Cite as:

Domènech-Abella, J., Mundó, J. et al (2018) The association of socio-economic status on depression among older adults in Finland, Poland and Spain: a comparative cross-sectional study of distinct measures and pathways, Journal of Affective Disorders, 241: 311-318 https://doi.org/10.1016/j.jad.2018.08.077

The association of socio-economic status on depression among older adults in Finland, Poland and Spain: a comparative cross-sectional study of distinct measures and pathways.

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Abstract

Background: Socioeconomic status, as measured by education, occupation or income, is associated with depression. However, data are lacking on the psychosocial, material and behavioral mediators of these associations. We have examined the association of education, occupation and income with depression and the potential mediations using community-based data.

Methods: A total of 7,966 older adults were interviewed in Finland, Poland and Spain. The differential associations between depression and SES, mediator variables, country of residence and cofounder variables, such as chronic physical conditions, were assessed through logistic regression models. Meditation analyses were carried out using khb method for Stata 13.1.

Results: Education, followed by household income, were the SES indicators most frequently significantly associated with depression. These SES markers, but not occupation, showed an independent effect in this association. Psychosocial factors and loneliness in particular showed the strongest associations with depression among mediator variables. However, material factors and, especially, financial strain had a higher mediating function in the association between SES and depression. Overall, SES markers, chronic conditions and mediation factors were more positive in Finland than in Poland and Spain.

Conclusion: Improving psychosocial and material dimensions as well as access to the educational system for older adults might result in a reduction in the prevalence of depression in the general population and particularly among individuals with low SES.
Keywords: Socioeconomic status; Depression; Pathways; Older adults.

Introduction

Depression is one of the most prevalent mental disorder among older adults and it is associated with low quality of life (Blazer, 2003), high likelihood of suicide (Ferrari et al., 2013) and poor physical health (Prince et al., 2007). A systematic review showed the prevalence of major depression ranges from 1% to 16% among the elderly, and from 7.2% and 49% of the elderly have clinically significant depressive symptoms. The main factors associated with depressive disorders in the elderly are female gender, somatic illness, cognitive impairment, functional disability, lack or loss of close social contacts and clinical history of depression (Djernes, 2006).

In 2003, a meta-analysis showed that socioeconomic status (SES) was significantly associated with depression, indicating that low SES slightly increased the risk of episodes and moderately increased the risk of persistence of depression (Lorant et al., 2003). This meta-analysis noted that education was used as a proxy for SES in most studies selected. Although this practice is common in social epidemiology (Dalstra et al., 2005; von dem Knesebeck et al., 2006; Pruchno et al., 2016), other researchers have showed that, in analyses using the three traditional SES indicators, namely educational level, occupation and household income (Krieger et al., 1997), mutually adjusted, each indicator shows independent effects in different chronic conditions

(Geyer et al., 2006). We hypothesize that these differences may be due to each SES indicator being associated with different mediating factors.

At an individual level, SES influences multiple determinants of health: behavioral scientists highlight an increased risk of unhealthy life styles such as a sedentary way of life or tobacco consumption in low SES individuals (Brunello et al., 2015); materialist theories cite unequal access to health care and differing exposure to material deprivation (Helfin and Iceland., 2009; Zimmerman and Katon, 2005); and psychosocial theories relate low SES to a smaller social network and greater likelihood of feeling lonely (Domènech-Abella et al., 2017a, 2017b).

A recent systematic review on the role of biomedical, psychosocial and behavioral factors in the association between SES and self-rated health revealed that material factors contributed most to differences in self-rated health, independently of age, gender and SES indicator (Moor et al., 2016). However, psychosocial factors were identified as the strongest mediator in the association between educational level and depression (Koster et al., 2006). In this last study, physical health status was added as a new pathway between SES and depression. In our view, although low SES is a risk factor for many chronic physical conditions associated with increased depressive symptoms (Bisschop et al., 2004; Koster et al., 2006), the association between SES and physical health status is explained through similar mediators (Stolz et al., 2018), as in the case of the association between SES and depression and it could, therefore, be a confounder in that association rather than a mediator

A recent systematic review and meta-analysis (Patel et al., 2018) showed that income inequality is associated with the prevalence of depression in the population. The Gini coefficient is the most commonly used measure of income inequality and previous studies suggest 0.3 as a potential threshold above which the impact of income inequality

on health may become significantly higher (Kondo et al., 2012). According to Organization for Economic Co-operation and Development data (n.d.), the countries analyzed by the present study (Finland, Poland and Spain), have Gini coefficients of 0.266, 0.298 and 0.344, respectively.

The aim of the present study is to compare the effect of the main socioeconomic status (SES) indicators (education, household income and occupation) and pathways (material, behavioral and psychosocial factors, and physical health status) on depression in a representative sample of older adults from three European countries (Finland, Poland and Spain) with distinct socio-economic characteristics. The goals are: (1) to investigate whether each SES indicator may have an independent effect on depression, (2) to ascertain whether each SES indicator can be associated with specific pathways and (3) to assess the role of income inequality at the country-level in the association between SES and depression.

Methods

Study Design

This study was part of COURAGE in Europe (Leonardi et al., 2014), an observational, cross-sectional, EU-funded, three-year survey of the general noninstitutionalized adult population (18 years or older) performed through household interviews in three European countries (Finland, Poland, and Spain) which were selected to ensure broad representation across different European regions; the north, the east and the south of Europe, taking into consideration various demographic, cultural, socio-economic and health characteristics.

A stratified, multistage cluster sample design was used to obtain nationally representative samples. A probability proportional to size design was used to select clusters. Within each cluster, an enumeration of existing households was done to obtain

an accurate measurement of size. Interviews were conducted face-to-face through Computer-Assisted Personal Interviewing (CAPI) at respondents' homes. All the interviewers participated in a training course on administration of the survey. Quality control procedures were implemented during fieldwork (Üstun et al., 2005). When individuals had severe cognitive impairment, judged at the interviewer's discretion, a shorter version of the questionnaire was administered to a proxy. The instruments were translated from English into Finnish, Polish and Spanish following translation guidelines for assessment instruments issued by the World Health Organization (2013), which included a forward translation, a targeted back-translation, review by a bilingual expert group, and a detailed translation report. The surveys were conducted between 2011 and 2012. The sample was composed of 10,800 individuals: 1,976 from Finland, 4,071 from Poland, and 4,753 from Spain. The individual response rate was 69.9% in Spain, 66.5% in Poland, and 53.4% in Finland. Only those individuals aged 50 years old and over who did not need a proxy respondent were included in this study (n=7,987). Participants not responding to questions on health issues (n=21) were also excluded. Therefore, the final sample was 7,966: 1,433 from Finland, 2,910 from Poland, and 3,623 from Spain.

Ethics statement

Ethical approval from the relevant ethics committees (Parc Sanitari Sant Joan de Déu, Barcelona, Spain; Hospital la Princesa, Madrid, Spain; National Institute for Health and Welfare, Helsinki, Finland, and Jagiellonian University Medical College, Krakow, Poland) was obtained and each participant provided written informed consent.

Measures

Participants were asked to provide socio-demographic and socio-economic information (age, gender, educational level, occupation, household income). Categories

for highest level of education completed were low (primary school or less), medium (secondary or high school) and high (university degree). Participants were asked about the highest professional position attained during his/her life. Occupation was defined using ISCO 08 categories (European Union, 2009) which were categorized into three levels according to their skill requirements: "high" corresponds to managers, senior officials and legislators, professionals, technicians and associate professionals; "medium" corresponds to clerks, service and sales workers, skilled agricultural and fishery workers, craft and related trades workers, plant and machine operators, and assemblers; and "low" corresponds to elementary occupations such as office cleaners, freight handlers, garden laborers and kitchen assistants. Respondents were asked about household income through written statements and marking their best estimates of total household income on scales provided, including income from wages or stipends from a job as well as income from unemployment benefit, pensions, investments, and aid to families or other government or non-government benefits during the previous 12 months. The amount obtained was divided by household size, determined after applying the following weights: 1.0 to the first adult, 0.5 to each other household member aged 14 or over and 0.3 to each household member aged under 14 years old (Eurostat, 2016). Finally, since the association between household income and depression may not be strictly linear (Domènech-Abella et al., 2017a), the variable was divided into quartiles according to the household income of the sample by country.

Pathways

In accordance with previous studies, we selected different pathways through behavioral, material and psychosocial factors (Koster et al., 2006; Moor et al., 2016; Stolz et al., 2018).

Material factors included labor situation (working, retired, unemployed or home-maker), having private insurance and financial strain. To assess financial strain, participants were also asked "Does your household have any problem paying bills (electricity, water, gas, telephone, etc.)?".

Psychosocial factors included social isolation, loneliness and marital status (married, single or previously married). Loneliness was assessed by means of the three-item UCLA Loneliness Scale which has a satisfactory degree of reliability and has both concurrent and discriminant validity (Hughes et al., 2004) and consists of the following items: ''How often do you feel that you lack companionship?''; ''How often do you feel left out?''; and ''How often do you feel isolated from others?''. Each item was answered on a three-point scale (1 = hardly ever; 2 = some of the time; 3 = often). The scores for each item were added to produce a loneliness scale from 3 to 9, with higher scores indicating a greater degree of loneliness. In line with a previous study (Domènech-Abella et al., 2017b), a cut-off of ≥6 for feeling loneliness was established. A social isolation index was also created based on the Berkam-Syme Social Network Index (SNI), which is a validated self-report questionnaire (Berkman and Syme, 1979). Respondents were given a point if they had less than monthly contact with children, other immediate family and friends (each scored as 1) and if they did not participate in any organizations, religious groups or committees more than twice per year (scored as 1). Being unmarried was not considered, as this was directly related to one of the covariates (marital status). The social isolation index was categorized as: Low (2-4), Medium (1) or High (0).

Behavioral factors included Body Mass Index (BMI), tobacco consumption and sedentary lifestyle. BMI was calculated as weight in kilograms divided by height in meters squared and obesity was defined as BMI≥30 kg/m^2. Tobacco consumption was

assessed by asking whether participants were daily smokers, nondaily smokers, former smokers, or had never smoked. Sedentary lifestyle was measured using the Global Physical Activity Questionnaire (Armstrong and Bull, 2006), which collects information on physical activity in three settings as well as sedentary behavior, consisting of 16 questions about activity at work, travel to and from places and recreational activities.

Chronic medical conditions

Chronic medical conditions were based on self-report diagnoses of chronic obstructive lung disease, asthma, hypertension, arthritis, stroke, angina pectoris and diabetes in the previous 12 months. Additionally, symptom algorithms were used to detect undiagnosed cases of arthritis, stroke, angina, chronic lung disease, and asthma (Garin et al., 2016). The presence of hypertension was based on self-report diagnosis or presence of systolic blood pressure $\geq$ 140 mmHg or diastolic blood pressure $\geq$ 90 mmHg measured at the time of the interview (Basu and Millett, 2013; Mancia et al., 2013). Participants were considered to have a chronic medical condition if there was presence of either a diagnosed or undiagnosed condition. An adapted version of the Composite International Diagnostic Interview (CIDI 3.0) was used to assess the presence of depression in the previous 12 months (Haro et al., 2006) along with an algorithm based on the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994).

Statistical analysis

All data were weighted to account for the sampling design in each country and to generalize the study sample to the reference population. Post-stratification corrections were made to the weights to adjust for the population distribution obtained from the national census from each country, and for non-response so that results were representative of the Finnish, Polish and Spanish populations (Moussavi et al., 2007).

Twenty-six percent of individuals had at least one missing socioeconomic variable. We cannot be certain about the reasons for the missing data, but no major discrepancy was found between imputed data and complete-case analysis so we are leaning towards imputed data as missing at random. Missing values were imputed using multiple imputation by chained equations using the predictive mean matching method. The imputation model included important sociodemographic and health-related variables associated with drop-outs. Thirty imputed databases were created (Rubin, 2004).

Descriptive analyses were conducted to characterize the study sample in the three countries. These analyses included weighted proportions and unweighted frequencies. Chi-square tests were used to assess differences across countries in socio-demographic characteristics, SES markers, depression, physical chronic conditions and behavioral, material and psychosocial factors.

Logistic regression models were fitted to test the relationship between SES markers, living in Finland, Poland or Spain, chronic conditions and behavioral, material and psychosocial factors and depression after distinct adjustments. Odds ratio (95% confidence interval) and significance when $p<0.05$ were reported in each model. To test whether the association between socioeconomic markers has a significantly different intensity depending on country, interactions between occupation, education and household income and country of residence were tested, obtaining no significant results (data not shown).

To assess the role of the distinct mediator-factor groups (see Fig.1) in the association between household income, educational level, and occupation skill and depression, mediational analysis were performed using the khb command (Breen et al., 2013; Karlson et al., 2012; Karlson and Holm, 2011) through Stata version 13.1

(StataCorp, 2013). It decomposes the total effect of a variable into direct and indirect (i.e., mediational) effects. For categorical variables, the effects for each category compared with the category of reference are reported. Differences between the highest level (as category of reference) and the lowest level of each SES marker are reported in the present study. This method also allows for the calculation of the mediated percentage, which is interpreted as the percentage of the main association that can be explained by the mediator. The mediated percentage was only considered significant when the total and indirect effects were significant (Santini et al., 2016). The mediational analyses were also controlled for age, sex, country of residence and chronic physical conditions. Results were expressed as coefficients with 95% confidence interval. A p-value less than 0.05 was considered to be statistically significant.

Results

Study sample characteristics are presented in Table 1. Statistically significant differences by country were detected. Spain had older individuals than Finland and Poland, with a lower level of education and occupation and a higher proportion of unemployed individuals. There were also more people suffering from depression, diabetes and chronic lung disease and also from loneliness. However, Spain had a lower proportion of participants with a high level of social isolation. Poland had a higher number of married or cohabiting people, and a higher proportion suffering from angina and hypertension. Finland had a lower proportion of participants with financial strain, obesity and sedentary lifestyles; and a higher proportion with private insurance, and asthma. Finland also had more participants smoking in the past, but with fewer individuals currently smoking.

The multivariable analysis (Table 2) reported factors related to depression after distinct adjustments. In Model 1 each variable was adjusted for age and sex. Having a

lower level of education, occupation skill and household income; smoking currently, having obesity and a sedentary life, with financial strains and without private insurance, not working, with loneliness and social isolation, being separated, divorced or widowed or never married, with chronic physical conditions and living in Spain, were associated with a higher probability of depression. All these associations remained significantly associated with depression in Model 2 (variables adjusted for age, sex and SES markers) and Model 3 (variables adjusted for age, sex, chronic physical conditions and behavioral, material and psychosocial factors) apart from occupation in Model 2 and daily smoker, sedentary, private insurance, diabetes and stroke in Model 3. In Model 4, (variables adjusted for age, sex, and remaining variables) having no formal education, smoking, with obesity and a sedentary lifestyle, being retired or disabled, with financial strain, loneliness and social isolation, being previously married, living in Spain and suffering from chronic conditions (except diabetes and stroke) remained significantly associated with depression.

The results from the mediation analyses on depression are shown in Table 3. All mediated percentages were considered significant apart from behavioral and psychosocial factors for household income; psychosocial factors for educational level; and behavioral factors for occupation skill. The percentages for behavioral, material and psychosocial factors and remaining SES markers as mediators in the association between the lowest household income level (compared with the highest level) and depression were 6.8%, 40.7%, 13.1% and 29.8%, respectively. In the case of educational level the percentages were 8.1%, 15.7%, 10.4%, and 20.0%) and for occupation skill, 9.6%, 24.0%, 27.1%, 52.0% 70.0%. Moreover, the mediated percentage of behavioral, material and psychosocial factors together was 46.6% for household income, 28.6% for education level, and 52% for occupation skill. In this last

case, no significant direct effects were found when analyzing the mediation of all factors together and the mediation of remaining SES markers.

Discussion

The present study analyzed the association between traditional SES markers and major depressive disorder with material, psychosocial and behavioral factors as mediators in three samples of older adults from Finland, Spain and Poland. Education was the SES indicator most frequently significantly associated with depression, whereas psychosocial factors and loneliness in particular showed the strongest associations with depression. However, material factors and, especially, financial strain showed a significantly higher mediating function in the association between SES and depression.

Whereas the association between household income and depression was significantly mediated by material factors, the association with educational level was also found to be significantly mediated by behavioral factors, and the association with occupation skill was mediated by psychosocial factors to an even greater extent than material factors. However, the association between occupation skill and depression is mainly mediated by remaining SES markers and no significant direct effects were found.

Although at a chronological level the logical order would be that a poor education leads to a low-skilled occupation and, consequently, to a low income that could help to explain a poorer health status (Lahelma et al., 2004), the present mediation analysis shows that household income and educational level in particular but not occupation skill have a direct effect on depression, which suggested the need to take into account other potential mediators for each SES marker. Although several studies used education as a proxy for SES (Dalstra et al., 2005; Lorant et al., 2003; Pruchno et al., 2016) arguing that education is a fundamental determinant of household income

(Ross and Wu, 1995) as well as of material and non-material resources and likelihood of unemployment (von dem Knesebeck et al., 2006), according to our results the relationship between each SES marker and depression was explained through different mediators and in different percentages. Therefore, each SES marker should have an independent effect.

Material factors were the main mediators between household income and depression and, with a lower effect, between educational level and depression. Among material factors, financial strain was the factor most strongly associated with depression. It could also have a direct impact on depression as financial strain is conceptually distinct from household income, because it also depends on the individual's ability to live within his/her means (Aneshensel, 2009). In this regard, a cross-sectional study with a representative sample of US older adults emphasized that controlling personal finances could be a protective factor against depression after adjusting for household income (Zurlo et al., 2014). In contrast, depression inequalities between the employed and unemployed (Catalano et al., 2011) as well as between those with and without private insurance (Burstin et al., 1992) have not been found to be significantly associated with depression after adjusting the association for SES and their impact on depression could be strictly as mediators.

The association between educational level and depression has also been found by several researchers to be significantly mediated for behavioral factors, arguing that limited education may mean less exposure to information about risk (Adler and Newman, 2002; van Lenthe et al., 2004). In line with the results of the present study, smoking (An and Xiang, 2015), physical activity (Strawbridge et al., 2002) and Body Mass Index (Oh et al., 2017) have been associated with depression. However, the factors taken into account as mediators by the present study explained 28.6% of the

association between educational level and depression, contrasting with 46.6% for the association between depression and household income. This suggests that other pathways exist, particularly in the association between educational level and depression. In fact, other researchers found developing cognitive abilities to be an important pathway in the association between educational level and depression or quality of life (Lara et al., 2017; Lee, 2011). Thus, future studies comparing distinct pathways between SES and depression should take into account cognitive ability as a potential mediator.

Although psychosocial factors and particularly loneliness were strongly associated with depression, confirming the findings of several studies (Cacioppo et al., 2006; Domènech-Abella et al., 2017a), the association between socio-economic status and loneliness is still unclear and a mixed results have been obtained (Hansen and Slagsvold, 2015; Zebhauser et al., 2015). According to the present study, psychosocial factors did not significantly mediate the association between SES and depression. This, in addition to the independence of marital status, social isolation and loneliness in their associations with depression found in the present study, is consistent with a 5-year longitudinal study on the prospective associations between loneliness and depressive symptoms, according to which this temporal association was not attributable to demographic variables or objective social isolation (Cacioppo et al., 2010).

Overall, the prevalence of depression was significantly lower in Finland than in Spain, with Poland at an intermediate point. Significant interactions between country of residence and SES markers with depression as outcome were not found and the association between higher likelihood of depression and living in Spain remains significant after adjusting the association for SES markers and mediator factors.

Therefore, a higher percentage of depression in Spain could be due to external factors such as income inequality at the country-level.

The results of the present study are consistent with research which compared countries according to their Gini coefficient and suggesting 0.3 as a potential threshold over which the impact of income inequality on health may become significantly higher (Kondo et al., 2012). This could explain why the association between living in Spain and depression remains statistically significant after adjusting the association for SES markers and mediator factors.

In contrast, our results were not consistent with a recent study comparing 23 European countries, according to which the general health status of the population must be poorer in Poland than in Spain (Muntaner et al., 2017). However, this study was not focused on depression and used data from 2003 to 2010 and perhaps the effect of the financial crisis not was as evident as it is nowadays. In fact, previous studies showed a stronger impact of the financial crisis on Spain compared with other European countries as a consequence of austerity policies (Karanikolos et al., 2013) which have been found to have an impact on depression prevalence (Reibling et al., 2017).

Strengths and limitations of the study

The strengths of our study include the use of community-representative data, a sample of older adults from a variety of socio-economic backgrounds and the ability to control for confounding factors. However, several limitations should be kept in mind. First, the cross-sectional design limited the possibility of examining causal relationships. However, two of the main independent variables were time invariant factors such as educational level and highest occupation skill among older adults. Second, there are more behavioral, material and psychosocial factors than are taken into account in the present study. Although we selected the most important mediator factors

according to the literature reviewed, some factors such as financial strain was assessed in a crude way and it is possible than another study with a more extensive factor selection could obtain more comprehensive results. Finally, the response rate in the COURAGE project ranged from 53 to 70%, and therefore there was a possibility of sample selection bias; however, even though there are no strict standards, these response rates can be considered adequate (Draugalis et al., 2008) and similar to the ones found in other European general population studies such as SHARE (Börsch-Supan, et al., 2005).

Conclusions

Our findings are of interest in disentangling various components of the complex associations between socioeconomic circumstances and depression in older adults. Education was the SES indicator most frequently significantly associated with depression, whereas psychosocial factors and loneliness showed the strongest associations with depression, although material factors and financial strain especially seemed to have a higher mediating function in the association between SES and depression. Therefore, improving psychosocial and material dimensions as well as access to the educational system for older adults might result in a reduction in the prevalence of depression in the general population of older adults and particularly among individuals with low SES. Future studies with longitudinal data are needed to reinforce these findings.

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Table 1. Characteristics of the study sample

Characteristic	Overall n=7966	Finland 1433 (21.7)	Poland 2910 (37.8)	Spain 3623 (40.5)	*p*-value
Age groups					
50-64	4095 (53.2)	738 (55.0)	1597 (58.9)	1760 (47.0)	0.000
65-79	2806 (36.5)	480 (34.0)	841 (32.3)	1485 (41.8)	
80+	1065 (10.3)	215 (11.0)	472 (8.8)	378 (11.2)	
Female*	4565 (54.8)	64.9 (28.5)	64.2 (23.7)	66.4 (24.1)	0.438
Household income					
Quartile 4	1721 (26.6)	335 (27.9)	726 (27.1)	660 (25.0)	Not applicable
Quartile 3	1706 (26.1)	271 (22.5)	734 (27.7)	701 (26.2)	
Quartile 2	1665 (24.1)	302 (25.1)	766 (24.4)	597 (23.1)	
Quartile 1	1620 (23.3)	299 (24.5)	675 (20.8)	646 (25.7)	
Educational level					
Tertiary	1218 (15.9)	405 (26.1)	420 (15.7)	393 (10.7)	0.000
Secondary	3306 (45.1)	778 (56.9)	1579 (59.3)	949 (25.5)	
Primary	2097 (24.6)	330 (15.7)	792 (22.6)	1075 (31.3)	
No formal education	1345 (14.4)	20 (1.3)	119 (2.4)	1206 (32.6)	
Occupation 1.					
Skill 3	1994 (28.6)	578 (39.0)	738 (31.6)	678 (19.8)	0.000
Skill 2	3561 (50.4)	678 (49.5)	1324 (52.9)	1559 (48.8)	
Skill 1	1016 (13.4)	145 (10.4)	330(11.7)	541 (16.7)	
Never worked	642 (7.6)	18 (1.1)	127 (3.7)	497 (14.7)	
BEHAVIORAL FACTORS					
Daily smoker					
Never	3877 (46.2)	533 (35.4)	1407 (44.6)	1937 (53.5)	0.000
In the past	2568 (35.0)	711 (50.0)	843 (33.1)	1014 (28.6)	
Currently	1521 (18.8)	189 (14.6)	660 (22.3)	672 (17.8)	
Obesity*	2878 (35.8)	453 (31.7)	1084 (38.0)	1341 (35.9)	0.008
Sedentary*	2550 (30.5)	373 (26.0)	1019 (31.7)	1158 (31.8)	0.018
MATERIAL FACTORS					
Financial strains*	802 (9.3)	71 (5.3)	294 (9.5)	437 (11.3)	0.000
Private Insurance*	1704 (22.6)	515 (36.6)	581 (21.6)	608 (16.0)	0.000
Labor situation					
Working	2229 (31.3)	518 (38.8)	855 (35.0)	856 (23.7)	0.000
Retired	4102 (52.8)	828 (57.4)	1663 (56.5)	1611 (46.9)	
Unemployed	1021 (11.3)	16 (1.0)	202 (5.8)	803 (22.1)	
Homemaker	374 (4.6)	37 (2.8)	77 (2.7)	260 (7.3)	
PSYCHOSOCIAL FACTORS					
Loneliness*	1053 (11.5)	84 (5.9)	497 (13.3)	472 (12.8)	0.000
Social isolation					
Low	5103 (63.4)	895 (61.2)	2036 (68.7)	2172 (59.7)	0.000
Medium	2475 (31.5)	444 (32.0)	723 (25.8)	1308 (36.4)	

High	388 (5.1)	94 (6.8)	151 (5.5)	143 (3.9)	
Marital status					
Single	693 (8.2)	117 (8.5)	266 (7.9)	310 (8.5)	0.006
Married	4819 (65.0)	912 (64.9)	1650 (68.1)	2257 (62.1)	
Separated / divorced	2454 (26.8)	404 (26.6)	994 (24.0)	1056 (29.4)	
CHRONIC CONDITIONS*					
Major depression	663 (7.7)	55 (3.9)	174 (5.2)	434 (12.1)	0.000
Arthritis	2133 (26.5)	393 (26.9)	759 (25.8)	981 (26.8)	0.757
Angina	946 (11.6)	157 (10.5)	554 (17.6)	235 (6.6)	0.000
Asthma	548 (6.6)	123 (8.6)	195 (5.8)	230 (6.3)	0.013
Diabetes	1056 (12.5)	163 (11.3)	380 (11.5)	514 (14.0)	0.042
Hypertension	3563 (45.1)	589 (40.7)	1518 (52.4)	1456 (40.7)	0.000
Chronic lung disease	427 (5.3)	36 (2.9)	159 (5.1)	232 (6.7)	0.000
Stroke	330 (4.4)	57 (4.0)	141 (4.3)	132 (4.6)	0.738

Unweighted frequencies (n) and weighted proportions are displayed. The difference in proportions among countries was tested by Chi-squared tests and p-values are displayed. *Categories of reference: male, body mass index below 30, moderate or high physical activity, without financial strains, without private insurance, below 6 on the 3-item UCLA loneliness scale, and without chronic condition.

Table 2. Factors related factors to depression after distinct adjustments

	Model 1	Model 2
Household income		
Quartile 4	Ref.	Ref.
Quartile 3	1.23 (0.93, 1.61)	1.01 (0.75, 1.36)
Quartile 2	**1.39 (1.07, 1.80)**	0.97 (0.73, 1.30)
Quartile 1	**2.04 (1.58, 2.63)**	1.18 (0.87, 1.59)
Educational level		
Tertiary	Ref.	Ref.
Secondary	**1.56 (1.13, 2.15)**	1.21 (0.84, 1.75)
Primary	**2.42 (1.74, 3.37)**	1.24 (0.83, 1.85)
No formal education	**6.10 (4.39, 8.49)**	**2.13 (1.39, 3.27)**
Occupation 1.		
Skill 3	Ref.	Ref.
Skill 2	**1.56 (1.24, 1.96)**	1.00 (0.76, 1.31)
Skill 1	**2.38 (1.82, 3.12)**	1.00 (0.71, 1.39)
Never worked	**2.88 (2.15, 3.87)**	1.42 (0.90, 1.22)
BEHAVIORAL FACTORS		
Daily smoker		
Never	Ref.	Ref.
In the past	**0.80 (0.65, 0.98)**	1.00 (0.79, 1.27)
Currently	**1.29 (1.04, 1.61)**	**1.31 (1.01, 1.69)**
Obesity*	**1.66 (1.41, 1.95)**	**1.26 (1.05, 1.52)**
Sedentary*	**1.62 (1.37, 1.91)**	**1.12 (0.93, 1.36)**
MATERIAL FACTORS		
Financial strains*	**3.49 (2.87, 4.25)**	**2.01 (1.60, 2.53)**
Private Insurance*	**1.50 (1.20, 1.86)**	1.02 (0.80, 1.30)
Labor situation		
Working	Ref.	Ref.
Retired	**1.97 (1.54, 2.53)**	**1.44 (1.10, 1.90)**
Unemployed	**2.70 (2.03, 3.59)**	1.11 (0.74, 1.66)
Homemaker	**2.79 (1.94, 4.00)**	1.32 (0.88, 1.98)
PSYCHOSOCIAL FACTORS		
Loneliness*	**5.34 (4.48, 6.36)**	**4.45 (3.66, 5.42)**
Social isolation		
Low	Ref.	Ref.
Medium	**1.57 (1.32, 1.86)**	1.12 (0.93, 1.36)
High	**2.45 (1.80, 3.32)**	**1.92 (1.36, 2.72)**

Marital status		
Single	Ref.	Ref.
Married	**1.39 (1.03, 1.86)**	1.19 (0.86, 1.64)
Separated / divorced	**1.98 (1.65, 2.37)**	**1.32 (1.08, 1.62)**
CHRONIC CONDITIONS*		
Arthritis	**2.25 (1.90, 2.65)**	**1.67 (1.38, 2.01)**
Angina	**2.30 (1.87, 2.83)**	**1.89 (1.47, 2.42)**
Asthma	**2.55 (2.01, 3.23)**	**1.49 (1.11, 2.01)**
Diabetes	**1.67 (1.35, 2.06)**	1.14 (0.90, 1.45)
Hypertension	**1.45 (1.24, 1.73)**	**1.22 (1.01, 1.47)**
Chronic lung disease	**3.78 (2.94, 4.85)**	**1.76 (1.28, 2.42)**
Stroke	**1.75 (1.25, 2.46)**	1.23 (0.84, 1.80)
Country		
Finland	Ref.	Ref.
Poland	**1.56 (1.14, 2.13)**	0.92 (0.66, 1.29)
Spain	**3.51 (2.63, 4.68)**	**2.26 (1.61, 3.17)**

NOTE: Logistic regression models adjusted for age and sex. Model 2 is also adjusted for all variables showed by the col. Odds Ratio (95% confidence interval) are displayed. *Categories of reference (ref.): male, body mass index below 30, moderate or high physical activity, without financial strains, with private insurance, below 6 on the 3-item UCLA loneliness scale, and without chronic condition. In bold, significant associations (p<0.05)

Table 3. Logistic regression analyses of the association between SES markers and depression (outcome) with distinct groups of variables as mediators (khb method).

	IV: Household Income		**IV: Educational Level**		**IV: Occupation Skill**	
Mediator	**Coefficient (95% CI)**	**% Mediated**	**Coefficient (95% CI)**	**% Mediated**	**Coefficient (95% CI)**	**% Mediated**
Behavioral factors						
Total	**0.59 (0.33, 0.85)**		**1.11 (0.75, 1.47)**		**0.52 (0.24, 0.81)**	
Direct	**0.55 (0.29, 0.81)**		**1.02 (0.66, 1.38)**		**0.48 (0.19, 0.76)**	
Indirect	0.04 (-0.02, 0.09)	6.8%	**0.09 (0.02, 0.16)**	**8.1%**	0.05 (-0.01, 0.11)	9.6%
Material factors						
Total	**0.54 (0.28, 0.80)**		**1.08 (0.72, 1.44)**		**0.50 (0.21, 0.78)**	
Direct	**0.32 (0.05, 0.59)**		**0.91 (0.55, 1.28)**		**0.38 (0.09, 0.67)**	
Indirect	**0.22 (0.13, 0.31)**	**40.7%**	**0.17 (0.07, 0.26)**	**15.7%**	**0.12 (0.04, 0.20)**	**24%**
Psychosocial factors						
Total	**0.61 (0.34, 0.88)**		**1.15 (0.78, 1.51)**		**0.48 (0.19, 0.78)**	
Direct	**0.53 (0.27, 0.80)**		**1.03 (0.66, 1.40)**		**0.35 (0.06, 0.64)**	
Indirect	0.08 (-0.05, 0.20)	13.1%	0.12 (-0.02, 0.25)	10.4%	**0.13 (0.00, 0.26)**	**27.1%**
All mediators						
Total	**0.58 (0.30, 0.85)**		**1.12 (0.76, 1.49)**		**0.50 (0.20, 0.79)**	
Direct	**0.30 (0.02, 0.59)**		**0.81 (0.43, 1.19)**		0.24 (-0.06, 0.54)	
Indirect	**0.27 (0.12, 0.43)**	**46.6%**	**0.32 (0.15, 0.49)**	**28.6%**	**0.26 (0.10, 0.41)**	**52.0%**
Remaining SES markers						
Total	**0.57 (0.31, 0.83)**		**1.10 (0.74, 1.45)**		**0.50 (0.21, 0.79)**	
Direct	**0.40 (0.13, 0.67)**		**0.88 (0.47, 1.29)**		0.15 (-0.17, 0.48)	
Indirect	**0.17 (0.07, 0.27)**	**29.8%**	**0.22 (0.00, 0.44)**	**20.0%**	**0.35 (0.17, 0.53)**	**70.0%**

NOTE: All models are adjusted for age, sex, chronic physical conditions and country of residence. Among SES markers, differences between the highest level (as category of reference) and lowest level are analyzed (quartile 4 vs. quartile1, tertiary studies vs. no formal education, and skill 3 vs. skill 1). IV=independent variable; CI=confidence interval. In bold, significant associations (p<0.05)