Archives of Gerontology and Geriatrics 72 (2017) 6–11

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Full Length Article

Motor functioning differentially predicts mortality in men and women

Marie Ernsth Bravell[a,*], Deborah Finkel[b], Anna Dahl Aslan[a,c], Chandra A. Reynolds[d], Jenny Hallgren[a], Nancy L. Pedersen[c,e]

[a] Institute of Gerontology, School of Health and Welfare, Jönköping University, Sweden
[b] Department of Psychology, Indiana University Southeast, USA
[c] Department of Medical Epidemiology and Biostatistics, Karolinska Institutet, Stockholm, Sweden
[d] Department of Psychology, University of California, Riverside, USA
[e] Department of Psychology, University of Southern California, Los Angeles, USA

ARTICLE INFO

Keywords:
Motor function
Gender differences
Survival

ABSTRACT

Introduction: Research indicates gender differences in functional performance at advanced ages, but little is known about their impact on longevity for men and women.
Objective: To derive a set of motor function factors from a battery of functional performance measures and examine their associations with mortality, incorporating possible gender interactions.
Method: Analyses were performed on the longitudinal Swedish Adoption/Twin Study of Aging (SATSA) including twenty-four assessments of motor function up to six times over a 19-year period. Three motor factors were derived from several factor analyses; fine motor, balance/upper strength, and flexibility. A latent growth curve model was used to capture longitudinal age changes in the motor factors and generated estimates of intercept at age 70 (I), rates of change before (S1) and after age 70 (S2) for each factor. Cox regression models were used to determine how gender in interaction with the motor factors was related to mortality.
Results: Females demonstrated lower functional performance in all motor functions relative to men. Cox regression survival analyses demonstrated that both balance/upper strength, and fine motor function were significantly related to mortality. Gender specific analyses revealed that this was true for women only. For men, none of the motor factors were related to mortality.
Conclusion: Women demonstrated more difficulties in all functioning facets, and only among women were motor functioning (balance/upper strength and fine motor function) associated with mortality. These results provide evidence for the importance of considering motor functioning, and foremost observed gender differences when planning for individualized treatment and rehabilitation.

1. Introduction

Studies of disability and function among older individuals are common, due to the changes that usually appear with advanced age and the effect these physical changes have on daily living. *Disability* is typically measured by self-reports of function in Personal Activities in Daily Life (PADL) and/or function in Instrumental Activities in Daily Life (IADL) (Fauth, Zarit, & Malmberg, 2008). Self-reports of disability are partly confounded by social and psychological health factors such as gender roles, labor, and interests (Larsson & Thorslund, 2002). Assessments of *functional impairments* via observed performance of motor function are considered to more accurately capture true physiological impairments (Avlund, 1999; Guralnik et al., 1994). The two most commonly examined measures are grip strength and walking speed (Cooper et al., 2011). Studies comparing self-reported disability and measured functional impairments show modest correlations, ranging from 0.17 to 0.54 (Ernsth Bravell, Zarit, & Johansson, 2011; Farag et al., 2012). Therefore, studies using self-reported versus assessed physical function will not necessarily yield the same results. Nevertheless, both self-reported ADL and observed functional ability decline with age, and they also demonstrate associations with longevity (Cooper, Kuh, & Hardy, 2010; Gallucci, Ongaro, Amici, & Regini, 2009; Hirsch, Bůžková, Robbins, Patel, & Newman, 2012; Stineman et al., 2012; Taekema, Gussekloo, Westendorp, de Craen, & Maier, 2012; Tiainen, Luukkaala, Hervonen, & Jylhä, 2013; White et al., 2013). In addition, there are documented gender differences in disability in late life, where women tend to have more problems at the same time as they live longer (e.g. Avlund, Vass, & Hendriksen, 2003; Crimmins, Kim, & Sole-Auro, 2010) and have poorer physical function (Daly et al., 2013; Orfila et al., 2006). Most current studies focus on single measurements such as grip

* Corresponding author.
E-mail address: marie.ernsth-bravell@ju.se (M.E. Bravell).

http://dx.doi.org/10.1016/j.archger.2017.05.001
Received 16 September 2016; Received in revised form 24 February 2017; Accepted 1 May 2017
Available online 02 May 2017
0167-4943/

strength (Oksuzyan et al., 2010; Wu et al., 2012) or gait speed (Studenski et al., 2011). Few studies have considered gender differences in the relationship between mortality and multiple measures of physical motor functioning tapping different functional modalities (Cooper et al., 2011).

The aim of the current study is therefore to evaluate a set of performance-based motor function factors and to explore their relationship to mortality, incorporating possible gender interactions.

2. Method and material

2.1. Sample

As a part of the longitudinal Swedish Adoption/Twin Study of Aging (SATSA), twenty-four different assessments of motor functioning were collected six times over a 19-year period. Accrual procedures for SATSA have been described previously (Finkel & Pederson, 2004). In-person testing (IPT) took place in a location convenient to the participants and was completed during a single 4-h visit. The second (IPT2) and third (IPT3) waves of in-person testing occurred at three-year intervals. In-person testing did not occur during wave 4; therefore, the next wave of in-person testing is labeled IPT5 and occurred after a 7-year interval (see Finkel & Pedersen, 2004). Regular 3-year testing continued after IPT5; therefore, the total time span from IPT1 to IPT7 was 19 years. For IPT1, motor function data was available for 645 persons. In addition, respondents were added during the study as they turned 50 years; 97 entered the study at IPT2, another 21 at IPT3, and finally 101 at IPT5. Not surprisingly, there was very little variance in motor function at IPT1; therefore, IPT2 was used as the baseline assessment for this study. Since almost all of the respondents performed fairly well with little variance before the age of 60, which agrees e.g. with Wu et al. (2012), only respondents aged 60 and above at IPT2 were included in the survival analyses. Baseline data (IPT2) on motor function were available from 436 twins ranging in age from 60 to 91 years. From these, 76% participated in three or more IPTs. Table 1 provides a description of the total sample, from which descriptive and factor analyses were performed (total sample). It also describes the sample from which the survival analyses were performed (age 60 +).

2.2. Measures

Twenty-four measures of functional ability were collected at each IPT. They are listed in Table 2. The functional ability tasks were timed but motor functioning measured in seconds was skewed (most individuals perform the tasks successfully into their mid-60s). Previous studies have found problems using time to complete a task due to lack of variation (e.g. Ernsth Bravell et al., 2011). Performance on the 24 motor functioning tasks was also categorized by the nurses administrating the testing as without difficulty (1), with some difficulty (2), or impossible (3). Thus, even when a participant could, for example, balance for 10 s with eyes closed (achieving the maximum score), the nurses were able to report whether the participant demonstrated any difficulty with the balance task, regardless of time. The analyses described below made use of the qualitative nurse ratings for each of the 24 tasks.

2.3. Analyses

To assess the effects of relatedness (twinship), the sample was divided into two groups: twin A from each pair in one group and twin B from each pair in another group. All analyses were conducted separately in each group to ensure that the results were the same. Only minor differences were found; thus, the descriptive statistics reported (Table 1) are from the full sample to maximize power. Cox regression survival models were applied using STATA/IC 12.1 and the robust sandwich estimation option to control for twinship and thus provide appropriate standard errors.

2.3.1. Factor structure

To begin with, several factor analyses were performed in order to create motor factors. Due to skew evident in motor functioning in the first IPTs, where most individuals performed well, the first factor analyses (Principal Component Analysis with Variamax rotation) were performed on the motor function measures from IPT7. The factor analysis converged in three iterations that could be interpreted as; 1. Fine motor ability (explained 33% of variance); 2. Balance and strength motor ability (explained 27% of variance); 3. Flexibility (explained 14% of the variance). The extractions in the factor analysis on IPT7 are based on eigenvalues, and explain a total of 71% of the variance in motor function, see Table 2.

Table 1
Sample characteristics and descriptive Mean (SD).

					Fine motor			Balance and strength			Flexibility		
	N	Men	Women	Age	Total	Men	Women	Total	Men	Women	Total	Men	Women
IPT 2	585	242	343	66.0 (9.0)	8.6 (1.2)	8.6 (1.3)	8.6 (1.2)	10.7 (2.0)	**10.4** ** **(1.3)**	**10.9** ** **(2.3)**	2.2 (0.5)	**2.1** ** **(0.4)**	**2.2** ** **(0.6)**
IPT 2[a]	436	174	262	70.2 (6.1)	8.7 (1.4)	8.6 (1.5)	8.7 (1.7)	10.9 (2.2)	**10.5** ** **(1.4)**	**11.1** ** **(2.5)**	2.2 (0.6)	**2.2** * **(0.4)**	**2.3** * **(0.6)**
IPT3	566	233	333	68.8 (9.2)	8.7 (1.3)	8.6 (1.4)	8.7 (1.3)	11.0 (2.1)	**10.7** * **(1.5)**	**11.2* (2.5)**	2.3 (0.6)	**2.2** * **(0.5)**	**2.3** * **(0.6)**
IPT3[a]	378	149	229	73.1 (5.8)	8.8 (1.5)	8.8 (1.6)	8.8 (1.3)	11.1 (2.1)	**10.9** * **(1.5)**	**11.2* (2.4)**	2.3 (0.6)	**2.2** * **(0.5)**	**2.3** * **(0.7)**
IPT5	541	213	328	70.6 (10.0)	9.0 (2.5)	8.8 (1.9)	9.2 (2.8)	11.7 (3.7)	**11.3** * **(3.1)**	**12.0* (4.1)**	2.3 (0.8)	**2.2** ** **(0.6)**	**2.4** ** **(0.9)**
IPT5[a]	252	90	162	78.5 (5.1)	9.4 (2.8)	9.2 (2.6)	9.5 (2.9)	12.6 (4.5)	12.3 (4.3)	12.7 (4.6)	2.4 (0.9)	2.4 (0.8)	2.5 (1.0)
IPT6	447	183	264	72.2 (9.3)	9.3 (2.2)	**9.1** * **(1.5)**	**9.5** * **(2.6)**	11.8 (3.3)	11.5 (3.1)	11.9 (3.4)	2.3 (0.7)	**2.2** *** **(0.5)**	**2.4** *** **(0.8)**
IPT6[a]	185	67	118	80.5 (4.6)	9.9 (2.9)	**9.5** ** **(1.8)**	**10.2** ** **(3.3)**	12.8 (4.1)	12.7 (4.1)	12.9 (4.1)	2.5 (0.9)	**2.3** ** **(0.6)**	**2.6** ** **(1.0)**
IPT7	379	155	224	74.3 (9.0)	9.8 (3.4)	9.8 (3.3)	9.8 (3.4)	12.3 (4.2)	12.11 (4.2)	12.5 (4.2)	2.5 (0.9)	2.4 (0.8)	2.5 (0.9)
IPT7[a]	138	47	91	83.23 (4.1)	10.7 (3.9)	11.1 (4.3)	10.5 (3.7)	14.2 (5.2)	14.5 (6.2)	14.0 (4.6)	2.7 (1.1)	2.5 (1.0)	2.9 (1.2)