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Disparities in Multimorbidity across Europe – Findings from the SHARE Survey

Camilla Riis Nielsen^a, Anders Halling^{b*}, Karen Andersen-Ranberg^a

^a The Danish Aging Research Center, Epidemiology, Biostatistics and Biodemography, Department of Public Health, University of Southern Denmark, J.B. Winsloews Vej 9B, 5000, Odense C, Denmark.

^b Research Unit of General Practice, Department of Public Health, University of Southern Denmark, J.B. Winsloews Vej 9A, 5000, Odense C, Denmark.

Corresponding Author: Camilla Riis Nielsen. Phone: +45 65504658. Email: crnielsen@health.sdu.dk

Abstract

Introduction: Europe is the continent with the highest share of older adults, many of which suffer from multiple chronic conditions (multimorbidity) and the associated negative outcomes. Health inequalities across European regions exist, but little is known about regional differences in multimorbidity.

Material and Methods: Cross-sectional analyses of data collected in the 5th wave of the Survey of Health, Ageing and Retirement in Europe (SHARE) during 2013. The study population included 50+ year olds from 14 European countries and Israel.

Results: Across all regions age and gender adjusted multimorbidity prevalence was 31.4 % [30.7;32.2]. Northern Europe had the lowest multimorbidity prevalence of 26.2 % [25.2;27.1], while Eastern and Central Europe had the highest, 35.2 % [33.8;36.5] and 34.8 % [33.8;35.9], respectively. In all regions female gender, increasing age, lower education, and lower household income were independently and significantly associated with higher odds of multimorbidity. Interestingly, 70-79 year old Central and Eastern Europeans suffered from about the same level of multimorbidity as 80+-year old northern Europeans. A similar pattern was seen for high education versus low education in Central and Eastern Europe compared to Northern Europe.

Conclusion: Multimorbidity is highly prevalent among older Europeans, but more so among Europeans in the Eastern and Central regions. Societal initiatives to improve health care for older adults are warranted in order to decrease old age health inequalities between European regions, where Central and Eastern European regions seem to suffer more from the burden of multimorbidity.

Keywords: *Multimorbidity, Chronic Disease, Health inequality, Aging, Europe.*

* Current Affiliation: Center for Primary Health Care Research, Department of Clinical Sciences, Malmö, Lund University, Sweden

1. Introduction

Population ageing is happening all over the developed world [1, 2], in particular in Europe, which today is the oldest-old continent [2]. Ageing is associated with an increased risk of developing diseases [3], leading to loss of functions and risk of subsequent disability [4]. Furthermore, with advancing age the number of concomitant chronic diseases and conditions increases. The co-existence of two or more chronic conditions is defined as multimorbidity [5]. Whereas *multimorbidity* describes the totality of chronic conditions, another similar term, *comorbidity*, is concerned with conditions that co-occur with a specific primary or index disease [6].

Determinants of multimorbidity have repeatedly been shown to consist of age, female gender, low socio-economic status, and lower educational level (reviewed in [5]). Moreover, multimorbidity has been associated with decreases in quality of life, self-rated health [7] and functional ability [8, 9], as well as increases in hospitalization, physiological distress, mortality, use of health care resources, and costs [7, 8, 10, 11]. With population ageing multimorbidity is gradually being recognized as a challenge for health care systems [12, 13].

While a number of European studies have assessed the burden of multimorbidity at national level [14-18], only two cross-national comparative studies [19, 20], both based on the Survey of Health, Ageing, and Retirement in Europe (SHARE) has been identified. In both studies Switzerland and the Netherlands had the lowest prevalence, while Hungary, Estonia, Poland, and Portugal had the highest, but there was no special attention put to regional differences. The lack of cross-national comparative studies is most likely explained by the lack of standardization of definition and assessment of multimorbidity, as well as differences in study populations [5, 21].

In 2013, a thorough report from the European Commission [22] showed that health inequalities exist within Europe with Eastern European countries suffering from shorter life expectancy at birth than the other European regions. Also alarming is that while all European countries experienced improvements in life expectancy at age 65 from 2002-2004 to 2007-2009 the increase was lowest in most of the eastern countries of Europe [22], suggesting that there are only small improvements in health care in Eastern Europe compared to the rest of Europe. In other words, there is an inequality in health between the European regions with Eastern Europe being less healthy.

This paper aims at describing whether inequality in health across the European regions can be associated with differences in multimorbidity burden.

2. Material and Methods

2.1. Study Population

We used cross-sectional data from the 5th wave [23] of the *Survey of Health, Ageing and Retirement in Europe* (SHARE). SHARE is a cross-national panel survey collecting data concerning health, economy and social networks of 50+ year olds living in Europe (+ Israel) [24]. The 5th wave of SHARE was conducted in 2012-2013 in 15 countries (i.e. Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Switzerland, Belgium, Czech Republic, Luxembourg, Slovenia, Estonia and Israel). Hungary, Poland, and Portugal did not participate in wave 5 [25].

2.2. Data Collection and Variables

Data were collected through computer assisted face-to-face interviews (CAPI) using an ex-ante harmonized generic questionnaire that was translated to the respective national languages of the participating countries. SHARE organizes central ‘hands on’ training of representatives of all the national survey agencies. The outline of the central training was repeated in the national SHARE training of survey agency interviewers before the field study [26]. Proxy information was allowed [25].

Chronic Conditions: Information on diseases and chronic conditions was obtained through self-report. Participants were handed a show card with a numbered list of specific chronic conditions listed and asked: *“Has a doctor ever told you that you had/Do you currently have any of the conditions on this card? With this we mean that a doctor has told you that you have this condition, and that you are either being treated for or bothered by this condition”* [27]. The participant mentioned the relevant disease(s) by their number. The card had 16 conditions and diseases listed, but we chose to only include the 12 most disabling diseases in the analysis: (1) high blood pressure or hypertension (‘hypertension’), (2) diabetes or high blood sugar (‘diabetes’), (3) osteoarthritis, (4) rheumatoid arthritis, (5) heart attack, including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure (‘heart disease’), (6) stroke, (7) cancer or malignant tumour, including leukaemia or lymphoma, but excluding minor skin cancers (‘cancer’), (8) chronic lung disease, (9) hip fracture or

femoral fracture ('hip fracture'), (10) Parkinson's disease, (11) Alzheimer's disease, dementia or senility ('dementia'), (12) affective or emotional disorders). The following 4 conditions were not included: high blood cholesterol, stomach or duodenal ulcer/peptic ulcer, cataracts, and 'other fractures'.

Multimorbidity: Multimorbidity was defined as the coexistence of two or more chronic conditions [5].

Educational Level: Education was determined by the question: "What is the highest school leaving certificate or school degree that you have obtained?" [27]. SHARE uses the 1997 International Standard Classification of Education (ISCED - 97) to standardize educational level across Europe [25] ISCED-97 is a 7-point scale ranging from 0 = Pre-primary education to 6 = Second stage of tertiary education (leading to an advanced research qualification) [28]. For the purpose of easing the interpretation of the analysis, the variable was re-categorized into three levels: 0 = low educational level (encompassing ISCED-97 codes 0, 1 and 2), 1 = medium educational level (encompassing ISCED-97 codes 3 and 4) and 2 = high educational level (encompassing the ISCED-97 codes 5 and 6).

Household Income: Household income was determined through the question: "How much was the overall income, after taxes and contributions, that your entire household had in an average month in year 2012?" [27] The range of income reported by all individuals was divided into tertiles (low, medium and high).

European Regions: The 15 countries were divided into four regions: Northern Europe (Denmark, Sweden, the Netherlands), Southern Europe (Italy, Spain, France, Israel), Central Europe (Austria, Belgium, Germany, Switzerland, Luxembourg) and Eastern Europe (Czech Republic, Slovenia, Estonia).

2.3. Statistical Analysis

Data was analysed using STATA version 14.0.

Crude as well as age and gender adjusted prevalence of chronic conditions and multimorbidity (including multimorbidity prevalences across sociodemographic factors) were analysed for the total study population and across regions and reported with 95 % Confidence Intervals. Significance of differences in multimorbidity proportions across the socio-demographic variables was assessed by chi-square test (χ^2). For variables with more than two levels (age groups, educational level and household

income) a chi-square test for trend was conducted. A p -value < 0.05 was determined as the significance level.

Association of socio-demographic factors with multimorbidity was assessed through firstly a univariate logistic regression and then through a multivariate logistic regression in order to assess the independent association. Odds Ratios (OR) was reported for the regression analysis.

Calibrated individual weights, provided in the SHARE dataset, were applied to the analyses as a means to reduce the impact of potential selectivity bias that might be present in the data due to unit non-response and panel attrition [25].

3. Results

3.1. Study Sample

A total of 63,842 individuals (55.4 % females) aged 50+ were included in the analysis. More than 75 % of the participants had a low or medium level of education. The largest share of participants ($n = 19,598$ (30.7 %)) came from Central European countries while the smallest share was from the Northern European countries ($n = 12,585$ (19.7 %)) (table 1).

3.2. Diseases and Chronic Conditions

In the total study population, age and gender adjusted self-reported hypertension (37.1% [36.3;37.8]) emerged as the most prevalent condition, followed by osteoarthritis (19.6% [19.0;20.3]), diabetes (12.4% [12.0;13.0]) and heart attack (11.0% [10.6;11.5]). At the regional level hypertension was lowest in Northern Europe 31.9 % [30.9;33.0], and highest in Eastern Europe 47.2 % [45.7; 48.6]. For details, see table A.1 in Appendix.

3.3. Multimorbidity

The overall age and gender adjusted prevalence of multimorbidity was 31.4 % [30.7 – 32.2] (table 2). At the regional level, multimorbidity was lowest in Northern Europe (26.2 % [25.2 – 27.1]), and slightly

higher in Southern Europe (29.8 % [28.7 – 30.9]), while it was equally high in Central and Eastern Europe (34.8 % [33.8 – 35.9] and 35.2 % [33.8 – 36.5] respectively) (table 2 and figure 1).

In each region, multimorbidity became significantly more prevalent with advancing age groups, female gender, lower education, and lower household income (table 2). Test statistics also showed that where there were overlapping confidence intervals trends were significant ($p < 0.05$ in all). Of interest is that multimorbidity in 80+ year olds Northern Europeans was below the prevalence of Eastern and Central Europeans aged 70-79 years (43.7 % [40.7 – 46.9] vs. 48.1 % [45.3 – 50.9] and 45.0 % [42.7 – 47.4] respectively). The same pattern is seen for educational level, and for household income, although the effect weakened a little.

In univariate analysis increasing age, female gender, lower education and lower household income were associated with increased odds of multimorbidity in each of the 4 regions (see table A.2 in Appendix). When adjusting for each of the other socio-demographic factors in multivariate analyses, these associations remained significant with the exception of gender in Central and Eastern Europe. Overall, the multivariate analysis showed that increasing age had the strongest association with multimorbidity (table 3), but with regional differences.

4. Discussion

This is the first comparative study on multimorbidity in Europe based on SHARE wave 5 data and addressing regional differences. Multimorbidity was lowest in Northern Europe and highest in Central and Eastern Europe. Increasing age was the most important determinant of multimorbidity, but with distinct differences between regions, as 70-79 year old Central and Eastern Europeans had a significantly higher prevalence of multimorbidity compared to 80+-year old Northern Europeans. A similar pattern was seen for high education.

It is a major strength that the data are based on an ex-ante harmonized survey questionnaire, central training of national survey agencies, and face-to-face interviews, as well as a large sample size covering almost 64,000 50+-year old participants in 15 countries. With the exception of Luxembourg, all countries had participated in earlier waves of SHARE. However, there are several limitations. SHARE provides only

self-reported data with the risk of selection, recall and desirability bias. A selection bias is probable as unhealthy and socio-economic disadvantaged eligible persons are likely underrepresented in the data set [29]. This leads to an underestimation of multimorbidity prevalence [21]. Recall bias also lowers the self-reporting of diseases again leading to underestimation of multimorbidity prevalence. This is supported by multimorbidity studies based on medical records in general practice, which showed higher prevalence compared to self-report of the patients [30]. The low prevalence for affective or memory disorders may result from desirability bias.

SHARE collects objective data on depressive symptoms and cognition. These data could have been added to the data set thereby contributing to higher prevalences of affective or emotional disorders, and to dementia disorders. But we chose to only use the self-reported information to be in line with most other studies on multimorbidity.

Many of our findings are unsurprisingly similar to the works of Köberlein and Jürges [19] and Palladino et al. [20] which also used SHARE data. However, in contrast to our overall multimorbidity prevalence of 31.4 %, Köberlein and Jürges reported a much higher one (44.3 %). This may be explained by their use of a pooled dataset from SHARE waves 1, 2 and 4, and their inclusion of 14 self-reported diseases and chronic conditions as a basis for the multimorbidity variable in contrast to our 12. Palladino et al. used a list of 15 conditions in SHARE wave 4 and found a prevalence of multimorbidity of 37.3 %. Again, the larger list (15 vs. our 12) may explain the higher multimorbidity prevalence reported in wave 4.

We deliberately chose to exclude 4 diseases/conditions. Hypercholesterolemia, because it is reported due to the fact that a person is treated with cholesterol lowering medicine due to a different condition than hypercholesterolemia. Peptic ulcer and gastritis because many people are treated with proton inhibitors just for the symptoms, but without any proper diagnosis. Catarract was excluded as it could have been treated with an operation, and thus no longer being a disease. Lastly 'other fractures' were excluded as it could include minor injuries with no real impact on the health of the individual.

At the regional level, the Central and Eastern Region had almost similar multimorbidity prevalence, but was significantly higher compared to Southern and Northern Europe (table 2). The high prevalence in Central and Eastern Europe seems to be driven by first of all hypertension, followed by diabetes, and cardiovascular diseases including stroke (see table A.1 in Appendix).

Unsurprisingly, higher age was significantly associated with multimorbidity in all regions, followed by low educational level and low household income according to the multivariate analyses (table 3). These results suggest that better access to higher education and improvements in income for the less affluent regions would reduce the presence of multimorbidity in all the European Regions.

As in previous studies, we could also show the inverse association of multimorbidity with respectively low educational level and low household income. This has been further elaborated by a study from general practice in Scotland, where Barnett et al. [31] showed that not only does morbidity prevalence increase with age, it is also higher in patients with lower SES.

5. Conclusion

This study does not only confirm that multimorbidity is prevalent among Europeans aged 50+ years, that it increases with age, and is associated with female gender, and lower socioeconomic status including low educational level, but it also shows that there are important cross-regional differences with Central and Eastern Europe suffering from significantly higher levels of multimorbidity compared to the two other European regions. From an over-all perspective, the ageing Europe will be challenged by the high levels of multimorbidity, and more so in Eastern and Central Europe. There is an urgent need to develop more systematic approaches both in the primary and secondary medical care especially in the countries of these two regions, both to prevent multimorbidity, and to assist multimorbid patients with management of their diseases, medications, and care. The approach should support the holistic view and treatment of a multimorbid patient in order to avoid the fragmentation resulting from handling the agendas of multiple chronic conditions. For health professionals there is a need for better vigilance to the socio-economic less advantaged middle-aged and older adults. Also, national health policymakers should be aware of the negative influence of low education and income on ageing health. It is likely that improvements in these areas may alleviate some of the challenges in an ageing Europe.

Disclosure of interest

The authors declare that they have each contributed to the article and that they have no conflict of interest.

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Table 1. Demographic Characteristics of Total Study Population and Across Regions

	Total Study Population	Northern Europe	Southern Europe	Central Europe	Eastern Europe
Total N (%)	63,842 (100)	12,585 (19.7)	17,537 (27.5)	19,598 (30.7)	14,122 (22.1)
Sex (%)					
<i>Male</i>	44.6	46.1	45.1	45.7	41.2
<i>Female</i>	55.4	53.9	54.9	54.3	58.2
Age Group (%)					
50 – 59	28.3	27.2	26.7	32.6	25.3
60 – 69	34.9	38.2	33.5	33.4	35.6
70 – 79	24.4	23.3	24.7	23.1	26.9
80+	12.4	11.3	15.1	10.9	12.2
Educational level (%)					
<i>High</i>	22.9	33.4	15.6	27.0	17.1
<i>Medium</i>	37.4	32.4	22.2	46.3	48.1
<i>Low</i>	39.7	34.2	62.2	26.7	34.8
Household Income (Mean)*					
3 rd tertile (highest)	58,213	63,360	52,091	80,979	29,646
2 nd tertile	24,514	31,438	19,802	32,999	12,504
1 st tertile (lowest)	10,849	15,235	7,838	14,743	5,219

* Purchasing Power Parity-Adjusted

Table 2. Multimorbidity Prevalence Across Sociodemographic Factors in Total Study Population and Across Regions

		Prevalence % [95 % CI]				
		Total Study Population	Northern Europe	Southern Europe	Central Europe	Eastern Europe
Total¹		31.4 % [30.7 – 32.2]	26.2 % [25.2 – 27.1]	29.8 % [28.7 – 30.9]	34.8 % [33.8 – 35.9]	35.2 % [33.8 – 36.5]
Sex²						
	<i>Male</i>	29.5 % [28.4 – 30.5]*	24.4 % [23.1 – 25.8]*	27.1 % [25.5 – 28.8]*	33.7 % [32.2 – 35.3]*	32.8 % [30.7 – 34.9]*
	<i>Female</i>	33.4 % [32.4 – 34.4]	27.8 % [26.6 – 29.1]	32.5 % [30.9 – 34.1]	35.9 % [34.4 – 37.3]	37.1 % [35.4 – 38.8]*
Age Group³						
	<i>50 – 59</i>	18.8 % [17.7 – 19.9]*, **	14.4 % [13.0 – 16.0]*, **	16.2 % [14.6 – 18.1]*, **	23.2 % [21.6 – 24.9]*, **	22.8 % [20.6 – 25.1]*, **
	<i>60 – 69</i>	30.0 % [28.7 – 31.3]	25.1 % [23.7 – 26.7]	28.7 % [26.7 – 30.9]	33.1 % [31.4 – 35.0]	33.4 % [31.2 – 35.6]*
	<i>70 – 79</i>	43.6 % [42.1 – 45.2]	37.4 % [35.3 – 39.5]	43.2 % [40.7 – 45.8]	45.0 % [42.7 – 47.4]	48.1 % [45.3 – 50.9]*
	<i>80+</i>	51.4 % [48.9 – 53.9]	43.7 % [40.7 – 46.9]	50.9 % [47.1 – 54.7]	53.7 % [50.0 – 57.3]	56.8 % [52.4 – 61.1]*
Educational Level¹						
	<i>High</i>	26.1 % [24.6 – 27.6]*, **	22.5 % [20.8 – 24.3]*, **	22.9 % [20.2 – 25.8]*, **	29.4 % [27.3 – 31.4]*, **	28.5 % [25.6 – 31.7]*, **
	<i>Medium</i>	31.7 % [30.6 – 32.9]	26.1 % [24.5 – 27.7]	26.5 % [24.4 – 28.7]	36.3 % [34.8 – 37.8]	34.1 % [32.1 – 36.1]*
	<i>Low</i>	33.8 % [32.5 – 35.0]	29.7 % [27.9 – 31.6]	33.0 % [31.5 – 34.6]	38.8 % [36.2 – 41.4]	40.8 % [38.5 – 43.2]*
Household Income¹						
	<i>3rd tertile (Highest)</i>	27.5 % [26.2 – 28.8]*, **	21.5 % [19.6 – 23.5]*, **	26.6 % [24.7 – 28.6]*, **	29.1 % [27.0 – 31.3]*, **	33.2 % [30.8 – 35.7]*, **
	<i>2nd tertile</i>	32.5 % [31.2 – 33.7]	24.9 % [23.2 – 26.8]	32.2 % [30.2 – 34.3]	34.2 % [32.3 – 36.0]	35.4 % [32.7 – 38.1]*
	<i>1st tertile (Lowest)</i>	35.4 % [34.1 – 36.7]	31.7 % [29.7 – 33.8]	31.6 % [29.5 – 33.8]	41.5 % [39.5 – 43.5]	38.0 % [35.6 – 40.4]*

Source: SHARE Wave 5 Release 1.0.0.. Calibrated Individual Weights Applied.

*Statistically significant difference between groups (p-value < 0.05), ** Statistically significant trend across levels (p^{trend} < 0.05)

¹Age and Sex Standardized Prevalence Proportions, ²Age Standardized Prevalence Proportions ³ Sex Standardized Prevalence Proportions

Table 3: Multivariate Analysis of the Association of Sociodemographic Factors with Multimorbidity in Total Study Population and Across Regions

		OR % [95 % CI]				
		Total Study Population	Northern Europe	Southern Europe	Central Europe	Eastern Europe
Sex						
	<i>Male</i>	1	1	1	1	1
	<i>Female</i>	1.15 [1.07 – 1.24]*	1.13 [1.02 – 1.26]*	1.27 [1.12 – 1.43]*	1.01 [0.91 – 1.11]	1.07 [0.94 – 1.22]
Age Group						
	<i>50 – 59</i>	1	1	1	1	1
	<i>60 – 69</i>	1.79 [1.63 – 1.96]*, **	1.86 [1.60 – 2.16]*, **	1.97 [1.67 – 2.32]*, **	1.58 [1.40 – 1.79]*, **	1.67 [1.42 – 2.00]*, **
	<i>70 – 79</i>	3.01 [2.73 – 3.33]*	2.94 [2.49 – 3.47]*	3.45 [2.92 – 4.08]*	2.38 [2.07 – 2.72]*	3.00 [2.50 – 3.57]*
	<i>80+</i>	3.90 [3.43 – 4.44]*	3.56 [2.93 – 4.32]*	4.44 [3.61 – 5.46]*	3.19 [2.65 – 3.84]*	4.24 [3.38 – 5.31]*
Educational level						
	<i>High</i>	1	1	1	1	1
	<i>Medium</i>	1.26 [1.15 – 1.39]*, **	1.20 [1.05 – 1.37]*, **	1.18 [0.96 – 1.46] **	1.26 [1.11 – 1.42]*, **	1.33 [1.11 – 1.61]*, **
	<i>Low</i>	1.38 [1.25 – 1.52]*	1.35 [1.18 – 1.55]*	1.68 [1.40 – 2.02]*	1.40 [1.20 – 1.63]*	1.83 [1.51 – 2.22]*
Household Income						
	<i>3rd tertile (Highest)</i>	1	1	1	1	1
	<i>2nd tertile</i>	1.30 [1.19 – 1.43]*, **	1.18 [1.03 – 1.36]*, **	1.29 [1.11 – 1.50]*, **	1.30 [1.15 – 1.48]*, **	1.05 [0.89 – 1.24] **
	<i>1st tertile (Lowest)</i>	1.44 [1.32 – 1.59]*	1.63 [1.41 – 1.88]*	1.19 [1.02 – 1.39]*	1.71 [1.50 – 1.95]*	1.19 [1.01 – 1.40]*

Source: SHARE Wave 5 release 1.0.0. Calibrated individual weights applied. Each variable is adjusted for each of the other variables.

* p-value < 0.05

** p^{trend} < 0.05

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