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Gendered patterns of depression and its determinants in older Europeans

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ABSTRACT

Background: Few studies consider multiple pathways for explaining the gendered patterns of depression in Europe's aged population, although ageing is often associated with an increased exposure to risk factors for depression, and the relevance of these risk factors is likely to differ between countries.
Methods: Based on the *Survey of Health, Ageing and Retirement in Europe* (SHARE), we assess the relevance of gender inequalities in the exposure to psychosocial, socio-economic, and health-related factors for explaining the gender gap in depression. Further, we investigate the association between depressive symptoms and these explanatory variables by gender and analyse whether their relevance differs between countries.
Results: Both the prevalence of depression by gender and the magnitude of the gender gap were low in Northern Europe and rather high in Southern Europe. Part of the gender gap was explained by psychosocial, socio-economic, and health-related factors but significant gender differences remained. Health-related factors were of outstanding importance for explaining within-country variation in depressive symptoms for both women and men. With regard to psychosocial and socio-economic factors, the results were less clear.
Conclusion: The assessment of gender inequalities in depression and their determinants within different social policy contexts enables evidence-based interventions to reduce the gender gap and ensure high quality of life for older men and women. To that end, the reduction of health-related risk factors seems to be of utmost importance in all European countries, whereas interventions in the area of socio-economic and psychosocial risk factors should be gender- and context-specific.

1. Introduction

Depression is one of the most prevalent mental health problems in old age (Andreas et al., 2017) and is expected to be the leading cause of disability by 2030 (Mathers & Loncar, 2006). The higher prevalence of depression in women as compared to men is one of the best documented findings in mental health research, also in older people (Bergdahl, Allard, Alex, Lundman, & Gustafson, 2007; Castro-Costa et al., 2007; Copeland, Beekman, Braam, & Dewey, 2004). Besides biological characteristics that contribute to the gender gap (Kuehner, 2003; Labaka, Goñi-Balentziaga, Lebeña, & Pérez-Tejada, 2018), research has emphasized the relevance of social risk factors related to gender roles. Empirical support comes from comparative studies that have shown great cross-national variation in the magnitude of the gender gap (van de Velde, Bracke, & Levecque, 2010; Crimmins, Kim, & Sole-Auro, 2010; Acciai & Hardy, 2017).

Besides the gap *between* women and men, also the prevalence rates of depression *within* the gender groups strongly vary between countries (Crimmins et al., 2010; Ploubidis & Grundy, 2009). While cultural differences in reporting styles and further measurement artefacts have been discussed (Ploubidis & Grundy, 2009; Jürges, 2007), it has been shown that also compositional differences in the countries' population with regard to socio-economic characteristics and health status contribute to this variation (van de Velde et al., 2010; Ploubidis & Grundy, 2009). However, studies that consider multiple pathways for explaining the gendered patterns of depression in different cultural contexts are scarce. This also applies to the older population, although ageing is often associated with an increased exposure to risk factors for depression, such as financial hardship and health problems. As European countries differ remarkably regarding the older population's health status and socio-economic characteristics (Crimmins et al., 2010; Weber, 2008), the relevance of risk factors is likely to vary depending on the country, as are their outcomes in terms of the gender gap in depression of older men and women.

Using data from the *Survey of Health, Ageing and Retirement in Europe* (SHARE), we study gendered patterns of depressive symptoms in the population aged 60–85 years from 17 European countries. Different to similar studies based on prior SHARE-waves, we were able to include

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countries of Eastern Europe, Portugal, and Luxembourg. We test whether gender differences are still present when controlling for inequalities in the exposure to psychosocial, socio-economic, and health-related factors. Further, we investigate the association between depressive symptoms and these explanatory pathways by gender and assess whether their relevance differs for women and men living in different countries.

2. Background

2.1. Social risk factors for depression

Research has identified multiple social risk factors for depression (Kuehner, 2003; Hopcroft & Burr Bradley, 2007; Aziz & Steffens, 2013). Besides personal experiences that can hardly be measured in population surveys, such as the experience of sexual abuse and violence, there are mainly three groups of risk factors.

First, there are *psychosocial risk factors*, such as adverse social network characteristics and critical life events. In general, receiving social support protects from depression (Gariépy, Honkaniemi, & Quesnel-Vallée, 2016). Regarding more specific characteristics of the social network, depression is more prevalent in people who are widowed, divorced, and in those who never were in a relationship (Lehtinen et al., 2003). Furthermore, childless people and those who have only few contacts with their children report more depressive symptoms (Buber & Engelhardt, 2008). The pathways through which the social network influences (mental) health are complex. On the one hand, members of the social network ("the significant others") provide physical and emotional support, and a sense of meaning. On the other hand, there may be selection effects in the sense that those with better mental health are more likely to get married and to have children (Buber & Engelhardt, 2008). Further, stressful life events, such as the loss of a spouse or unemployment (Schaan, 2013; Tennant, 2002), as well as ongoing strains due to role conflicts between childcare, housework, and paid work (Marchand et al., 2016; van de Velde et al., 2010) are important risk factors for depression.

Second, there are risk factors related to a person's *socio-economic resources*. An increased risk of depression has been observed in people with poor education, low occupational positions, and in those that face financial hardship. Regarding the association between socio-economic status (SES) and depression, both causation (low SES leads to depression) and social selection (depression hinders social mobility) are discussed. Further, according to the stress theory, personal resources, such as coping styles, self-esteem, and control beliefs buffer the impact of stress on depression (Lorant, 2003; Thoits, 2010).

Third, *health-related factors*, such as chronic diseases, pain, and the experience of functional decline can evoke depressive reactions (Aziz & Steffens, 2013), and it has been shown that poor physical health is predictive for both the onset and the persistence of depression (Gallagher, Savva, Kenny, & Lawlor, 2013). Depression is also associated with a range of adverse health behaviors, amongst them excessive alcohol consumption that increases the risk of depression through the associated cerebral changes and often related adverse socio-economic conditions (Fergusson, Boden, & Horwood, 2009). Further, numerous studies document the protective and therapeutic effect of physical activity on depressive symptoms (Dinas, Koutedakis, & Flouris, 2011).

2.2. Variation in the gender gap in depression and diverging prevalence rates between countries

The 'actual' prevalence of depression in old age, as well as the 'actual' magnitude of the gender gap can hardly be determined. On the one hand, this is due to the diverging ways of measuring depression in large-scale population surveys, e.g., the application of symptom scales leads to higher prevalence rates as compared to structured diagnostic interviews (Ferrari et al., 2013). On the other hand, prevalence rates differ depending on the study sample with marked differences between persons in private households and individuals in nursing homes (Fiske, Loebach Wetherell, & Gatz, 2009). Copeland et al. (1999) investigated the prevalence of depression based on a semi-structured interview in people aged 65+ living in private households in nine European cities. While, on average, the prevalence amounted to around 14 percent in women and nine percent in men, prevalence rates were varying between cities.

Regional variation was also found in a study by Crimmins et al. (2010) who estimated the prevalence of depression based on a depression-screening instrument in the European population aged 50 + . The authors stated a higher prevalence in women in all countries, but also observed marked differences of the gender gap's magnitude between countries. While women in Denmark had an Odds Ratio for depression of around 1.7 as compared to their male counterparts, women's risk was more three times higher in Greece and Spain. Further, the prevalence rates were highly variable when comparing women and men between countries. In men, the prevalence ranged from around 12 percent in Switzerland up to around 26 percent in Italy. For women, the lowest prevalence was observed in Denmark (22%), whereas women in Spain ranged on top with a prevalence of around 47 percent.

2.3. Explanations for the gender gap in depression

There is a debate over whether there are gender differences in how depressive symptoms are reported and diagnosed. It is assumed that gender differences might be due to differences in reporting behaviors in the sense that women are more prone to report depressive symptoms because they talk about emotions more readily, or because they have more contact to clinicians who provide the opportunity for discussing negative feelings. However, research has found that the gender gap is not an artifact of gender-specific reporting styles (Acciai & Hardy, 2017). Moreover, current classification systems and diagnostic tools favor the expression of 'female' over 'male' symptoms (Kuehner, 2003). Against the background that suicide rates are much higher in men than in women, others have emphasized health professional's incapacity to diagnose depression in men, as well as men's reluctance of seeking help and the denial of depression in order to demonstrate masculinity (Courtenay, 2000).

Meanwhile, it seems common sense that the gender gap in depression results from an interplay of biological and social factors (Hopcroft & Burr Bradley, 2007; Kuehner, 2003). Regarding the pathways through which the social determinants lead to the gender gap in depression (or more generally to gender differences in multiple dimensions of health), two hypotheses have been proposed. The *differential exposure hypothesis* claims that the unequal access of women and men to health relevant resources is responsible for the gender gap in depression. If this holds true, inequalities should disappear when relevant risk factors are controlled for in statistical analyses. The *differential vulnerability hypothesis* suggests that women and men are not only unequally exposed to health determinants, but that they also react differently to potential health threatening factors, so that certain risk factors are more important for women than for men and vice versa. This differential vulnerability is assumed to result from the social roles that societies assign to women and men: while women as the kin-keeper of the family, bearing the "cost of caring" (Kessler & McLeod, 1984), may be more reactive to social network events and family-related stressors, men in their role as the "breadwinner of the family" might be more vulnerable to stressors related to socio-economic status (Jeon, Jang, Rhee, Kawachi, & Cho, 2007; Pinquart & Sörensen, 2001).

2.4. Explanations for cross-country variation

It is likely that compositional differences in the countries' population with regard to socio-economic characteristics, which in turn are

dependent on country characteristics on the macro-level, such a policy regimes, contribute to the diverging magnitude of the gender gap between European countries. Acciai and Hardy (2017) tested whether compositional differences between women and men regarding marital status, education, employment status, wealth, and a number of health characteristics could explain the gender gap in Europe's population aged 50+. Additionally, the authors examined the contribution of gender differences in reporting styles. They found that the gender gap in depression only partially derived from compositional differences, and that the gap was not an artefact of gender-specific reporting styles. However, the authors did not differentiate between countries, so that no conclusions on country differences in the relevance of compositional differences between women and men can be drawn.

Empirical studies on the relevance of social risk factors *within* the groups of women and men from a cross-country comparative perspective are scarce. Two recent notable exceptions will be discussed in the following. Ploubidis and Grundy (2009) found that after controlling for education, marital status, and the presence of chronic illness, there were still significant differences in the number of depressive symptoms between women and men aged 50+ living in different European countries. However, one can assume that there are important influences for explaining cross-country differences that were not included, such as social network characteristics or financial resources. van de Velde et al. (2010) investigated the relative contribution of a wider range of socio-economic and family-related factors to the explanation of the gender gap in depression on the one side, and country-differences within the groups of women and men in the European population aged 18–75 years one the other side. The authors expected that, in countries with a traditional gender ideology like in Southern and Eastern Europe, women's levels of depression would be related more strongly to family-related factors and men's depressive levels would be more strongly related to socio-economic factors. However, they found that the contribution of socio-economic factors was larger than the contribution of family-related factors in both women and men in most of the countries. Still, these findings cannot necessarily be transferred to older age. In older cohorts, gender roles have been much stricter so that a differential vulnerability seems more likely than in the younger population. Further, there are several risk factors for depression that were not considered in previous studies, but which might to be of particular relevance in old age, such as financial hardship, functional limitations, pain, and caregiving (Savage & Bailey, 2004; Aziz & Steffens, 2013). Not least, these risk factors are likely to be unequally distributed across countries.

Our study contributes to the literature by examining the following questions: (1) How pronounced are gender differences in depression in the population aged 60–85? (2) Can gender differences be traced back to the gendered exposure to psychosocial, socio-economic, and health-related factors? (3) What is the association between the single explanatory variables and depressive symptoms *within* the groups of women and men? (4) Does the relevance of the three explanatory pathways differ between countries?

Our sample comprised individuals from 17 countries spanning Europe from North to South and West to East. Especially regarding the Eastern European population, research on depression in old age is scarce, as these countries were not included in prior waves of SHARE.

3. Material and methods

3.1. Data source and sample

Data were drawn from the *Survey of Health, Ageing and Retirement in Europe* (SHARE), a nationally representative study on the living conditions of the population aged 50+ years and their partners living in private households. We use data from the sixth wave that was collected in 2015, including 17 countries from Northern Europe (Sweden, Denmark), Eastern Europe (Czech Republic, Slovenia, Poland, Estonia, Croatia), Southern Europe (Spain, Italy, Greece, Portugal), and Western Europe (Austria, Belgium, France, Germany, Luxembourg, Switzerland). Time-invariant information was partly given only in the baseline interview and thus forwarded. A detailed description of the survey can be found elsewhere (Börsch-Supan et al., 2013; Munich Center for the Economics of Aging, 2018).

As the age group between 60 and 85 years differs from younger people and the oldest old in terms of health and social network characteristics (Cherry et al., 2013; Smith, Borchelt, Maier, & Jopp, 2002), we decided to exclude older and younger respondents. 2079 respondents (4.5%) provided no information on depressive symptoms, so that we rely on a sample of 43,739 respondents for estimating the depression prevalence. In the multivariate analyses, another 1968 respondents (4.5%) were excluded due to missing information, so that the analytic sample comprised 41,771 respondents.

3.2. Dependent variable and explanatory variables

Depressive symptoms were measured based on the EURO-D scale, a depression-screening instrument specifically designed for cross-country comparisons of older people. It encompasses 12 items: depressed mood, pessimism, wishing for death, feelings of guilt, sleep disturbances, loss of interest, irritability, loss of appetite, fatigue, concentration problems, lack of enjoyment, and tearfulness. Its criterion validity and psychometric properties have been confirmed previously (Prince, 2002).

When the term 'explain' is used in the upcoming sections, it should be understood in a statistical sense rather than causally as our analysis is based on cross-sectional data. The *psychosocial factors* included in our analysis were marital status, parenthood, caregiving, and limitations in activities due to family responsibilities. The *socio-economic factors* were education, housing tenure, the household's financial situation, and limitations in personal activities due to financial restrictions. The *health-related factors* were pain, (instrumental) limitations in activities of daily living ((I)ADL), the number of chronic diseases, excessive alcohol consumption, and both moderate and vigorous physical activity. Information on the operationalization and the coding of the variables for our analyses is presented in Table 1.

3.3. Statistical analysis

We derived means and standard deviations (SD) on the number of depressive symptoms by gender and country. We additionally report the proportion of those at risk for depression according a cut-off threshold of four symptoms that has been validated to identify those at risk of manifest depression (Prince, 2002). Afterwards, we calculated the gender gap in means of percentage points differences between the share of women and the share of men at risk of depression (*research question 1*). To account for country-specific sampling strategies and response rates, these analyses weighted with SHARE's calibrated cross-sectional weight (Munich Center for the Economics of Aging, 2018).

Research questions 2–4 were answered based on the results of ordinary least squares regressions (OLS) with the number of depressive symptoms as the dependent variable. Although a cut-off threshold of four symptoms has been validated to identify those at risk of depression, we rely on the number of depressive symptoms as this allows finer gradations in severity (Acciai & Hardy, 2017; van de Velde et al., 2010). To check for non-random measurement errors, the standardized residuals were plotted against a plot for the normal curve. As the residuals were close to a normal distribution, we assume no bias due to homoscedasticity. Variance inflation factors were within acceptable limits (Mean VIF = 1.6), indicating no problems of multicollinearity.

In order to test if the gender gap in depression can be traced back to inequalities in the exposure to psychosocial, socio-economic, and health-related factors (*research question 2*), we compared an unadjusted model, in which only gender and age as a control variable were included, with a model adjusted for all explanatory variables. By

Table 1
Operationalization of explanatory variables.

Variable	Operationalisation in SHARE and coding for analysis
Psychosocial factors	
Marital status	0 = married / in a relationship, 1 = divorced / separated / widowed / single
Parenthood	0 = at least one child alive, 1 = no child alive
Caregiving for someone inside the household	0 = no, 1 = yes
Limitations in personal activities due to family responsibilities	*"How often do you think that family responsibilities prevent you from doing what you want to do?"*, 0 = never, 1 = rarely, 2 = sometimes, 3 = often
Socio-economic factors	
Education	0 = high (ISCED 5, 6), 1 = medium (ISCED 3, 4), 2 = low (ISCED 0 - 2)
Housing tenure	0 = owners, 1 = non-owners
Household's ability to make ends meet	0 = easily, 1 = fairly easy, 2 = with some difficulty, 3 = with great difficulty
Limitations in activities due to financial restrictions	*"How often do you think that shortage of money stops you from doing the things you want to do?"*, 0 = never, 1 = rarely, 2 = sometimes, 3 = often
Health-related factors	
No. of limitations in ADL	Limitations in activities of daily living; continuous variable
No. of limitations in IADL	Limitations in instrumental activities of daily living; continuous variable
No. of chronic diseases	Number of chronic diseases; continuous variable
Presence of pain	*"Are you troubled with pain?"*; 0 = no, 1 = yes
Alcohol consumption	*"In the last three months, how often did you have six or more units of alcoholic beverages on one occasion?"*; 0 = not at all / less than once a month, 1 = more often
Moderate physical activity	*"How often do you engage in activities that require a moderate level of energy such as gardening, cleaning the car, or doing a walk?"* 0 = more than once a week, 1 = once a week, 2 = one to three times a month, 3 = hardly ever, or never
Vigorous physical activity	*"How often do you engage in vigorous physical activity, such as sports, heavy housework, or a job that involves physical labour?"* 0 = more than once a week, 1 = once a week, 2 = one to three times a month, 3 = hardly ever, or never

comparing the coefficient estimates for the gender effect between models $[((\beta_{(\text{unadjusted model})} - \beta_{(\text{adjusted model})})/ \beta_{(\text{adjusted model})}) \times 100]$, we quantified the contribution of compositional differences between women and men to the gender gap in depression.

In order to assess the association between the single psychosocial, socio-economic, and health-related factors within the groups of women and men irrespective of the country context (*research question 3*), we estimated a model for the pooled sample by gender, which includes age as a control variable, country dummy variables, as well as the psychosocial, socio-economic, and health-related factors. Despite the hierarchical structure of the data (i.e. individuals nested in countries), we decided to forego multilevel modelling, which generally allows for an unbiased estimation of parameters and standard errors, as well as for decomposing the explained variance to individual and country effects, because of the small number of countries in our analysis (n = 17). Instead, we estimated country fixed effects of the explanatory variables that control for variance related to the country level. This is done by including N-1 country dummy variables in the regression analysis so that the predictors of the country dummies are actually the estimators of the country specific error terms (Allison, 2009; Möhring, 2012).

We finally examined the contribution of the three explanatory pathways to depressive symptoms separately by gender and country (*research question 4*). For this purpose, we applied the 'rego-ado' written by Huettner and Sunder (2012) in Stata V.13 for decomposing R^2.

4. Results

4.1. Patterns of depression in the older European population and exposure to risk factors

Table 2 shows the mean number of depressive symptoms and the share of those at risk of depression. In men, the mean number of depressive symptoms in the total sample amounted to 2.1 with marked country differences ranging between 1.4 in Denmark up to 2.8 in Poland. In the European average, around 21 percent of men were at risk of depression. The lowest share of men at risk can be observed in the Northern European countries (Sweden: 11.0%, Denmark 10.2%) and in Switzerland (10.7%), while the highest share was found in two of the Eastern European countries (Poland: 32.5%, Estonia: 28.1%), and Portugal (26.6%). Women, in the European average, reported 3.1 depressive symptoms and around 38 percent were at risk of depression. The ranking of countries follows a similar pattern as in men: women in Sweden (23.5%), Denmark (18.1%), and Switzerland (21.6%) had the lowest share of those at risk of depression, while the share was highest in Portugal (57.6%) and Poland (52.8%).

When looking at the magnitude of the gender gap in the prevalence of those at risk, again, enormous cross-national variation was evident. While the gender gap was rather small in the Northern European countries, in some of the Eastern European countries (Czech Republic, Slovenia, and Estonia), and in most of the Western European countries (Austria, Belgium, Germany, and Switzerland), the gap was more pronounced in Southern Europe with an outstandingly large gender gap of around 31 percentage points in Portugal.

Table 3 reports the compositional characteristics of women and men in the pooled sample. Women and men were significantly different in all of the explanatory variables. However, gender differences were rather small (i.e. less than five percentage points) regarding parenthood, caregiving, limitations in activities due to family responsibilities, housing tenure, household's ability to make ends meet, and limitations in activities due to financial restrictions. In contrast, gender differences in educational attainment, pain, excessive alcohol consumption, and physical activity were more pronounced. Women also suffered from more chronic diseases and limitations in (I)ADLs.

4.2. Magnitude of the gender gap before and after controlling for compositional differences

Table 4 presents the estimates of OLS regressions for the effect of gender in the age-adjusted model with the fully adjusted model, in which socio-economic, health-related, and psychosocial factors were added. Gender differences were still present in every country after controlling for compositional differences between women and men regarding our explanatory variables. In the total sample, the percentage reduction of the gender effects amounted to 38 percent. Notably higher reductions as compared to the European average (i.e. five percentage points or more) were present in Croatia (55%), in all of the Southern

Table 2
Number of depressive symptoms and share of respondents at risk of depression by country and gender.
Source: SHARE wave 6, own calculations, weighted data.

	N	Men		Women		Gender gap
		No. of symptoms	At risk	No. of symptoms	At risk	Δ Percentage points
		Mean (SD)	%	Mean (SD)	%	
Total	43,739	2.1 (2.1)	20.8	3.1 (2.5)	37.9	17.1 **
Northern Europe						
Sweden	3,095	1.6 (1.6)	11.0	2.3 (1.9)	23.5	12.5 **
Denmark	2,250	1.4 (1.6)	10.2	1.9 (1.9)	18.1	7.9 **
Eastern Europe						
Czech Republic	3,604	1.6 (1.8)	14.0	2.4 (2.2)	26.1	12.1 **
Slovenia	2,866	1.9 (1.9)	18.4	2.8 (2.3)	31.9	13.5 **
Poland	1,168	2.8 (2.4)	32.5	4.0 (2.6)	52.8	20.3 **
Estonia	3,604	2.6 (2.0)	28.1	3.3 (2.3)	42.0	13.9 **
Croatia	1,539	2.2 (2.3)	22.8	3.4 (2.6)	43.9	21.1 **
Southern Europe						
Spain	3,672	1.9 (2.2)	17.9	3.2 (2.8)	39.1	21.2 **
Italy	3,437	2.3 (2.3)	24.8	3.5 (2.8)	43.2	18.4 **
Greece	3,251	2.1 (2.4)	22.7	3.2 (2.8)	40.2	17.5 **
Portugal	1,070	2.3 (2.2)	26.6	4.5 (2.9)	57.6	31.0 **
Western Europe						
Austria	2,401	1.6 (1.7)	14.4	2.4 (2.1)	26.0	11.6 **
Belgium	3,469	2.0 (2.0)	20.0	2.8 (2.2)	34.2	14.2 **
France	2,507	2.3 (2.0)	23.1	3.2 (2.3)	41.2	18.1 **
Germany	2,873	1.9 (1.8)	16.9	2.6 (2.0)	29.6	12.7 **
Luxembourg	926	2.0 (1.9)	19.2	3.0 (2.3)	40.7	20.5 **
Switzerland	2,007	1.5 (1.6)	10.7	2.2 (1.8)	21.6	10.9 **

** $p < .001$ (two-tailed χ 2-test).

European countries (ranging from 43% in Portugal up to 48% in Italy), and in Belgium (43%). Reductions of the gender gap were less pronounced in the Northern European countries (Sweden: 30%, Denmark: 29%), in some of the Eastern European countries (Czech Republic: 33%, Poland: 26%, Estonia: 30%), as well as in Switzerland (18%).

4.3. Associations between depression, psychosocial, socio-economic, and health-related factors

Table 5 shows the associations between our explanatory variables and depressive symptoms for the pooled sample. All coefficient estimates for the psychosocial factors showed the expected directions: Those without a partner reported significant more depressive symptoms than their counterparts living in a partnership. Parenthood was only negatively associated with depressive symptoms in women, while the effect was rather small and non-significant in men. Irrespective of gender, caregivers reported significantly more depressive symptoms. The same holds for limitations in personal activities due to family responsibilities: the more serious the limitations, the more depressive symptoms were reported.

When looking at the socio-economic factors, the number of depressive symptoms was higher in those with low educational attainment, whereas those with medium education did not report significantly more depressive symptoms as compared their counterparts with high educational attainment. Housing tenure had no significant effect as compared to non-tenants. Regarding the household's financial situation, the more serious the difficulties in making ends meet, the higher the number of depressive symptoms (although the answer category "with some difficulties" that had no significant effect in men). Furthermore, the more often a person felt limited in activities due to financial restrictions, the more depressive symptoms were reported (although not significant for the answer categories "rarely" irrespective of gender and "sometimes" in men).

Most of the health-related variables showed a significant association with depressive symptoms: those who were troubled with pain reported significantly more depressive symptoms. Furthermore, the higher the number of chronic diseases and limitations in (instrumental) activities of daily living, the higher the number of depressive symptoms. In men, excessive alcohol consumption was associated with an increase in depressive symptoms, while the effect was not significant in women. Last, both moderate and vigorous physical activity were associated with a decrease in depressive symptoms in both genders.

4.4. Cross-country differences in the relevance of the explanatory pathways

Figs. 1 and 2 show the country-specific contribution of psychosocial, socio-economic, and health- factors to the explained variance by gender. It was evident that health-related factors had the largest explanatory power, whereas both socio-economic and psychosocial factors were far less influential for explaining within country variance. These findings hold irrespective of gender and the country context.

In men, the contribution of health-related factors ranged between 54 percent in Germany up to 82 percent in Austria. Socio-economic factors contributed to between nine percent in Luxembourg, while they had the highest relevance in Portugal (29%) and Greece (28%). The relevance of psychosocial factors also varied between countries ranging between five percent in Estonia and 24 percent in Germany. In seven countries (Denmark, the Czech Republic, Estonia, Croatia, Greece, Portugal, and Switzerland), the contribution of socio-economic factors was at least five percentage points higher than that of psychosocial factors, whereas the opposite (psychosocial factors were more relevant than socio-economic factors) was only observed in Sweden and Luxembourg. In the remaining countries, the relevance of these explanatory pathways was rather similar.

For women, the contribution of health-related factors to the explained variance was highest in Spain (78%) and lowest in Italy (54%). Regarding socio-economic factors, the contribution was highest in Portugal (27%) and Italy (26%), while the share of explained variance was lowest in Denmark (13%) and Switzerland (14%). Again, also the contribution of psychosocial factors strongly differed between

Table 3
Exposure to psychosocial, socio-economic, and health-related factors by gender. Source: SHARE wave 6, own calculations, weighted data.

	Women	Men	Difference
Psychosocial factors			
No partner (%)	43.9	23.6	**
At least one child alive (%)	90.8	88.9	*
Caregiver (%)	6.7	6.2	**
Limitations in activities due to family responsibilities (%)			**
- Never	43.9	46.5	
- Rarely	25.2	27.7	
- Sometimes	22.1	20.2	
- Often	8.8	5.7	
Socio-economic factors			
Education (%)			**
- Low	50.4	39.1	
- Middle	34.6	36.9	
- High	15.1	24.0	
Housing tenure (%)	73.4	78.5	**
Household's ability to make ends meet (%)			**
- Easily	33.3	37.6	
- Fairly easy	28.4	29.8	
- With some difficulties	26.2	23.0	
- With great difficulties	12.3	9.7	
Limitations in activities due to financial restrictions (%)			**
- Never	29.3	31.6	
- Rarely	21.0	23.5	
- Sometimes	27.3	26.5	
- Often	22.5	18.4	
Health-related factors			
Troubled with pain (%)	56.4	40.1	**
Number of chronic diseases (Mean and SD)	2.1 (1.7)	1.8 (1.5)	**
Number of limitations in ADL (Mean and SD)	0.23 (.08)	0.19 (0.7)	**
Number of limitations in IADL (Mean and SD)	0.50 (1.3)	0.30 (1.1)	**
Excessive alcohol consumption (%)	5.4	15.9	**
Vigorous physical activity (%)			**
- Hardly ever or never	54.7	45.2	
- One to three times a month	8.7	9.7	
- Once a week	13.5	13.7	
- More than once a week	23.2	31.4	
Moderate physical activity (%)			**
- Hardly ever or never	16.9	11.0	
- One to three times a month	6.3	5.8	
- Once a week	14.4	14.5	
- More than once a week	62.4	68.7	

* $p > .05$ (two-tailed χ 2-test for categorical variables, two-tailed *t*-test for metric variables).
** $p < .001$.

countries, being most relevant in Italy and Poland (20%), while their relevance was comparably low in Spain (6%), Greece and Austria (7%).

In nine countries (the Czech Republic, Slovenia, Estonia, Spain, Italy, Greece, Portugal, Austria, and Belgium), the contribution of socio-economic factors was at least five percentage points higher than that of psychosocial factors. In the remaining countries, the relevance of these explanatory pathways was rather similar.

5. Discussion

Our first objective was to examine gender differences in depression in Europe's population aged 60–85 years. Different to studies based on prior waves of SHARE, we were able to include the countries of Eastern Europe, Portugal, and Luxembourg. Our results show that gender is an important predictor for depression in old age, but its importance varies greatly between countries. The gender gap was rather low in the Northern European countries, as well as in some of the Eastern and Western European countries, whereas it was more pronounced in

Table 4
Association between gender and depressive symptoms by country (reference: men).
Source: SHARE wave 6, own calculations. OLS regression, standard errors in brackets (sample weights not used).

	Age-adjusted model	Fully adjusted model	%-reduction of the gender coefficient
Total	.853 (.021)**	.533 (.020)**	38
Northern Europe			
Sweden	.656 (.064)**	.459 (.062)**	30
Denmark	.496 (.074)**	.354 (.070)**	29
Eastern Europe			
Czech Republic	.712 (.068)**	.480 (.067)**	33
Slovenia	.845 (.079)**	.547 (.075)**	35
Poland	1.00 (.147)**	.736 (.141)**	26
Estonia	.655 (.076)**	.458 (.073)**	30
Croatia	1.15 (.123)**	.512 (.112)**	55
Southern Europe			
Spain	1.11 (.084)**	.587 (.076)**	47
Italy	1.13 (.087)**	.592 (.080)**	48
Greece	0.92 (.089)**	.493 (.087)**	46
Portugal	1.60 (.161)**	.907 (.151)**	43
Western Europe			
Austria	.723 (.079)**	.488 (.076)**	33
Belgium	.817 (.074)**	.465 (.068)**	43
France	.909 (.087)**	.566 (.085)**	38
Germany	.707 (.071)**	.427 (.069)**	40
Luxembourg	.930 (.139)**	.582 (.131)V	37
Switzerland	.721 (.078)**	.593 (.074)**	18

** $p < .001$ (two-tailed tests).

Southern Europe. Furthermore, we also showed marked differences in the prevalence rates of those at risk for depression when comparing women and men living in different countries. Prevalence rates in both women and men were comparably low in the Northern European countries, whereas prevalence rates were high in Southern Europe, as well as in some of the Eastern and Western European countries. The finding of high depression scores in the Eastern and Southern European countries was also observed in the population aged 18–75 years (van de Velde et al., 2010). From this one can conclude that some countries provide living conditions which allow for good mental health, whereas there remains great potential to improve the population's mental health in others. The fact that, on average, more than one third of the female population and a quarter of the male population aged 60–85 is at risk of depression warrants for targeted public health actions. However, cross-country differences may also – at least in part – be due to measurement invariance of the screening-instrument and country-specific reporting behaviors, on which we will elaborate in more detail below.

The second objective was to assess if the gender gap in depression can be traced back to compositional differences in the male and female population regarding our explanatory variables. According to the differential vulnerability hypothesis, gender differences in depression should be attenuated when relevant risk factors are controlled for in statistical analyses. Indeed, we observed a reduction of gender differences in all countries when controlling for inequalities in psychosocial, socio-economic, and health-related factors. While this finding is consistent with previous research (Acciai & Hardy, 2017; van de Velde et al., 2010), the broader range of covariates in our analysis underscores the robustness of these studies. Moreover, we revealed country-specific differences in the relevance for explaining the gender gap in depression. In the European average, the gender coefficient was reduced by 38 percent, while notably higher reductions occurred in Croatia, in all of the Southern European countries, and in Belgium. In contrast, these variables were less important for explaining the gender gap in the Northern European countries, in some of the Eastern European countries, as well as in Switzerland. Besides our explanatory variables, one can easily assume that there are more underlying

Table 5
Associations between explanatory variables and depressive symptoms in the pooled sample.
Source: SHARE wave 6, own calculations. OLS regression, standard errors in brackets (sample weights not used).

	Women	Men
Age	.006 (.002)*	.010 (.002)**
N-1 country dummy variables (coefficients not shown)		
Psychosocial factors		
No partner	.112 (.030)**	.334 (.034)**
At least one child alive	−.116 (.049)*	−.019 (.045), ns
Caregiver	.394 (.053)**	.345 (.053)**
Limitations in activities due to family responsibilities (Reference: Never)		
- Rarely	.164 (.035)**	.129 (.031)**
- Sometimes	.397 (.037)**	.328 (.036)**
- Often	1.01 (.055)**	.908 (.061)**
Socio-economic factors		
Education (Reference: High)		
- Middle	−.008 (.039), ns	.032 (.033), ns
- Low	.092 (.040)*	.091 (.036)*
Housing tenure	−.054 (.034), ns	−.053 (.033), ns
Household's ability to make ends meet (Reference: Easily)		
- Fairly easy	−.008 (.037), ns	.030 (.034), ns
- With some difficulties	.170 (.044)**	.059 (.042), ns
- With great difficulties	.705 (.060)**	.528 (.058)**
Limitations in activities due to financial restrictions (Reference: Never)		
- Rarely	.043 (.040), ns	−.001 (.036), ns
- Sometimes	.124 (.041)*	.040 (.038), ns
- Often	.542 (.050)**	.546 (.047)**
Health-related factors		
Troubled with pain	.665 (.029)**	.508 (.028)**
Number of chronic diseases	.228 (.009)**	.188 (.009)**
Number of limitations in ADL	.129 (.024)**	.181 (.026)**
Number of limitations in IADL	.286 (.016)**	.280 (.017)**
Excessive alcohol consumption	.022 (.057), ns	.141 (.034)**
Moderate physical activity (Reference: Hardly ever, or never)		
- One to three times a month	−.100 (.069), ns	−.252 (.069)**
- Once a week	−.333 (.056)**	−.400 (.058)**
- More than once a week	−.499 (.048)**	−.598 (.050)**
Vigorous physical activity (Reference: Hardly ever, or never)		
- One to three times a month	−.160 (.048)*	−.085 (.045), ns
- Once a week	−.158 (.042)**	−.247 (.040)**
- More than once a week	−.223 (.035)**	−.227 (.033)**
Adjusted R^2	0.28	0.26

* p < .05.
** p < .001 (two-tailed tests).

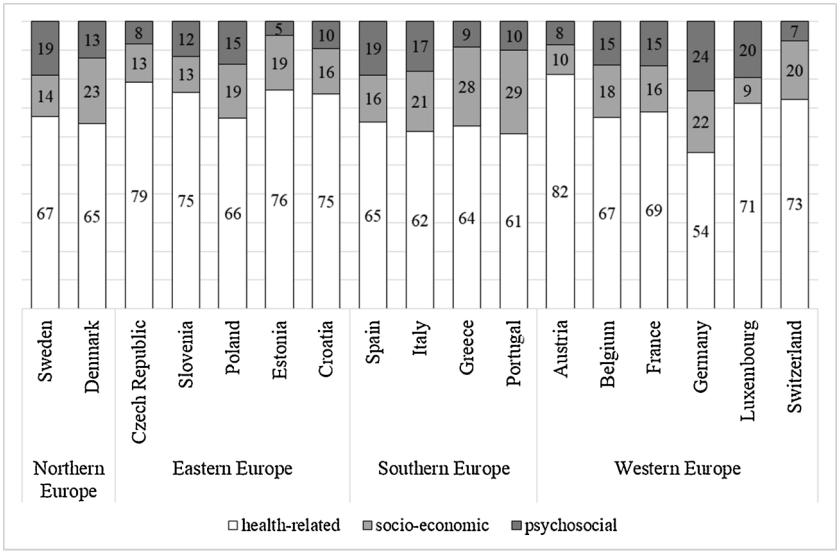

Fig. 1. Contribution of explanatory pathways to the explained variance in men by country.
Source: SHARE wave 6, own calculations. OLS regression (sample weights not used).

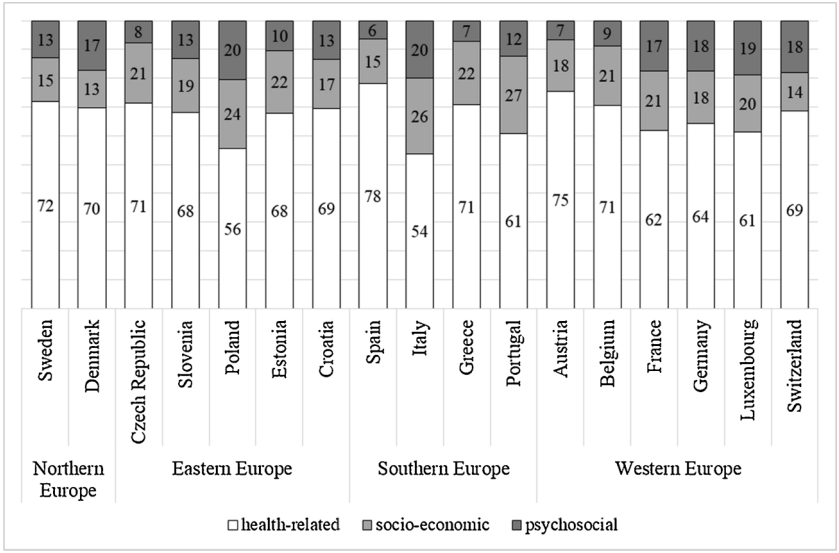

Fig. 2. Contribution of explanatory variables to the explained variance in women by country.
Source: SHARE wave 6, own calculations. OLS regression (sample weights not used).

mechanisms that have to be considered, both at the micro-level and the macro-level. The former concerns for example the exposure to critical life events like widowhood (Schaan, 2013) or other influences from prior life stages (Angelini, Klijs, Smidt, & Mierau, 2016). Regarding the latter, Ploubidis and Grundy (2009) suggest that the availability of state-provided support might enhance feelings of security and reduce anxiety, which is conform the their observation that people are less depressed in countries with generous social security systems.

The third objective was to test the association between a wide range of social risk factors and depression by gender in a multivariate analysis, and we showed that adverse socio-economic and psychosocial conditions, as well as a wide range of health problems are all negatively associated with depression. As our analysis is based on cross-sectional data, we could not identify causal effects, but deem that some of the results of our multivariate analyses are important to highlight. First, even after controlling for a wide range of risk factors, limitations in personal activities due to both financial restrictions and family responsibilities were associated with a marked increase of depressive symptoms. Thus, social exclusion can be considered an important risk factor for depression in old age. Second, even when controlling for limitations in activities due to family responsibilities, caregiving was associated with higher levels of depressive symptoms. The number of older people in need of care is expected to rise, so that European societies are forced to develop adequate strategies for supporting family carers (Colombo, Llema-Nozal, Mercier, & Tjadens, 2011). Third, although most estimates were of comparable size for women and men, some exceptions are worth noting. Living without a partner had a three times higher effect for men as compared to women. This may be due to the fact that, for men, spouses are the main source of social support, whereas women can often rely on larger and more diverse social networks (Faltermaier & Hübner, 2016) so that the consequences of being single are less pronounced. In contrast, being childless had a detrimental effect on women's mental health, but not in men. These results indicate that childlessness may be more of a social stigma for women with negative consequences for mental health in old age, and that they rely more on children's support in old age than men do (Deindl & Brandt, 2017).

Our fourth aim was to examine the relevance of our explanatory variables for women and men living in different countries. Our results did neither support the expectation that socio-economic factors would be more important for explaining men's levels in the Southern and Eastern European countries due to traditional gender ideologies, nor the expectation that women's levels of depressive symptoms would be more strongly related to psychosocial resources in countries with a more traditional gender ideology. Instead, we observed that (in case there was a difference of more than five percentage points) that socio-economic were of greater importance. These results are in accordance with the study of van de Velde et al. (2010), who concluded that there was no differential vulnerability of women and men in the population aged 18–75 years depending on the country of residence. Still, we did not examine the contextual dependency of single explanatory variables and thus differential exposure according to context. Regarding family responsibilities, for example, it is very likely that the gendered inequalities are more pronounced in countries with traditional gender ideologies. However, when comparing the relevance of the three groups of explanatory variables as a whole, it became evident that health-related factors were of an outstanding importance for explaining differences in depressive symptoms. Thus, efficient supportive services for people with health problems are needed that should optimize current function, prevent further decline, and treat symptoms of depression (Gallagher et al., 2013).

In order to enhance our understanding of the interplay between gender, risk factors on the micro-level, and country characteristics, future studies could benefit from gender policy regime theory, as well as on the investigation of concrete indicators for gender equality on the macro-level as the 'outcome' of social policy. While it has been suggested that, in countries where women and men live more similar lives, their (mental) health outcomes are more equal (Crimmins et al., 2010), theoretical predictions on the effect of living in a gender equal society on (mental) health are not straightforward. On the one hand, living in a gender-equal society might attenuate gender differences in health. Especially women's health might be promoted due to a reduction of inequalities in power and access to economic resources. On the other hand, gender equality can harm women's health when they take up masculine unhealthy behaviours (Dahlin & Härkönen, 2013; Backhans, Lundberg, & Mansdotter, 2007).

Furthermore, one cannot easily assume that characteristics on the country level have an 'overall' effect for the whole population. A recent study (van de Velde, Huijts, Bracke, & Bambra, 2013) found that a high degree of macro-level gender equality was related to lower levels of depression in both women and men, and also to a smaller gender gap in depression, but only in specific subgroups and specific dimensions of gender equality. The authors also emphasize the fact that Eastern and Southern Europe are experiencing marked changes of gender ideologies

and policy systems, and not all social groups may similarly react to changes in such contextual factors.

5.1. Methodological considerations

There are several methodological limitations of our study that merit discussion. First, this study has a cross-sectional design. Although we assume that the exposure towards risk factors causes depressive symptoms, reverse causation cannot be ruled out in the sense that, for instance, depressed people are less likely to build strong social networks, or that depression leads to a withdrawal of physical activity and an increased consumption of alcohol so that health problems occur in the long run. Thus, the results of our study need to be replicated longitudinally.

Furthermore, our study is based on a self-report depression screening instrument, so that possible country and gender differences in reporting styles should be kept in mind, although the analysis by Acciai and Hardy (2017) suggests that the gender gap is not an artefact of gender-specific reporting styles. Castro-Costa et al. (2008) investigated the psychometric properties of the EURO-D-scale across ten SHARE-countries and considered the scale as either a uni-dimensional or bi-dimensional scale measure of depression across-countries. Still, the authors emphasize that culturally determined differences in norms or expressions of mood and mental health may have an influence on reporting behaviors. For self-rated health, such influences have clearly been established in the SHARE-sample (Jürges, 2007), so that further studies which adjust for reporting differences to improve the cross-cultural comparability of self-reported depression assessments are needed.

6. Conclusions

This study shows regional differences in the gender gap in the population aged 60–85 years, and that part of the gender gap can be traced back to gendered inequalities in psychosocial, socio-economic, and health-related factors. Further, also prevalence rates within the groups of women and men differed enormously between countries, so that there is still potential to improve mental health in old age in many European countries. Regardless of the country context, health-related factors were of an outstanding importance for explaining within-country variation in depressive symptoms for both women and men. While an extensive review of the literature on interventions for reducing depression in old age is beyond the scope of this study, several recommendations from a public health perspective can be concluded. First, prevention is better than cure. To that end, social policies should aim at providing living conditions that allow for healthy ageing irrespective of gender and further domains of social inequality, such as socio-economic status. Policies relevant for health have often been reduced to health care (Bambra, Fox, & Scott-Samuel, 2005). This falls short as it is not the health care system that keeps people healthy, but rather the social conditions under which people live and work (Marmot, 2005). For instance, Levecque, van Rossem, de Boyser, van de Velde, and Bracke (2011) have shown that welfare state regimes play a significant role in attenuating, boosting, or even reversing the link between depression and economic hardship in old age. Thus, various policy areas are involved in the promotion of mental health in old age.

Second, more efforts are needed to improve help for those already suffering from depression. Depression in older adults is often underdiagnosed so that many of these people receive no or inadequate treatment. Community-based medical and social services are considered important opportunities for recognition and intervention as many older adults with depression are present in these environments (Steinman et al., 2007). However, access to health care is affected by various individual characteristics, such as socio-economic status, age, gender, and the social network. Unmet needs for health care in the older population due to health care costs exist across Europe and are serious in some countries, especially in Estonia and Italy. Most vulnerable are older people with a low income (Krůtilová, 2016). As older women are more often affected by material deprivation than men, inequities in access to health care might also be a contributing factor to the gender gap in depression which should be addressed by policy makers.

As our study shows, the reduction of health-related risk factors for depression seems to be of utmost important for older people in all European countries, whereas interventions regarding socio-economic and psychosocial risk factors should be gender- and context-specific.

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Author's contributions

AS developed the study idea, conducted the statistical analysis, performed the interpretation of the study results and led the writing. MB made substantial contributions to the methodological conception of the study, assisted with the data interpretation and contributed to the writing. Both authors approved the final manuscript.

Declaration of interests

The authors declare that they have no conflicts of interest.

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