participants using gait aids were allowed for the walking test. Trained staffs used a stopwatch to record the time taken for a 4-m walk. Gait speed was then calculated in metres per second.

Socioeconomic status (SES) was represented by wealth index score, which is calculated based on the number of household items owned and is assigned as a standardized score to each participant (Aekplakorn et al., 2015). Wealth quintiles were created in which the lowest quintile indicated the poorest group and the highest indicated the richest group.

Mortality data was retrieved until May 2016 from the Thai vital registration system, which was affirmed to be a reliable source of death statistic in the country (Tangcharoensathien, Faramnuayphol, Teokul, Bundhamcharoen, & Wilbulpholprasert, 2006).

2.2. Development of the Thai frailty index (TFI)

The TFI was created following a suggested standard procedure (Searle et al., 2008). Thirty variables that included medical comorbidities, function as well as physical and emotional health were selected to calculate the TFI (Kulminski et al., 2008). These 30 variables were dichotomous (Supplementary data: Appendix A). Reduced hand grip strength was defined as having a body weight-adjusted grip strength less than gender-specific lowest tertile for this study cohort. Reduced gait speed was defined as a having gait speed less than the lowest quintile for the present cohort which was 0.55 m/s or less. Participants reporting moderate and very poor health statuses were rated as having poor health status. Responses to question regarding QOL were collapsed into 2 categories; moderate to very worst were classified as poor QOL whereas good and best represented good QOL. Having impaired ADL was defined as any response to questions concerning functional status indicating that the respondent required any assistance in performing any ADL. The frailty index (Searle et al., 2008) was calculated as the number of items defined as a deficit divided by the 30 items considered. We selected a TFI score of > 0.25 (Romero-Ortuno, 2013; Song, Mitnitski, & Rockwood, 2010) to identify a person as frail.

2.3. Statistical methods

Baseline characteristics were compared between groups using the chi-square test for categorical data. For continuous data, parametric and non-parametric tests were applied as appropriate after examining the distribution of variables. A p-value of 0.05 was considered statistically significant. Differences in baseline characteristics were analyzed for gender and frailty status. The associations with mortality was explored using Cox proportional hazard models. Several comorbidities and related health conditions were included in the TFI, only variables not included in the TFI were investigated in hazard models. Age, smoking status and socioeconomic status were therefore explored. Statistical analyses were performed using STATA 12.0. College Station, TX Stata Corp LP.

3. Results

Eight thousand one hundred and ninety-five participants were included. The mean age was 69.2 years (SD = 6.8), and 50.8% were female. Prevalence of frailty for the whole population was 22.1% in which 26.8% of female and 17.2% of male participants were defined as frails. Prevalence of frailty in the first wealth quintile (least wealthy) to the fifth quintile were 27.0%, 22.9%, 24.1%, 20.6% and 16.6% respectively. Demographic and clinical data of participants by frailty classification and gender are shown in Table 1.

3.1. Frailty and mortality

Over 7 years of follow-up, 1284 of 8195 participants died. Deaths per 1000 person-years in frail and non-frail groups were 48.8 (95% CI = 44.7–53.4) and 21.5 (95% CI = 20.0–23.0), respectively. Fig. 1 demonstrates death rate in each quartile of TFI, which shows that older people in higher quartile had a higher mortality rate in both genders. Males had a greater increase in death rate with increasing FI compared with females.

In the study cohort as a whole, frail predicted mortality (hazard ratio [HR] = 2.30, 95% CI 2.06–2.58). In stratified analysis according to gender, frailty was slightly more strongly associated with mortality in male (HR = 2.71, 95% CI 2.33–3.16) than in female (HR = 2.26, 95% CI 1.90–2.68). Further analysis explored the effect of wealth index and frailty status on mortality was also conducted (Table 2). Among non-frail participants of both genders; age, smoking and wealth index were independent predictors of mortality. Higher wealth index appeared to be a protective factor among non-frail males in dose-respond fashion, with the highest wealth index group having a lower mortality at HR 0.63 (95% CI 0.48–0.82). Among non-frail females, the effect was only statistically significant in the highest wealth index quintile (HR = 0.58, 95% CI 0.40–0.84). The association between wealth and frailty on mortality was attenuated in oldest old groups in both genders (Supplementary data: Appendix B). Among frail participants, benefit of wealthy status on mortality was not seen for both genders in all age groups. Age and smoking remained to be independent predictors of mortality among frail older people.