Original Study

Associations Between Geriatric Syndromes and Mortality in Community-Dwelling Elderly: Results of a National Longitudinal Study in Taiwan

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ABSTRACT

Objective: Although geriatric syndromes have been studied extensively, their interactions with one another and their accumulated effects on life expectancy are less frequently discussed. This study examined whether geriatric syndromes and their cumulative effects are associated with risks of mortality in community-dwelling older adults.
Methods: Data were collected from the Taiwan Longitudinal Study in Aging in 2003, and the participant survival status was followed until December 31, 2007. A total of 2744 participants aged ≥65 years were included in this retrospective cohort study; 634 died during follow-up. Demographic factors, comorbidities, health behaviors, and geriatric syndromes, including underweight, falls, functional impairment, depressive condition, and cognitive impairment, were assessed. Cox proportional hazard regression analysis was used to estimate the hazard ratios (HRs) and 95% confidence intervals (CIs) for the probability of survival according to the cumulative number of geriatric syndromes.
Results: The prevalence of geriatric syndromes increased with age. Mortality was significantly associated with age ≥75 years; male sex; ≤6 years of education; history of stroke, malignancy; smoking; not drinking alcohol; and not exercising regularly. Geriatric syndromes, such as underweight, functional disability, and depressive condition, contributed to the risk of mortality. The accumulative model of geriatric syndromes also predicted higher risks of mortality (N = 1, HR 1.50, 95% CI 1.19–1.89; N = 2, HR 1.69, 95% CI 1.25–2.29; N ≥ 3, HR 2.43, 95% CI 1.62–3.66).
Conclusions: Community-dwelling older adults who were male, illiterate, receiving institutional care, underweight, experiencing a depressive condition, functionally impaired, and engaging in poor health behavior were more likely to have a higher risk of mortality. The identification of geriatric syndromes might help to improve comprehensive care for community-dwelling older adults.

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As the population ages, an increased number of geriatric syndromes, including depression, cognitive impairment, falls, malnutrition, and functional impairment, occur among older people. Geriatric syndromes, also called geriatric conditions, are multifactorial health conditions that occur when the accumulated effects of impairments in multiple systems render a person vulnerable to situational challenges. These syndromes share a common presentation of multiple underlying diseases and have a negative impact on quality of life, contributing to an increased care burden, greater disability, worse prognosis, and a shorter life span.[1,2] Screening for geriatric syndromes is feasible and improves comprehensive care for older adults.[3,4]

Geriatric syndromes have been associated with an increased risk of mortality.[5–10] Moreover, self-reported health and healthy lifestyles are also associated with a lower incidence of functional disability and lower rates of all-cause mortality.[11–14] Although individual geriatric

syndromes have been studied extensively, their interactions with one another and their accumulated effects on life expectancy are less frequently discussed.[15] A previous study showed that the cumulative effects of multiple geriatric syndromes on life satisfaction among the older adults occurred only among those with ≥ 2 geriatric syndromes.[16] As older people often have several geriatric syndromes simultaneously, it is not enough to measure the association between individual geriatric syndromes and outcomes. Understanding these cumulative impacts could help us clarify the risk of mortality and provide appropriate multifactorial interventions for clinical geriatric care. Moreover, we also lack evidence regarding how these factors affect different age groups according to randomized population-based data. Thus, we designed a retrospective cohort study to analyze national longitudinal data to investigate the associations between geriatric conditions and the risk of mortality.

Methods

Data and Sample

The study data were collected from the Taiwan Longitudinal Study on Aging, a prospective cohort study funded by the Taiwan Bureau of Health Promotion and the Population Studies Center at the University of Michigan. The detailed research design and sampling strategy have been reported elsewhere.[17] We used the 2003 data wave, which included 2751 respondents aged 65 years and over, and completed the follow-up survey via household interviews. Seven cases were excluded because of unknown survival status after emigration. The respondents' vital status and date of death were obtained by linking information gathered from the household registration files maintained by the Ministry of the Interior and the national death certification files of the Department of Health in Taiwan. All death dates were collected on December 31, 2007. Participants were defined as survival cases if they were alive at the end of 2007.

Sociodemographic Characteristics and Self-Health Evaluation

Basic characteristics, including age, sex, years of education, living alone, area of residence, institutional care, and comorbidities were obtained at baseline. Years of education were grouped into 4 levels according to the international standard classification of education. Area of residence was categorized into rural, suburban, and urban. Institutional care was assessed as yes or no according to whether the individual was currently living in an institution or nursing home or had received institutional care in the past year. Evaluation of perceived health status was classified as good, fair, or poor.

Comorbidities

Chronic diseases, including hypertension, diabetes mellitus, heart disease, lung disease, stroke, malignancy, gastric disease or ulcer, liver or biliary disease, hip fracture, arthritis or rheumatism, gout, cataract, osteoporosis, and renal disease were recorded when a respondent indicated having been diagnosed with one of these diseases by a doctor.

Health Behaviors and Self-Health Evaluation

Data regarding health behaviors, including regular exercise, smoking, betel nut chewing, and alcohol drinking, were collected. Regular exercise was defined as exercising outdoors more than 3 times a week. Smoking behaviors were grouped as never, former, and current. Alcohol drinking was categorized as never, moderate (<1 time/week to every other day), and regular (more than every other day).

Geriatric Syndromes

Geriatric syndromes, including underweight, falls, functional impairment, depressive condition, and cognitive impairment, were recorded. Body mass index (BMI) was categorized into 1 of 4 groups defined by the Asia-Pacific Region of the World Health Organization (underweight, <18.5 kg/m^2; normal, 18.5–22.9; overweight, 23–24.9; and obese, ≥ 25).[16] A fall was indicated if the participants had had ≥ 2 falls in the past year. Functional status was measured by assessing activities of daily living (ADLs), including eating, dressing, bathing or showering, toileting, transferring, and walking. Functional impairment was defined as dependence in any ADL. Depressive condition was measured using the 10 items of the shortened Center for Epidemiologic Studies Depression Scale-10.[5] The range of the Center for Epidemiologic Studies Depression Scale-10 is 0 to 30, and a cut-off score of 10 or higher indicates the presence of a depressive condition.[18] Cognitive status was measured using the modified Short Portable Mental Status Questionnaire.[6] Incorrect answers on more than 2 questions indicated cognitive impairment. One additional error is allowed for participants with a grade school education or less, and 1 fewer error is allowed for participants with a high school education or higher.[19,20]

Statistical Analyses

Data were analyzed using IBM SPSS software v 17 for Windows (IBM, Chicago, IL). Categorical variables are expressed as numbers and percentages, and continuous variables are expressed as means $\pm$ standard deviations. Comparisons between survivors and nonsurvivors were conducted using χ^2 tests for categorical variables and t-tests for continuous variables. Regarding statistical significance, P values of less than .05 were considered significant. One-way analysis of variance was applied to compare the percentages of geriatric syndromes among different age groups. When the main effects were significant, Fisher least significant difference method was used for multiple comparisons. Linear regression was also used to test for linear temporal trends between age and the number of geriatric syndromes.

The Cox regression model was used to examine the association between possible risk factors and mortality. The effects of geriatric syndromes were assessed using individual items and the cumulative number of occurrences. For the multivariate analysis, variables with P values of less than .05 in the univariate analysis and potential confounders were included. Backward elimination of nonsignificant variables was then conducted to arrive at the final model. Based on backward selection, all models (model A and model B) were adjusted according to age, sex, education level, living alone, comorbidities, and health behaviors. To determine the mortality rate during the 5-year follow-up period, the Kaplan-Meier survival analysis model and the survival curves of the Cox model adjusted for age and sex were used to provide the accumulated probability of survival (months).

Results

A total of 2744 participants aged ≥ 65 years were included in the analysis. Nearly one-half (50.3%) of the participants were male, and 30.6% of the participants lived alone. During the 5-year follow-up, 634 participants (23.1%) died before the end of 2007. The most common comorbidities were hypertension, cataract, osteoporosis, arthritis, gastric disease, and heart diseases. Regarding geriatric syndromes, 44.9% of the participants had at least 1 condition, including underweight (6.4%), falls (9.9%), functional impairment (13.7%), depressive condition (20.1%), and cognitive impairment (9.2%). Table 1 shows the univariate analysis between survivors and nonsurvivors. Death during the follow-up period was associated with older age, male sex, a lower education level, living alone, receiving