When is GALI better than ADL and IADL? Measures of disability of older people and their differences in assessing health care needs

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Abstract

Objectives: To evaluate the characteristics of four different measures of disability of older people and their differences when assessing health care needs (in particular: Healthy Life Years). **Methods:** We use bivariate tests and multinomial logistic methods to assess the key differences in the usage of different disability measures, including the effects over different welfare regimes. **Results:** GALI and Functional Limitation measures are significantly more related to the health care needs than ADL and IADL. Furthermore, physical health (chronic diseases, long-term illness) has the largest effect among the measures of health, while for mental health such effects are least visible. **Conclusions:** In future assesments of health care needs and Healthy Life Years' projections it is strongly advised to use GALI and/or Functional Limitations instead of ADL or IADL measures. Usage of the latter can lead to distorted projections.

1. Introduction

Life expectancy in European countries is still increasing, in the largest part due to the lowering of old-age death rates. Thereby, the key question is whether we spend the additional years of our lives in good or poor health or we are limited in performing various activities. Monitoring is important not only from the perspective of planning in health and long-term care, but also due to economic and social reasons: an increase in the employment of elderly (50 - 65 years), their larger involvement with the society and an increase in the retirement age,

are possible only in the case of a better health and higher independence of older citizens (Robine et al., 2014).

HLY (Healthy Life Years) is an indicator, which measures the remaining years, for which a person of certain age can expect, that they will spend without larger or moderate health issues. In the EU, it is recognized as the main structural indicator for monitoring health status of health[1], and, in the recent years, it is more and more commonly in use also as one of the key outcome indicators for the evaluation of the quality and efficiency of health and long-term care systems[2]. The basis for the calculation of the HLY indicator is a combination of data on mortality and morbidity. The source of the data on morbidity is an indicator on limitations in carrying out activities of daily living, calculated based on the so-called GALI question (Global Activity Limitation Indicator), which is included in the life conditions survey (EU-SILC). The HLY indicator at the age of 65 years is also used to evaluate the needs for long-term care. The answers to the GALI question from the EU-SILC survey are, in the scope of the European Commission (hereinafter EC), also directly used for the evaluation of the share of dependent population, which receives long-term care and the projections of formal (publicly financed) long-term care (European Commission, 2015a). In the last ten years, since the HLY indicator is being monitored, a lot of effort has been put into the harmonization of data, used to calculate HLY. The EU-SILC survey, coordinated by Eurostat, based on the GALI questions, ensures the information regarding limitation in carrying out of activities of daily living, for all EU countries. The GALI questions are a part of a family of indicators of limitation due to health issues. So, the GALI question is also included in the EHIS[3] and SHARE surveys, which, along with GALI question additionally include questions, relating to other internationally harmonised measures of limitation in carrying out of activities of daily living – ADL[4], IADL[5] and functional limitations).

Although there is not much evidence on the relationship between the four measures of disability, some recent studies tried to validate the GALI indicator. Van Oyen et al. (2006) show that GALI performs appropriately against other health indicators and appears to reflect long-standing activity limitation associated with both mental and physical conditions. Jagger

[1] Eurostat. http://ec.europa.eu/eurostat/web/health/health-status-determinants
[2] See e.g.: (a) European Commission. (2015 a; b; c); OECD (2014).
[3] European Health Interview Survey 2007.
[4] (Basic) Activites of Daily Living - ADL include bathing, dressing, eating, laying down into bed, standing up from it, movement and use of tiolet. It is often a matter of personal care (Colombo et al., 2011: 11).
[5] Instrumental Activities of Daily Living - IADL are mainly food preparation, laundry, transportation and cleaning.

et al. (2010) show that GALI shows good agreement with other subjective and objective measures of function across 11 European countries. They concur that "GALI appears to be a useful addition to European surveys, where time constraints make a longer set of ADLs or IADLs impossible and it provides a firm basis for the HLY indicator" (Jagger et al., 2010: 898). Berger et al. (2015) found that GALI is significantly associated with both measures of activities of daily living, instrumental activity of daily living, and functional limitations when considering each country separately or all combined; and associations are largest for activity of daily living and lowest though still high for functional limitations. Overall, however, GALI differs significantly between countries in how it reflects each of the three disability measures. (Berger et al., 2015: 1).

In our article we explore the relationship between the four measures of disability for the older people, using data from the Wave 5 of SHARE[6] survey. We relate the measures of disability to different measures of health condition – physical, mental and self-assessed health. Our main hypothesis is that "GALI is a significantly better measure when estimating HLY, than either of the ADL or IADL measures". In this manner, this is a strong validation of the usage of GALI for assessing the health condition of older Europeans, giving it strong priority over other measures of disability.

Our article is structured in the following manner. In the second section, we present our methods. In the third section we present results of the estimation. And in the final, fourth section we discuss the findings and explore their public health implications.

2. Methods

To verify the main hypothesis we use bivariate chi square tests of the relationship between two variables and multinomial logit econometric models. We use dataset derived from Wave 5 of the SHARE survey. The Survey of Health, Ageing and Retirement in Europe (SHARE) is a multidisciplinary and cross-national panel database of micro data on health, socio-economic status and social and family networks of approximately 123,000 individuals (more than

[6] This paper uses data from SHARE Wave 5 (DOI: 10.6103/SHARE.w5.100), see Börsch-Supan et al. (2013) for methodological details. The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N°211909, SHARE-LEAP: N°227822, SHARE M4: N°261982). Additional funding from the German Ministry of Education and Research, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064) and from various national funding sources is gratefully acknowledged (see www.share-project.org). For more details, see also Börsch-Supan (2015), Börsch-Supan et al. (2015) and Malter and Börsch-Supan (2015).

293,000 interviews) from 20 European countries (+Israel) aged 50 or older. SHARE is centrally coordinated by the Munich Center for the Economics of Aging (MEA), Max Planck Institute for Social Law and Social Policy. It is harmonized with the U.S. Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA) and has become a role model for several ageing surveys worldwide.

In our analysis we use the following variables:

Dependent/main variables

- *ADL*: limitations of activity of daily living, including the following: Dressing, including putting on shoes and socks; Walking across a room; Bathing or showering; Eating, such as cutting up your food; Getting in or out of bed; Using the toilet, including getting up or down; our variable is a binary variable, indicating the presence or (complete) absence of ADL limitations;
- *IADL*: limitations of instrumental activity of daily living, including the following: Using a map to figure out how to get around in a strange place; Preparing a hot meal; Shopping for groceries; Making telephone calls; Taking medications; Doing work around the house or garden; Managing money, such as paying bills and keeping track of expenses; our variable is a binary variable, indicating the presence or (complete) absence of IADL limitations;
- *GALI*: Global Activity Limitation Indicator; our variable is a binary variable, indicating presence or (complete) absence of limitations;
- *FUNC*: functional limitations, including the following: Walking 100 metres; Sitting for about two hours; Getting up from a chair after sitting for long periods; Climbing several flights of stairs without resting; Climbing one flight of stairs without resting; Stooping, kneeling, or crouching; Reaching or extending your arms above shoulder level; Pulling or pushing large objects like a living room chair; Lifting or carrying weights over 10 pounds/5 kilos, like a heavy bag of groceries; Picking up a small coin from a table; our variable is a binary variable, indicating the presence or (complete) absence of functional limitations;
- *ADL/IADL*: a binary variable, indicating the presence of either ADL and/or IADL limitations (value 1) or absence of both types of limitations (value 0);
- *GALI/FUNC*: a binary variable, indicating the presence of either GALI and/or functional limitations (value 1) or absence of both types of limitations (value 0);

- *Difference*: a categorical variable, having the value of »1« for those respondents having GALI/FUNC variable equal to 1 and ADL/IADL variable equal to 0; »-1« for those respondents having GALI/FUNC variable equal to 0 and ADL/IADL variable equal to 1; and »0« for having both variables of equal values (either 1 or 0).

Main independent variables

- *I_ChronDis*: a binary variable, indicating that respondent has 2 or more chronic diseases[7] (value 1) or less than 2 diseases (value 0);
- *I_SelfRatHealth*: a binary variable, indicating that respondent indicates he/she has less than very good health (value 1) or very good or excellent health (value 0);
- *I_Depression*: a binary variable, indicating that respondent has a score of 4 or more on EURO-Depression scale[8] (value 1) or a score of less than 4 (value 0);
- *I_NrMedic*: a continuous variable, indicating number of medications[9] the respondent is taking currently at least once a week;
- *I_LongTermIll*: a binary variable, indicating whether respondent suffers from chronic or long-term health problems (those that have troubled the respondent over a period of time or is likely to affect him/her over a period of time).

Control variables:

- *I_Gender*: gender, binary variable (1 – female; 0 – male);
- *I_Age6579*: age of respondent, binary variable (1 – 65-79 years of age; 0 – otherwise);
- *I_Age80plus*: age of respondent, binary variable (1 – 80 or more years of age; 0 – otherwise);
- *I_EduSecond*: years of education, binary variable (1 – secondary education; 0 – otherwise);
- *I_EduTert*: years of education, binary variable (1 – tertiary education or more; 0 – otherwise);

[7] Chronic diseases include the following: A heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure; High blood pressure or hypertension; High blood cholesterol; A stroke or cerebral vascular disease; Diabetes or high blood sugar; Chronic lung disease such as chronic bronchitis or emphysema; Cancer or malignant tumour, including leukaemia or lymphoma, but excluding minor skin cancers; Stomach or duodenal ulcer, peptic ulcer; Parkinson disease; Cataracts; Hip fracture; Other fractures; Alzheimer's disease, dementia, organic brain syndrome, senility or any other serious memory impairment; Other affective or emotional disorders, including anxiety, nervous or psychiatric problems; Rheumatoid Arthritis; Osteoarthritis, or other rheumatism; Other conditions, not yet mentioned.

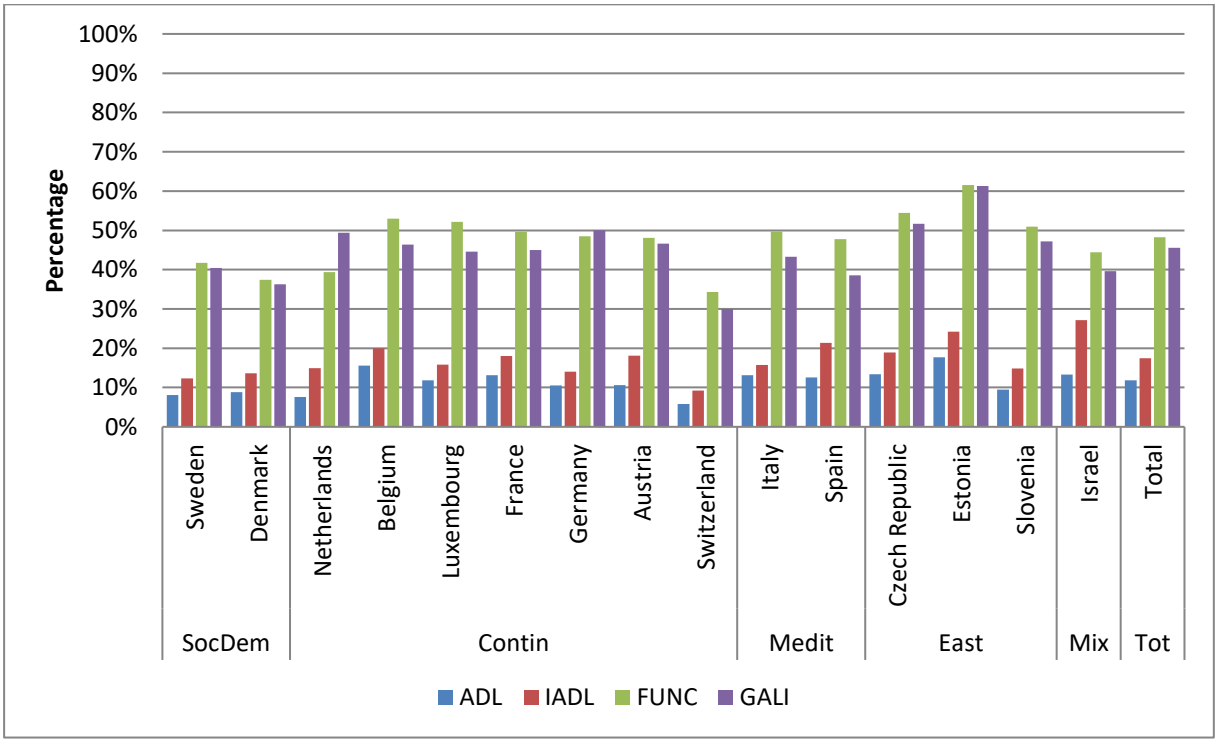
[8] Measurement of the mental condition on EURO-Depression (EURO-D) scale is realized by covering questions that indicate 12 items: the presence of, respectively, depression, pessimism, suicidality, guilt, sleep, interest, irritability, appetite, fatigue, concentration, enjoyment and tearfulness (see Prince et al., 1999). The scale runs from 0-12; with the number of depressive symptoms denoting the score.

[9] Medications include: Drugs for high blood cholesterol; Drugs for high blood pressure; Drugs for coronary or cerebrovascular diseases; Drugs for other heart diseases; Drugs for diabetes; Drugs for joint pain or for joint inflammation; Drugs for other pain (e.g. headache, back pain, etc.); Drugs for sleep problems; Drugs for anxiety or depression; Drugs for osteoporosis; Drugs for stomach burns; Drugs for chronic bronchitis; Drugs for suppressing inflammation (only glucocorticoids or steroids); Other drugs, not yet mentioned.

- *I_IncomeMid*: total household equivalent net income, using SHARE generated variable thhinc2, binary variable (1 – middle tertile, country specific; 0 – otherwise);
- *I_IncomeHigh*: total household equivalent net income, using SHARE generated variable thhinc2, binary variable (1 – upper tertile, country specific; 0 – otherwise);
- *I_Settlement*: place of living, binary variable (1 – urban, 0 – rural);
- Welfare regimes: *I_WelfSocDem* – social democratic (Sweden, Denmark); *I_WelfContin* – continental (Austria, Germany, Netherlands, France, Switzerland, Belgium, Luxembourg); *I_WelfMedit* – Mediterranean (Spain, Italy); *I_WelfEast* – Eastern European (comparison group: Czech Republic, Slovenia, Estonia); *I_WelfMixed* – mixed (Israel).

In Figure 1 we show the distribution of the limitation measures. It is clear from the figure that both ADL and IADL have smaller shares than GALI and FUNC measures, with most countries following a similar distribution. In most countries, there is slightly higher share of IADL than ADL limitations, as well as a higher share of FUNC than GALI limitations (with the apparent exceptions of Netherlands and Germany).

Figure 1: Distribution of measures of disability across the SHARE countries



Note: Abbreviations for welfare regimes: SocDem – socialdemocratic; Contin – continental; Medit – Mediterranean; East – Eastern European; Mix – Mixed; Tot – pooled sample.

Source: Own calculations.

3. Results

In Table 1 we present results of basic chi square tests of the relationship between the selected health variable and limitation measure. It is clear that for all five included health variables there is a strong relationship to the ADL/IADL as well as GALI/FUNC variable. The relationship appears strongest for the number of taken medications and presence of a long-term chronic disease. It appears weakest for the self-rated health (ADL/IADL) and, in particular, depression (GALI/FUNC).

What can be observed as well is that Cramer's V statistic significantly differs between relationships of individual health variables to the ADL/IADL vs. GALI/FUNC measure. For four of the health variables (excluding only depression), relationship to the GALI/FUNC measure is by far stronger than to the ADL/IADL measure.

Table 1: Results of bivariate tests

		ADL/IADL		FUNC/GALI	
		% (n)	**Chi Sq** ***Cramer's V***	**% (n)**	**Chi Sq** ***Cramer's V***
Nr. of chron. dis.	**Less than 2**	9.8 (3237)	4900.0***	40.9 (13502)	9800.0***
	2 or more	32.3 (9964)	*0.2775*	79.4 (24495)	*0.3914*
Self-rated health	**V.good/Excell.**	4.1 (669)	3700.0***	24.7 (4043)	1100.0***
	L. th. v.good	26.4 (12534)	*0.2402*	71.4 (33969)	*0.4153*
Depression - EURO-D	**Less than 4**	12.4 (5656)	5700.0***	50.4 (23068)	5100.0***
	4 or more	39.7 (6448)	*0.3037*	82.6 (13404)	*0.2876*
Nr. of taken medications	**Zero**	5.5 (866)	7500.0***	28.7 (4488)	12000.0***
	One or two	15.8 (4767)	*0.3416*	58.5 (17640)	*0.4332*
	Three +	41.6 (7533)		87.4 (15834)	
Long term chron. dis.	**No**	7.5 (2350)	6600.0***	34.0 (10690)	17000.0***
	Yes	33.4 (10862)	*0.3204*	84.1 (27334)	*0.5096*

Note: Significance: *** - 1%; ** - 5%; * - 10%.

Source: Own calculations.

In Table 2, we present results of multinomial logistic regression modelling, where the reference category is »0«, i.e. no difference between ADL/IADL and GALI/FUNC. We present results for five different models, where in each we include only one health covariate.

Results clearly reveal the underlying dynamics. For each of the five included health variables, greater problems with health are associated with significantly higher probability of being selected in the category »1« (respondent has only GALI/FUNC limitations) and significantly lower probability of being selected in the category »-1« (respondent has only ADL/IADL limitations). This clearly shows that, on the one hand, categories of the variables *Difference* are strongly related to health condition, and, on the other, that worse health condition is significantly more probable in the category »1« and less probable in category »-1«. This strongly confirms our initial hypothesis, goes in line with the observations from Table 1 and shows that GALI measure, being similar to functional limitations, is significantly more strongly related to the health condition of the respondent than either ADL or IADL measures.

Table 2: Results of regression modellings, multinomial logit, reference category: no difference between ADL/IADL and GALI/FUNC.

	Difference **(reference category: no difference between ADL/IADL and GALI/FUNC)**					
	Only ADL/IADL			**Only GALI/FUNC**		
	Coef.	**Z**	**Sig**	**Coef.**	**Z**	**Sig**
I_ChronicDis	-0.4672	-4.5	***	0.6570	37.4	***
I_SelfRatHealth	-0.3182	-3.0	***	1.1577	50.4	***
I_Depression	-0.3062	-2.5	**	0.1559	7.9	***
I_NrMedic	-0.2336	-6.3	***	0.1301	24.7	***
I_LongTermIll	-0.5088	-4.9	***	1.0138	57.4	***
Observations	60889					
LR chi2(24)	3921.9	***				
Log likelihood	-41401.5					
Pseudo R2	0.0452					

Note: Controlled for Gender; Age Categories; Education; Income Tertiles; Settlement; and Welfare Regimes. Significance: *** - 1%; ** - 5%; * - 10%.

Source: Own calculations.

All models have been tested to independence of other alternatives (IIA) assumption, using Hausman and Small-Hsiao tests, and for combining/collapsing alternatives, using Wald and LR tests, and satisfied all the required assumptions.

4. Discussion

The results of the article demonstrate several important findings. Firstly, although thereferenced literature points to strong correlation between ADL/IADL and GALI measures of disability (see e.g. Berger, 2015), the relationship was found much weaker in our study. The correlations between the measures are surely positive and strong (for details see e.g. Zver and Srakar, 2015), but when observed in relationship to health measures significantly differ.

It was clearly demonstrated that for observed health measures, the relationship of GALI and/or functional limitations to those variables is significantly higher than the relationship of ADL and/or IADL. We also noted that the relationship is strongest for the physical health and weakest for mental health/depression. This shows an important consideration, namely that the HLY indicator, which is based on limitations according to GALI (severely and 'limited, but not severely') is a *suitable measurement for general health issues, but might not be the best to evaluate the need for long-term care*. For the latter, it might be better to use ADL and IADL limitations.

Our article, therefore, serves both as a validation of GALI indicator as well as an indication that, at least for the older people, it is strongly recommended not to use ADL and/or IADL limitations in the health projections (if not done so, the results might be seriously distorted or at least provide only a second-best solution). By this, it provides important information to policy makers on the pan-European and national level and serves as a strong recommendation in future projections. It also provides new ground for research in the relationship between different measures of disability, at least for the older people. It would be important to validate and explore the findings of the article for the general population as well, although, as noted, there are some contradictory observations on this level (e.g. Becker et al., 2015). For future research, it would be important to explain the disparity in the findings, which was perhaps not done in a most thorough manner in our article.

5. Public Health Implications

As stated before, HLY is an indicator, which measures the remaining years, for which a person of certain age can expect, that they will spend without larger or moderate health issues. The basis for the calculation of the HLY indicator is a combination of data on mortality and morbidity and the source of the data on morbidity is an indicator on limitations in carrying out activities of daily living, calculated based on the so-called GALI question (Global Activity Limitation Indicator). The HLY indicator at the age of 65 years is also used to evaluate the needs for long-term care and the answers to the GALI question from the EU-SILC survey are, in the scope of the European Commission, also directly used for the evaluation of the share of dependent population, which receives long-term care and the projections of formal publicly financed long-term care.

In the last ten years, since the HLY indicator is being monitored, a lot of effort has been put into the harmonization of data, used to calculate HLY. As our analysis shows (and this has significant implications for the policy measures in this area), the GALI indicator is the best one when accessing health care measures and ADL/IADL probably the preferred ones when accessing long-term care. The indicator framework currently used by the European Commission to assess health care need and HLY is, therefore, justified and correct which bring significant information for future calculations in this area and for the knowledge and policy of public health in general. We expect future research in different geographical and social contexts to be able to verify and make robust our findings.

References

Berger, N., Van Oyen, H., Cambois, E., Fouweather, T., Jagger, C., Nusselder, W., Robine, H.M. (2015). Assessing the validity of the Global Activity Limitation Indicator in fourteen European Countries. *MBC Medical Research Methodology* 2015, 15: 1.

Börsch-Supan, A. (2015). *Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 5. Release version: 1.0.0*. SHARE-ERIC. Data set. DOI: 10.6103/SHARE.w5.100

Börsch-Supan, A., Brandt, M., Hunkler, C., Kneip, T., Korbmacher, J., Malter, F., Schaan, B., Stuck, S., Zuber, S. (2013). Data Resource Profile: The Survey of Health, Ageing and Retirement in Europe (SHARE). *International Journal of Epidemiology* 2013;42(4):992-1001, DOI: 10.1093/ije/dyt088.

Börsch-Supan, A., T. Kneip, H. Litwin, M. Myck, G. Weber (Eds.) (2015). *Ageing in Europe - Supporting Policies for an Inclusive Society*. Berlin: De Gruyter.

Colombo, F., Llena-Nozal, A., Mercier, J., Tjadens, F. (2011). *Help Wanted? Providing and Paying for Long − Term Care*. OECD Health Policy Studies, OECD Publishing.

European Commission (2015a): *The 2015 Ageing Report: Economic and budgetary projections for the 28 EU Member States (2013−2060)*. Brussels: European Commission.

European Commission (2015b): *Age-related fiscal sustainability challenges: A horizontal assessment framework for pension, health care, long-term care policies for the 2015 European semester. Note to the Economic Policy Committee*. April 2015. Brussels ECFIN/C2. Brussels: European Commission.

European Commission (2015c): *Efficiency estimates of health care systems in the EU. Note to the Economic Policy Committee*. April 2015. ECFIN. Brussels: European Commission.

Jagger, C., Gillies, C., Cambois, E., Van Oyen, H., Nusselder, W., Robine, J.M. (2010). The Global Activity Limitation Index measured function and disability similarly across European countries. *J Clin Epidemiol*. 2010; 63: 892–9.

Malter, F, Börsch-Supan, A. (Eds.) (2015). *SHARE Wave 5: Innovations & Methodology*. Munich: MEA, Max Planck Institute for Social Law and Social Policy.

OECD (2014): *Health at a glance: Europe 2014*. Paris: OECD.

Prince, M.J., Reischies, F., Beekman, A.T., Fuhrer, R., Jonker, C., Kivela, S.L., Lawlor, B.A., Lobo, A., Magnusson, H., Fichter, M., van Oyen, H., Roelands, M., Skoog, I., Turrina, C., Copeland, J.R. (1999). Development of the EURO-D scale--a European, Union initiative to compare symptoms of depression in 14 European centres. *The Brit J of Psyc.* 1999; 174: 330-338

Robine, J.M., Cambois, E. (2013). Healthy Life expectancy in Europe. *Population & Societies* No. 499, april 2013: 1-4.

Van Oyen, H., Van der Heyden, J., Perenboom, R., Jagger, C. (2006). Monitoring population disability: evaluation of a new Global Activity Limitation Indicator (GALI). *Soz Praventivmed*. 2006; 51(3): 153-61.

Zver, E., Srakar, A. (2015). Mere oviranosti kot podlaga za ocenjevanje zdravih let življenja in potreb po dolgotrajni oskrbi. In Majcen, B. (ed.). *Značilnosti starejšega prebivalstva v Sloveniji - prvi rezultati raziskave SHARE*. Ljubljana: Inštitut za ekonomska raziskovanja: = Institute for Economic Research, 2015, pp. 150-163.