The heterogeneous health latent classes of elderly people and their socio-demographic characteristics in Taiwan

Li-Fan Liu [a,*], Wei-Hua Tian [b], Hui-Ping Yao [a]

[a] Institute of Gerontology, College of Medicine, The National Cheng Kung University, Tainan, Taiwan
[b] Department of Economics, College of Social Sciences, The National Cheng Kung University, Tainan, Taiwan

A B S T R A C T

The health care needs of elderly people were influenced by their heterogeneity. This study aimed to identify the health latent classes of elderly people by using latent class analysis to deal with heterogeneity and examine their socio-demographic characteristics. Data came from the 2005 National Health Interview Survey (NHIS) in Taiwan. In total, 2449 elderly individuals with available health indicators were examined in latent class analysis (LCA), and 2217 elderly community-dwellings with complete socio-demographic data were analyzed by multinomial logistic regression. Four health latent classes were identified which included 1066 (43.5%) people in the High Comorbidity (HC), 152 (6.2%) in the Functional Impairment (FI), 252 (10.3%) in the Frail (FR), and 979 (40.0%) in the Relatively Healthy (RH) group. Multinomial logistic regressions revealed socio-demographic characteristics among health classes. The variables associated with an increased likelihood of being in the FR group were age, female, and living with families. They were also correlated to ethnicity and educations. Apart from age and gender, the Functional Impairment group was less likely to be ethnicity of Hakka, more likely to live with others than were the RH group. The HC group tended to be younger, with higher educations, and more likely to live in urban area than the Functional Impairment group. The correlations between health classes and socio-demographic factors were discussed. The health status of elderly people includes a variety of health indicators. A person-centered approach is critical to identify the health heterogeneity of elderly people and manage their care needs by targeting differential aging.

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1. Introduction

With a rate of aging faster than that of most developed countries (Bureau of National Health Insurance, 2009), Taiwan now faces an increased prevalence of aging population and related social impacts on aged care. There was 11.15% of the population aged 65 and over in the end of 2012 and it is estimated that the elderly population will double to 20% in only 20 years (Ministry of Interior, 2012). As the population ages, it is expected that more elderly people would have a greater demand for medical and long-term care services. For example, according to the statistics (NHI, 2011), more than 35% of the total health care expenditure of Taiwan's National Health Care Insurance (NHI) was utilized by elderly people aged 65 and over. In addition, the number of disabled elderly people in Taiwan was 336,000 in 2011 and this number is estimated to double in 20 years (Wang & Teng, 2009).

It has been well-documented that the heterogeneous group of elderly people actually consumes a disproportionate and sometimes inappropriate share of health care services (Lafortune, Beland, Bergman, & Ankri, 2009). Previous researches also showed that need factors including objective and perceived were stronger than did other variables (Andersen, 1995), an effect which persisted after controlling for potential endogenous factors (McNamee, 2004). For elderly people with complex care needs, comorbidity has now become the rule (Olshansky, Perry, & Butlermrn, 2006) and the extent to which each disease and syndrome translates into disability and service utilization varies greatly (Fried, Bradley, Williams, & Tinetti, 2001; Fried, Ferrucci, Darer, Williamson, & Anderson, 2004; Lafortune et al., 2009). Therefore, it is increasing important to deal with the health care needs of elderly people in considering their health status holistically and vertically by individual-based, person-centered approach which takes multiple observed health indicators into account to describe health heterogeneity more comprehensively.

For elderly people, previous research also showed that different socio-demographic and economic characteristics were risk factors influencing their health status and care utilization (Huisman, Kunst, & Mackenbach, 2003; Knesebeck, Luschen, Cockerham, & Siegrist, 2003; Schäfer et al., 2012). For example, research indicated that the health status of elderly people deteriorates with aging

* Corresponding author. Tel.: +886 6 3028173; fax: +886 6 3028173.
E-mail address: lilian@mail.ncku.edu.tw (L.-F. Liu).

process and age was one of the most important factors in health care utilization (Gonzalez-Gonzalez et al., 2011; Nie, Wang, Tracy, Moineddin, & Upshur, 2008; Schäfer et al., 2012). Gender difference was also shown, such as, female reported poor self-rated health, had higher cognitive impairment, and poor scores on activities of daily living (ADLs) and instrumental activities of daily living (IADLs) than males. Women also have twice as much comorbidities and symptoms of depression, and three times as much mobility limitations (Zunzunegui, Alvarado, Béland, & Vissandjee, 2009). Widowhood together with economic difficulties is associated with a higher risk of depression in men (Sonnenberg, Beekman, Deeg, & van Tilburg, 2000) and research also suggested the relationship between living arrangements and health for men and women (Rahman, Menken, & Kuhn, 2004). Socio-economic status (SES) was also found significantly associated with people's health conditions (Dalstra, Kunst, & Mackenbach, 2006; Knesebeck et al., 2003; Schäfer et al., 2012). Andersen (1995) also indicated that SES played as predisposing factors did influence the individual's health behaviors in health care utilization. Socio-economic characteristics related to social capital as "the ability of actors to secure benefits by virtue of membership in social networks or other social structures" (Portes, 1998) in which we believe they did like other form of capital impact on the health care utilization of elderly people.

Based on the emphases of the health and socio-demographic and economic factors in Andersen behavior model (Andersen, 1995), this study aimed to identify the health status of elderly people by using the person-centered approach and further to examine the socio-demographic and economic characteristics associated with the health status of elderly people. It is believed that the person-centered approach that took unobserved heterogeneity into account (Muthen & Muthen, 2000) could be valuable in understanding the burden of heterogeneous elderly people on the health care system, and provide new perspectives for policy makers to develop measures for the evaluation of trends and outcomes in order to monitor the needs for care, and improve quality of aged care and efficiency at the national level.

2. Methods

2.1. Data source and study design

The 2005 NHIS, a national representative data that covered all the administrative divisions in Taiwan, was used in this study. A multistage, stratified systematic sampling design was adopted for the survey and all members of a sampled household were interviewed.

In total, 2727 elderly people aged 65 and over were interviewed as part of the survey and cases with missing data on health indicators were deleted. A total 2449 cases were finally entered in the LCA. It was found that those with missing data in health indicators tended to be a little bit older than the group of complete cases (mean age 74.01 vs. 73.50). For the multinomial logistic regression, 2217 elderly community dwellings were analyzed after excluding those who stayed in institutions when the survey was conducted as well as the missing covariates.

2.2. LCA

LCA is a model-based tool which utilizes the methodology that is part of the Mplus program (Muthen, 2012) and is suitable to identify heterogeneity. As a person-centered approach, LCA's goals are to reveal the smallest number of unobserved groups of individuals in terms of health latent classes that can adequately account for the associations among observed health dimensions. The goal is to group individuals into categories, each of which contains individuals who are similar to each other and different from individuals in other categories (Muthen & Muthen, 2000). The health latent classes encompass multiple dimensions of health, and capture their likely synergistic effect on the overall health needs of older individuals (Lafortune et al., 2009). Previous research also suggested that exploration of the heterogeneity of elderly people with a person-centered approach using homogenous health state categories combined with their socio-economic characteristics provided a valid basis for comparing configurations of service utilization (Lafortune et al., 2009; Muthen & Muthen, 2000).

2.3. Health latent class identification

From the NHIS dataset, 16 health indicators were used to determine health latent classes by LCA. The health indicators chosen were related to need factors as measured by health conditions, sensory limitations, and functional impairments as the potential endogenous factors that influenced the health of elderly people. Indicators of chronic conditions (yes/no) included self-reported hypertension, diabetes, renal disease, heart disease, stroke, cancer, respiratory disease, joint and musculoskeletal problems, and other comorbid conditions. Only those conditions where individuals acknowledged that the diagnosis had been confirmed by a physician were used.

Sensory limitations (yes/no) included self-declared problems with hearing and vision. Self-rated health (bad/not bad) was determined by the interviewee's own perception. Cognitive problems were measured with the Mini Mental State Examination (MMSE, scores $< = 23$ indicated cognitive impairment). Depression was examined with the Geriatric Depression Scale (GDS-15, scores ≥ 10 indicated depression).

Functional disability (yes/no) was defined as difficulty with ADLs, including eating, taking a bath/shower, dressing, using the toilet, getting up from bed/chair, moving around the home; IADLs, including cooking, shopping, using the phone, taking medication, doing light and heavy housework, washing, managing money and mobility referring to difficulty in performing upper and lower limb movements as shown in Table 1.

Socio-economic variables collected in the study included gender, age, education, ethnicity, marital status, living arrangements and residence area based on Anderson health behavior model (Andersen, 1995) and the economic status was categorized by monthly household income.

2.4. Statistical analyses

The data and statistical analyses in the study were divided into two parts. First, LCA was used to deal with the classification of health latent classes of elderly people that could adequately account for the associations among observed health dimensions. Second, the socio-demographic characteristics among health classes of elderly people were described and analyzed by using multinomial logistic regression.

LCA estimates 2 types of parameters based on maximum-likelihood (Muthén & Muthén, 2008): conditional item response probabilities and health latent class probabilities. Conditional item response probabilities are class-specific and correspond to the probability that a response is associated with the health latent class. Health latent class probabilities represent individuals' probability of belonging to each class. Based on their highest health latent class probability, individuals are assigned to one class. Within each class, individuals have common conditional item response probabilities and these were assumed to be independent (Muthen & Muthen, 2000). Model fit of LCA was assessed with Bayesian information criteria (BIC) and