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Author(s): Viljanen, Anne; Mikkola, Tuija; Rantakokko, Merja; Kauppinen, Markku; Kaprio, Jaakko; Rantanen, Taina

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Genetic Effects on Life-Space Mobility in Older Women

Anne Viljanen ^a, PhD, Tuija M. Mikkola ^a, PhD, Merja Rantakokko ^a, PhD, Markku Kauppinen ^a, MSc, Jaakko Kaprio ^{b,c,d}, PhD, MD, and Taina Rantanen, PhD ^a

^a Gerontology Research Center and Department of Health Sciences, University of Jyväskylä, Jyväskylä, Finland

^b Department of Public Health, Hjelt Institute, University of Helsinki, Helsinki Finland

^c Institute of Molecular Medicine, University of Helsinki, Helsinki, Finland

^d Department of Mental Health and Substance Abuse Services, National Institute for Health and Welfare, Helsinki, Finland

Corresponding author:

Anne Viljanen

Gerontology Research Center

P.O Box 35 (Viveca)

FIN – 40014 University of Jyväskylä

Phone: +358-40-8053603

Fax: -

E-mail: anne.viljanen@jyu.fi

Alternate corresponding author:

Tuija Mikkola

Gerontology Research Center

P.O Box 35 (Viveca)

FIN – 40014 University of Jyväskylä

Phone: +358-40-5025772

Fax: -

E-mail: tuija.m.mikkola@jyu.fi

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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 earlier⁷. 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 balance⁹, walking speed and muscle strength¹⁰. 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.

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Table 1. Characteristics of the Participants by Zygosity

| Characteristic | Monozygotic Twins | Dizygotic Twins | Wald test | Variance ratio test |
|---------------------------------------------------------|-------------------|-----------------|-----------|---------------------|
| | n=119-162 | n=144-182 | p | p |
| Life-space composite score (range 0-120), mean \pm SD | 64.2 \pm 21.4 | 55.0 \pm 21.6 | .001 | .910 |
| Age, mean \pm SD | 78.6 \pm 3.6 | 79.6 \pm 3.0 | .034 | .017 |
| CES-D score (range 0-60), mean \pm SD | 13.8 \pm 8.0 | 14.4 \pm 7.5 | .552 | .441 |
| Number of chronic diseases, mean \pm SD | 3.6 \pm 2.1 | 4.0 \pm 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