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Letter to the Editor

Comment on: A critical analysis of the internal logic in the Life-Space Assessment (LSA) composite score and suggested solutions

We read with interest the critical analysis of the LSA composite score by Siordia [1] and would like to comment on several issues related to study methodology and conclusions.

First, it seems that Siordia criticizes the internal logic of scoring the LSA because of a different view on the life-space concept. In the LSA, life-space mobility is viewed as a mobility behavior, which also includes transportation activities such as driving a car.[2,3] Other publications refer to life-space as areas where activities take place and generally exclude transportation.[4,5] Siordia mostly refers to walking as a means to move through life-space areas. This view may explain why Siordia refers to "jumping between zones" and "hypothetical movements" taking place instead of actual movements captured by the LSA. An example: When an individual uses a car to move to town or beyond, he or she may not perceive having moved in the neighborhood, as that was not the destination of the trip nor did any activities take place there besides driving through. Yet, this situation cannot be described as a "hypothetical movement" or "jumping between zones", as it was an actual movement of the individual, who left home and drove through the neighborhood to reach his or her destination in town or beyond. This is what the scale incorporates into the composite score.

Second, missing data is a huge and acknowledged problem in aging research. In studies of older people it is generally hard to include more frail persons and they tend to be the ones failing to respond to all questions.[6] Excluding them would inevitably lead to selection bias as data are missing not at random.[6] Imputation strategies for missing data are challenging and thus prevention strategies should be emphazised.[6,7] The LSA scoring algorithm uses such a prevention strategy by complimenting responses of participants based on legitimate assumptions. It is reasonable to assume that if a person reports having visited a place in town that the person has, on the way to that place, travelled through other more interior life-space levels (yard, neighborhood).

Third, we are critical about the methods used in the article by Siordia that were based entirely on a simulated dataset. As the article states, data were created in a "semi-random pattern". What does this mean? What were the assumptions underlying the creation of data? The article states that "Because regression results are based on artificial observations, risk factors for life-space should not be understood are presenting true risk profiles in the population aged 30 to 39." Furthermore, the author chose only to use dichotomous variables in the multivariate regression models. Unfortunately, the rationale for this choice was not provided. Real study participants base their responses in their own situation and these systematic patterns are what gerontologists aim to identify in data analyses.

Fourth, the author concludes that journal editors should request data-editing protocols and sensitivity analyses that explore "both data-edited and nondata-edited LSA composite scores." We conducted sensitivity analyses on the LISPE cohort data comprising of 848 75-90-year-old people living independently in Central Finland.[8] LSA scores were calculated based on the original data-edited formula (edited LSA), using the same formula without data-editing (non-edited LSA), and using the non-edited formula and, in addition, excluding "jumpers" (N=27), to ensure comparability of the different LSA measures. Table 1 shows how many scores were edited. Table 2 demonstrates that mean LSA scores and associations of LSA scores with our previously studied key variables [9-11] were not affected by data-editing or exclusion of participants. The intra-class correlation coefficients between the edited LSA and non-edited LSA variables were >0.99. Finally, 0-3% of the participants in the quintile of the lowest or highest edited LSA score were not present in the same quintile based on non-edited LSA variables. "Jumpers" had statistically significantly poorer physical (Short Physical Performance Battery) and cognitive (Mini-Mental State Examination) performance and a higher number of chronic diseases compared to other participants. These participants are not a random selection of participants and excluding them will lead to biased results.

Table 1. Number of participants with edited values for each LSA question (N=848).

	Has been at level	Frequency at level	Need for assistance at level	Overall
Life-space level 1 (Inside home)	0	7	0	7
Life-space level 2 (Outside home)	1	3	1	5
Life-space level 3 (Neighborhood)	15	22	0	37
Life-space level 5 (Town)	12	4	1	17
Life-space level 5 (Beyond town)	0	0	1	1
Overall	27	34	3	59

Table 2. Mean LSA composite scores when calculated using different methods and correlation coefficients with some key variables.

	Edited LSA (N=848)		Non-edited LSA (N=845)		Non-edited LSA excluding "jumpers" (N=818)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
LSA score	63.9	20.6	63.4	20.7	64.4	20.1
	R	**P**	**R**	**P**	**R**	**P**
Age	-0.381 *	<.001	-0.378 *	<.001	-0.379 *	<.001
Sex	-0.272 *	<.001	-0.261 *	<.001	-0.286 *	<.001
SPPB score	0.428 *	<.001	0.437 *	<.001	0.411 *	<.001
CES-D score	-0.283 *	<.001	-0.285 *	<.001	-0.279 *	<.001
WHOQOL-BREF score	0.464 *	<.001	0.460 *	<.001	0.447 *	<.001
Edited LSA score	-	-	0.997 [#]	<.001	0.995 [#]	<.001

SPPB = Short Physical Performance Battery

CES-D = Centre for Epidemiological studies Depression Scale

WHOQOL-BREF = World Health Organization Quality of Life abbreviated version

* Spearman correlation coefficient

[#] Intra Class Correlation coefficient

Finally, Siordia states that "technical documentation (on the scoring algorithm) is not made available in publication". The paper by Baker et al.,[2] in which the LSA composite score was first described, states that a scoring manual can be obtained from the authors. We were provided with the manual and other related information on the use of the LSA upon request. Additionally, the manual is available online at http://services.medicine.uab.edu/publicdocuments/physiology/exercise/Life-Space_-_forms_and_instructions_July_2008%5B1%5D.doc.

To conclude, the paper by Siordia presented theoretical problems (supported by artificial data), which we do not see represented in our data drawn from real older people. In samples of real people responses have meaning to participants. Irregularities or potential anomalies may occur in a small portion of people, but they are not likely to have major impact on research results in studies with large numbers of people. Each measure or scale has limitations. We have discussed some limitations of the LSA in a previous paper,[12] but in our opinion, the LSA is a helpful instrument to study mobility behavior in large-scale research projects in older people. Its use in clinical settings warrants further study. Therefore, based on our experience and the sensitivity analyses on our data, we feel that Siordia's main conclusions on notable limitations of the LSA composite score and the need for cautious interpretation of previously published results are not just.

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