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Long term determinants of functional decline of mobility: An 11-year follow-up of 5464 adults of late middle aged and elderly

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ABSTRACT

This confirmatory study aims at investigating the long term determinants of mobility limitation among late middle aged and elderly in a physically less active population. Five thousand four hundred and sixty-four participants aged 50–97 in 1996 enrolled the Taiwan Longitudinal Study on Aging (TLSA) for four waves of interview during 11 years. Social and health-related determinants were collected in each interview. Mobility limitation was enquired level of difficulty in eight movement tasks, including lifting 11 kg weight, squatting, running 20–30 m, standing for 15 min, walking 200–300 m, climbing up two to three floors, raising arms up and grasping with fingers. According to the mixed models with repeated measurements, more frequent gardening and longer time for each exercise predicted subsequent better mobility function in Taiwanese elderly while controlling demographics and current comorbidities. The protective effect of gardening was robust in all models. Frequent alcohol consumption was harmful to future mobility function, but less as harmful when participants aged. Besides, the depression-related somatic complaints were predictive to future mobility limitation among those without limitation at baseline. It shall be worthy to explore the dosage as well as the mechanism of these protective factors, especially the most significant but the least explored factor, gardening. Additionally, efforts should be made to understand the relationship between depression-related somatic complaints and mobility decline and so as the relevant interventions.

1. Introduction

Since aging is a worldwide phenomenon, both maintaining high physical function in successful aging (Rowe & Kahn, 1997) and early detecting mobility limitation in disablement process (Verbrugge & Jette, 1994) are of great significance in all societies. Decline of mobility is not only a precursor of disability (Barberger-Gateau, Rainville, Letenneur, & Dartigues, 2000; Guralnik et al., 1995), dependency and mortality (Cesari et al., 2009), but also a reversible stage by means of exercise (Nelson et al., 2007) even among the very old (Simons & Andel, 2006). It is important to identify high risk people as well as to hunt for feasible interventions.

Amongst various risk factors, physical conditions including major comorbidities (e.g. stroke and hip fracture) and previous disability may result in both immediate and progressive loss of mobility (Bootsma-van der Wiel et al., 2002; Guralnik et al., 1995; Guralnik, Ferrucci, Balfour, Volpato, & Di Iorio, 2001; Tas et al., 2011). To explore the closer-to-reality association between mobility decline and potential risk factors, several carefully analyzed studies took current diseases into consideration when constructing the models (Penninx, Leveille, Ferrucci, van Eijk, & Guralnik, 1999; Peres, Verret, Alioum, & Barberger-Gateau, 2005; Van Gool et al., 2005). The present study would control the potential impacts of current diseases and pre-existing disability accordingly.

Depressive symptoms predicted further incidence of mobility limitations or progression of functional decline no matter what mobility condition was at baseline (Cronin-Stubbs et al., 2000; Penninx et al., 1998; Van Gool et al., 2005), whereas other studies did not detect such an association (Dalle Carbonare et al., 2009; Everson-Rose et al., 2005). Thus, this study intended to explore into the concealed mechanism and factorial structure of depression

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questionnaire for the above discrepancy. In addition, physical activities(Lee & Park, 2006), cognition (Bootsma-van der Wiel et al., 2002), drinking (LaCroix, Guralnik, Berkman, Wallace, & Satterfield, 1993), and social ties (Lund, Nilsson, & Avlund, 2010) have been reported to be related to physical decline.

We are fortunate to have a comprehensive collection of data of different major comorbidities, psychometric assessment of depression, exercise, previous mobility condition, and leisure time activities, as well as social connection, which were measured repeatedly during the 11 years of follow-up among late middle aged and elderly. With all the above risk factors in mind, this study aims to understand the longitudinal association between mobility and all these determinants in a non-western population.

2. Materials and methods

2.1. Participants

The TLSA has conducted six waves of data collections since 1989. The trained interviewers home-visited the sampled subjects and detailed information of demographic and medical histories were taken. The original cohort sampled 4 049 non-institutionalized participants over 60-year-old with a three-stage probability sampling based on the national household register of Taiwan in 1989. In 1996, the survey supplemented with 2463 subjects aged 50–67 for the extensiveness of this study and yielded a total of 5464 survived sample. The attrition rate other than mortality during the follow-ups was generally less than 10%, and the comparison of age, gender, and years of education between the interviewed and the loss to follow-ups in each survey was summarized in Table 1. Since the attrition rate of 1996 only took the subjects who lost to follow-up from the original cohort, they were significantly older (mean age 74.1 ± 5.5 years) in comparison with the interviewed group (mean age 66.7 ± 9.4 years) which supplemented with young new cohort. No differences in age were found in the following three surveys. No gender difference in these two groups. There were significantly more years of education in those who lost to follow up than in the interviewed groups in all four surveys (Table 1), which might reduce the sample size and make us less likely to detect a significant effect in education. Most of the interviewees were the sampled subjects themselves, but some interviewees were their proxies due to the sampled subject's mental or physical limitations. Proxies could answer most questions but not those subjective ones such as self-reported depression questionnaire and cognitive test. Among the interviewed group, there were 379 (7.38%), 313 (7.05%), 344 (9.11%), and 387 (12.36%) answered, partly or fully, by the proxies in 1996, 1999, 2003, and 2007, respectively. Proportion of proxy interviews increased as the subjects aged. The human experiment and ethics committee in the National Cheng Kung University Hospital approved the study.

2.2. Measurements

Mobility limitation was a 4-point measurement enquiring level of difficulty in eight mobility tasks, including lifting 11 kg weight, squatting, running 20–30 m, standing for 15 min, walking 200–300 m, climbing up two to three floors, raising arms up and grasping with fingers. The sum of these eight items ranged 8–32 and the higher the score indicated the more difficult the mobility. These mobility tasks were hierarchically correlated to instrumental and basic activities of daily living (Chen et al., 2010).

Determinants were divided into following four dimensions: demographics, physical conditions, health behavior-related characteristics, and social connection. Demographics included gender, age, years of education, satisfaction with present income, living in nursing home, proxy instead of sampled participant interviewed, and employment.

Fourteen common chronic physical conditions included hypertension, diabetes, heart disease, stroke, cancer, chronic obstructive pulmonary disease (COPD), arthritis, gastric disease, hepatobiliary disease, hip fracture, cataract, renal disease, gout, and spurs detected on spines. The criteria to include any of the above 14 conditions required positive responses to all three questions, that is, been diagnosed by physician(s), seen by doctor(s) in the past one year, and still had the condition when interviewed. Additional questions such as pains and discomfort, and number of days stayed in bed due to sickness or injury in the last month were also inquired.

Health behavior characteristics included self-reported depressive symptoms (described in the next paragraph), cognition (immediate recall of ten items modified from Rey Auditory Verbal Learning Test (Lezak, 1983), and from Digits Backward Test; Wechsler & Matarazzo, 1972)), number of cigarettes smoked per day, frequency of alcohol consumption (0, <1 per month, 1–2 per month, once a week, 2–3 days per week, daily, and categorized as 0–5 accordingly), frequency of exercise (0, ≦2, 3–5, ≧6 times per week), duration of each exercise (0, <15 min, 15–30 min, >30 min), sweating level after exercise (none, a little, a lot, none of the above), panting level after exercise (none, a little, a lot, none of the above), nine leisure activities (watching TV, listening to

Table 1
Sampled subjects interviewed in each survey.

Year	*N* (%)	Female *N* (%)	Age mean (SD)	Years of education mean (SD)
1996 (*N*)	5451			
Interviewed	5131(94)	2371(46)	66.7(9.4)	4.7(4.5)
Loss to follow-up in 1996[a]	320(6)	136(43)	74.1(5.5)*	5.2(4.7)*
Deceased	–	–	–	–
1999 (*N*)	4917			
Interviewed	4440(90)	2082(47)	69.5(9.1)	4.7(4.5)
Loss to follow-up in 1999[a]	477(10)	221(46)	69.0(9.5)	5.6(4.8)*
Deceased	534	204(38)	76.4(8.9)	3.7(4.3)
2003 (*N*)	4124			
Interviewed	3778(92)	1830(48)	71.5(8.6)	4.9(4.5)
Loss to follow-up in 2003[a]	346(8)	167(48)	71.8(9.7)	5.8(4.8)*
Deceased	793	306(39)	78.6(8.6)	4.0(4.4)
2007 (*N*)	3470			
Interviewed	3132(90)	1558(50)	74.4(8.2)	5.1(4.6)
Loss to follow-up in 2007[a]	338(10)	168(50)	75.2(9.6)	5.9(5.0)*
Deceased	654	271(41)	80.6(8.0)	4.1(4.2)

[a] *T*-tests of age and education were performed in comparison with the interviewed group surveyed in the same year.
* $p < .05$.