Genetic Effects on Life-Space Mobility in Older Women

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Funding sources: This study was funded by grants from the Academy of Finland. Jaakko Kaprio has been supported by the Academy of Finland Centre of Excellence in Complex Disease Genetics (grant numbers: 213506, 129680).

Abbreviated title: Genetic Effects on Life-space Mobility

LETTER TO THE EDITOR: RESEARCH

To the Editor: The ability, safely and reliably, to go where, when and how a person wants to go is a fundamental part of active aging and one of the important considerations for research, practice and policy in the aging field.[1] Life-space mobility describes persons´ ability to move and travel in their living environment. It is based on the balance between internal physiologic capacity and the external challenges encountered in daily life.[2,3] Restricted life-space mobility correlates with difficulties in basic and instrumental activities of daily living (ADL), difficulties in transportation, poorer physical and cognitive performance, depressive mood, and also with low income, female gender and older age.[3,4,5] Previous studies on the factors underlying life-space mobility are scarce, and no previous study has attempted to estimate the relative contribution of genetic and non-genetic effects on life-space mobility.

This study forms part of the Finnish Twin Study on Aging (FITSA), launched in 2000 to study the contribution of genetic and environmental effects to the disablement process in older women (n=434 twin individuals from 217 pairs). The recruitment process has been described in more detail earlier.[6] The data used in the present analyses are drawn from the third FITSA data collection round in 2011-12, when 91% (n=344) of the 377 surviving participants answered a structured, postal questionnaire. The Ethics Committee of the Central Finland Health Care District approved the study, and participants gave their informed consent.

Life-space mobility was measured with the University of Alabama at Birmingham Study of Aging Life-Space Assessment (LSA)[3], which was translated into Finnish as described earlier[7]. The life-space composite score reflects participants' mobility performance in daily

life, comprising the distance, frequency, and level of independence of travel (range 0-120, higher score indicating better life-space mobility).[3]

Depressive symptomatology was measured using the Center for Epidemiologic Studies Depression Scale (CES-D) (range 0-60, higher score indicating more severe depressive symptoms). We treated the entire CES-D scale as missing if more than four of the twenty items were missing.[8] We classified participants as having difficulties in basic ADL (eating, toileting, bathing, or dressing) or in instrumental ADL (using the telephone, managing money, preparing meals, shopping, doing light housework, or doing heavy housework) if she reported major difficulties in doing, or being unable to do, the task. Self-rated health, memory, vision, hearing, balance and fear of falling were assessed using either 3- or 5-point rating scales. Information on current living and driving status, as well as number of self-reported chronic diseases was also gathered.

We had full LSA data on both cotwins in 61 monozygotic (MZ) and 61 dizygotic (DZ) pairs, while in 28 MZ and 44 DZ pairs data from only one twin were available. 222 (66%) participants reported unlimited life-space, meaning that they had travelled outside their town during the previous 4 weeks, and 158 (49%) participants reported unlimited life-space even without any assistive devices or help from other persons. The life-space of 39 (12%) participants was restricted to the immediate neighbourhood level. The mean life-space composite score was higher in MZ than DZ twins (64.2 vs. 55.0, p=.001) and the difference persisted when adjusted for age (p=.005). Furthermore, DZ twins were older, more often reported difficulties in walking 2 km, and were less often active car drivers than MZ twins. (Table 1.)

The intra class correlation for the life-space composite score was 0.430 within MZ twin pairs and 0.168 within DZ twin pairs. The age-adjusted, quantitative genetic modelling revealed that additive genetic effects accounted for 43% (95% CI 21-61%) of the total variance in the LSA score, with the remaining variance due to non-genetic effects, 57% (95% CI 39-79%).

Genetic effects account for about two-fifths of individual differences in life-space mobility, while the remainder are accounted for by non-genetic effects. The observed genetic effects on life-space mobility may be explained by genetic effects on individual´s competence i.e. internal physiologic capacity, such as postural balance[9], walking speed and muscle strength[10]. The non-genetic effect on life-space mobility is likely to consist of the demands set for mobility by the living environment, and various lifestyle factors that have negative or positive influences on internal physiologic capacity. It is worth noting that genetic effects may also underlie the process of choosing one´s living environment. Although genetic effects account for a marked proportion of life-space mobility, their relative importance can be attenuated by increasing environmental variability in terms of the living environment or living habits. Increase in physical activity, enhancement of the built environment, and transportation options will likely increase older persons' life-space and engagement in society.

ACKNOWLWEDGMENTS

We are indebted to all the participants for their commitment to the study. The Gerontology Research Center is a joint effort between the University of Jyväskylä and the University of Tampere.

Conflict of interest: The authors have no financial or any other kind of personal conflicts with this paper.

Authors' contributions: Anne Viljanen: study concept and design, acquisition of data, analysis and interpretation of data, drafting the article, approval of manuscript. Tuija Mikkola, Merja Rantakokko and Markku Kauppinen: study concept and design, analysis and interpretation of data, critical revision of the article, approval of manuscript. Jaakko Kaprio and Taina Rantanen: study concept and design, acquisition of data, analysis and interpretation of data, critical revision of the article, approval of manuscript.

Sponsor´s role: The sponsors did not have any role in the design, methods, subject recruitment, data collection, analysis, or preparation of this manuscript.

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Table 1. Characteristics of the Participants by Zygosity

Characteristic	Monozygotic Twins n=119-162		Dizygotic Twins n=144-182		Wald test p	Variance ratio test p
Life-space composite score (range 0-120), mean ± SD	64.2	± 21.4	55.0	± 21.6	.001	.910
Age, mean ± SD	78.6	± 3.6	79.6	± 3.0	.034	.017
CES-D score (range 0-60), mean ± SD	13.8	± 8.0	14.4	± 7.5	.552	.441
Number of chronic diseases, mean ± SD	3.6	± 2.1	4.0	± 2.4	.268	.078
Living status, n (%)						
Alone in private accommodation	79	(50.3)	113	(62.4)	.107	
With someone in private accommodation	74	(47.1)	65	(35.9)		
In sheltered housing	4	(2.5)	3	(1.7)		
ADL difficulties, n (%)	14	(8.9)	11	(6.2)	.349	
IADL difficulties, n (%)	51	(32.1)	63	(35.0)	.598	
500 m walking difficulties, n (%)	23	(14.2)	32	(17.9)	.382	
2 km walking difficulties, n (%)	40	(25.2)	67	(37.6)	.024	
Active car driver, n (%)	45	(30.8)	29	(18.1)	.025	
Self-rated health, n (%)						
Good or very good	50	(31.6)	41	(22.7)	.268	
Intermediate	96	(60.8)	125	(69.1)		
Poor or very poor	12	(7.6)	15	(8.3)		
Memory, n (%)						
Good or very good	42	(26.6)	55	(30.4)	.764	
Intermediate	105	(66.5)	114	(63.0)		
Poor or very poor	11	(7.0)	12	(6.6)		
Vision, n (%)						
Good	72	(45.9)	81	(45.5)	.470	
Intermediate	81	(51.6)	88	(49.4)		
Poor	4	(2.5)	9	(5.1)		
Hearing, n (%)						
Good – no problems	60	(37.3)	92	(51.1)		
Slightly reduced	91	(56.5)	81	(45.0)		
Substantially reduced	10	(6.2)	7	(3.9)	.033	
Balance difficulties, n (%)						
Never	84	(54.9)	92	(52.0)		
Sometimes	55	(35.9)	66	(37.3)	.861	
Often or always	14	(9.2)	19	(10.7)		
Fear of falling, n (%)						
Never	45	(29.4)	49	(27.4)	.676	
Sometimes	87	(56.9)	99	(55.3)		
Often or always	21	(13.7)	31	(17.3)		

CES-D Center for Epidemiologic Studies Depression Scale
ADL Activities of daily living, IADL Instrumental activities of daily living
SD Standard deviation