Impact of the disability trajectory on the mortality risk of older adults in China

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ARTICLE INFO

ABSTRACT

Using data from the Chinese Longitudinal Health Longevity Survey of 2005, 2008 and 2011, the authors compared the difference in the disability trajectory (DT) of survivor, decedent and dropped-out survey respondents and examined gender differences in DT using a group-based trajectory model, gender differences in the impact of DT on mortality risk (MR) among older adults, and mediating effects of resources and health status during late life through survival analysis. This analysis shows that the DTs of the survivors, decedents and dropped-out respondents differ remarkably. The trajectories of the decedents generally begin higher and increase more rapidly. Three types of DT exist for both genders: Type 1, the "independent type"; Type 2, the "low start, rapidly increasing in late life type"; and Type 3, the "high start, rapid development type". Women are more likely to experience a DT of functional impairment. Men who experience the Type 3 trajectory suffer the highest MR, followed by those of the Type 1 and Type 2 trajectories. Women who experience the Type 3 trajectory suffer the highest MR, followed by those of the Type 2 and Type 1 trajectories. In addition, economic status, medical treatment, daily care by the family and chronic diseases mediate the impact of DT on MR for both genders, while the mediating effect of emotional support from children was only observed for women.

1. Introduction

According to a report on the National Survey of Disability of Urban and Rural Older Adults released by the China Research Center on Aging, 33 million older adults in China were partially or fully disabled note at the end of 2010, and 10.8 million were fully disabled, accounting for 19.0% and 6.23% of the aggregate of older adults in China, respectively (Zhang 2011). The increase in the number of disabled older adults has posed multiple challenges to family care, social care and health care (Zhao, Smith, & Strauss, 2014).

Health and longevity, two of the ultimate goals for human beings, are equally important. In prior studies, the level of disability and mortality risk (MR), two major indicators of health and longevity, have been increasingly closely associated. These research illustrate that the disability of older adults is highly predictive of their MR (Ho, 1991; Incalzi et al., 1992; Koyano et al., 1989; Lamarca et al., 2003; Manton, 1988; Millan-Calenti et al., 2010; Pijls, Feskens, & Kromhout, 1993; Reuben, Rubenstein, Hirsch, & Hays, 1992; Ruigómez, alonso, & antó, 1993; Scott, Macera, Cornman, & Sharpe, 1997; Wolinsky, Callahan, Fitzgerald, & Johnson, 1993). In addition, differences in the development of disability have exhibited a varying magnitude of impact on the

mental status (Lenze et al., 2001), healthcare utilization (Spillman, 2004) and economic status (ES) (Smith, 1999) of the elderly, thus leading to distinct MR. Most prior studies use disability level at a given time point to predict the MR level (Ho, 1991; Incalzi et al., 1992; Koyano et al., 1989; Lamarca et al., 2003; Manton 1988; Pijls et al., 1993; Reuben et al., 1992; Ruigómez et al., 1993; Scott et al., 1997; Wolinsky et al., 1993). However, such an approach ignores differences in disability level before that time point and the disability development rate and therefore obscures the impact of disability level on MR. Thus, there may be inaccuracy in predicting MR by disability level, which is static, based on a fixed time point. The authors posit that a precise depiction of the development of disability level (or body function) and the prediction of MR necessitate examination of the entire trajectory and dynamics of the development of disability. In addition, although the influence of social resources and health behavior on disability and MR is well documented (Cockerham, 2000; Hsu and Chang 2015; Hill, Uchino, Eckhardt, & Angel, 2016; Liang et al., 2000; Zeng, Liu, Zhang, & Xiao, 2004; Zhu, 2015), investigation of the mediating effect of these factors on the impact of disability trajectory (DT) on MR remains rare.

For most individuals, disability is a dynamic process of evolution and the result of an accumulation of factors through the life course (Wu,

2009; Zimmer, Martin, Nagin, & Jones, 2012). The trend and process of the change in the level of disability of older adults should not be ignored. In addition, the DT of older adults exhibits different patterns not only with a distinct level of disability at the starting and end points but also with constantly changing developments during the process. It is inappropriate to generalize the development of disability into one trajectory. The focus and the challenge of this study involve the detection of different trajectories and the depiction of their features.

The group-based trajectory model, which represents a special category of the finite mixture model (Nagin, 2005), could effectively fill the gap left by prior DT studies that tend to generalize the development of disability into a single trajectory and ignore the differences in development (Bryk & Raudenbush, 1987; McArdle & Epstein 1987; Meredith & Tisak, 1990; Muthén, 1989; Raudenbush & Bryk, 2002; Willett & Sayer, 1994). This approach could also demonstrate the heterogeneity of the trajectories and avoid subjective assumptions regarding them, thus contributing to a clear understanding on the full-course development trajectory of disability.

Prior studies on disability using group-based development modeling are few in number and mostly focus on categories of DT of survivors and the attributive factors of DT types. These studies suggest (1) that demographic, socioeconomic factors and conditions during earlier life have an impact on the DT of older adults (Kingston et al., 2015; Wu, 2009), (2) that the impact has gender differences (Zimmer et al., 2012) and (3) that genetic factors could significantly influence the categorization of an older adult's DT (Hu, 2014).

Other factors influencing the MR of older adults are well-documented. Respondents who resided in rural areas (Cockerham, 2000), were male (Cockerham, 2000), of Han ethnicity (Zeng et al., 2004), of lower professional status (Zeng et al., 2004), illiterate (Liang et al., 2000) and who lacked familial care and emotional support from children (Hill et al., 2016; Zeng et al., 2004) suffered higher MR. Respiratory and circulatory diseases and malignant tumors are the main causes of death among Chinese older adults and that remarkable gender differences exist in the death structure of the Chinese population (You & Zheng 2005). Children with lower parity live longer than those with higher parity (Bell 1918; Zhou & Ren 2001). Left-hand-dominant individuals are prone to breast, cerebral and other cancers (Ramadhani et al., 2007). Unhealthy habits and conditions, such as tobacco use, alcohol use and obesity (factors for which health care is instrumental (Preston, 1975)) could affect human health (World Health Organization, 2009. Additionally, poor living conditions during the initial part of life could increase the risk of disease in later life (Tarry-Adkins & Ozanne 2014). Importantly, certain researchers believe that due to the selective role of death, individuals who avoid poor health or living conditions during childhood and adulthood can live longer in later life (Wang, 2011).

To summarize, prior studies have investigated the association of the DT and MR of older adults in different disciplines and from different perspectives. These efforts have been highly important to better knowledge and more accurate evaluation of DT and MR. Most studies, grounded in social medicine and epidemiology, have focused on the magnitude of the influence of socio-demographic factors on DT and MR or endeavored to determine the direct causes of disability and death in older adults. However, they lack systematic theoretical deliberation on the impact of DT on MR. In addition, the mediating effect of social resources and other factors on DT and MR during old age has not been well documented. In addition, Gu (2007) found that loss to follow-up in the Chinese Longitudinal Health and Longevity Survey (CLHLS) for those aged 80 and older was associated with being female, living in urban areas, having fewer social contacts, and having a disability. The disability experiences of individuals who were successfully interviewed in all waves are milder than those of decedents and those of all dropouts taken together (Zimmer, et al. 2012). These socioeconomic and health profiles, which differ among older adults who died within the observation period, those who survived and those who dropped out, could affect the pattern of DT. However, most prior research has been

confined to the study of the DT of the survivors and often ignores the deviation of the trajectory of the two other respondent groups, which might potentially underestimate the level of disability or even distort the curve of DT (Kingston et al., 2015; Wu, 2009).

To assess this gap in the literature, the authors first used a group-based trajectory model to reveal the different trajectories of the survivors, decedents and the dropouts. After determining the existence trajectories of the decedents and dropouts, which differ substantially from those of the survivors, the authors pooled the data for the survivors, decedents and dropped-out respondents for model fitting to determine the real trajectory of the studied elderly population. Prior studies have found a large difference in the level of disability between older men and women, with older women often suffering higher levels of disability because they differ from men in physiology and social status (Zeng et al., 2004). Does the DT of older adults differ between the two genders longitudinally? Compared with older men, do older women suffer higher levels of disability at the starting and end points and experience a faster rate of development? To answer these questions, the authors pooled the data in a gender-split stratification of trajectory types. Next, the authors adopted a gender-specific approach to compare the impact of DT on MR and the mediating effect of health-related resources on the impact of DT on MR to develop a better understanding of the multiple factors that result in the divergence in the MR of older adults. Finally, the authors offer suggestions on how to reduce the MR of older adults and promote health equality.

2. Theoretical framework and study design

2.1. Theoretical framework

According to Andersen's healthcare demand theory (1973), the population profile, which includes propensity factors, enabling resources, demand factors and health behaviors (including lifestyle and health-services utilization), affects the health of the elderly. This study treats age, gender, etc. as propensity factors, children's economic support, emotional support, etc. as enabling resources, life-threatening chronic diseases as demand factors, smoking, drinking, etc. as ways of life and disease treatment as an indicator of health-services utilization. These factors were incorporated into cox regression as covariates to examine the impact on MR. Similar to chronic diseases, DT could affect the demand for medical care among the elderly. Therefore, it was included as a demand factor, and the impact of the different trajectory types on MR was analyzed (Fig. 1). Additionally, the following factors were analyzed: economic status, economic support and emotional support from children, daily care by the family, the status of chronic diseases and the status of medical treatment. These factors represent adjustable factors during old age that could reduce the disability and MR of older adults, as demonstrated by prior studies, so the authors deduced these factors might affect the impact of DT on MR. Therefore, this study intersected these factors and DT and examined the mediating effects of the factors on the impact of DT on MR.

2.2. Study design

2.2.1. Data source

This study selected data from the last three rounds of the CLHLS, which covered 23 provinces and was conducted for six rounds in 1998, 2000, 2002, 2005, 2008 and 2011. (See the survey website for details: http://web5.pku.edu.cn/ageing/html/detail_project_1.html).

In total, 7979 older adults in the 2005 survey aged between 65 and 105 years (inclusive) were chosen for the study because the age above 105 might have been wrongly reported (Wu, 2009) (See Table 1 for the profile of the respondents). During the Survey from 2005 to 2011, survivors, decedents and dropped-out respondents accounts for 31.39% (2505), 44.34% (3538) and 24.26% (1936) among the total studied respondents, respectively. If we presume being lost to follow-up is