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Social participation and depression in old age: A fixed effects analysis in ten European countries

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ABSTRACT

We examined whether changes in different forms of social participation were associated with changes in depressive symptoms in older Europeans. We used lagged individual fixed effects models based on data from 9,068 individuals aged 50+ in wave 1 (2004/05), wave 2 (2006/07) and wave 4 (2010/11) of the Survey of Health, Ageing and Retirement in Europe (SHARE). Controlling for a wide set of confounders, increased participation in religious organizations predicted a decline in depressive symptoms four years later (β =-0.190 units, 95% confidence interval: -0.365, -0.016), while participation in political/community organizations was associated with an increase in depressive symptoms (β =0.222, 95% confidence interval: 0.018, 0.428). There were no significant differences between European regions in these associations. Our findings suggest that social participation is associated with depressive symptoms, but the direction and strength of the association depends on the type of social activity. Participation in religious organizations may offer benefits to mental health beyond those offered by other forms of social participation.

Keywords: ageing; depression; Europe; fixed effects models; social participation

List of abbreviations:

CI: confidence interval

EURO-D: EURO-Depression scale

SHARE: Survey of Health, Ageing and Retirement in Europe

The recent Burden of Disease study ranks Major Depressive Disorders as a leading cause of disability (1, 2). A study comparing ten countries in Northern, Southern and Western Europe reported that the prevalence of depressive symptoms of clinical significance in older adults ranged from 18% in Denmark to 37% in Spain (3). Despite the high burden of depression in old age, there is limited understanding of the potential causes and interventions that may help preventing depressive symptoms among older individuals.

Lower social participation and less social interaction in old age are each associated with higher depressive symptoms (4-15). Social interaction provides individuals with a sense of belonging and social identity together with opportunities for participation in activities and projects (16). With some exceptions (17), several studies have found that active participation in religious or church activities, clubs, political groups, and volunteering are associated with better mental health and reduced depressive symptoms (6, 8, 11, 13-15). However, the causal impact of social participation on depression has not been well established. Associations may reflect confounding by unmeasured characteristics, or reverse causality from depression to social participation. One source of confounding comes from permanent personal characteristics that differ between individuals and that may be associated with both depressive symptoms and social participation, such as personality traits, socioeconomic status, childhood conditions or intellectual ability (18). For example, individuals with certain psychological or personality traits may be more likely to engage in social participation and they may also exhibit lower levels of depression,

which may result in a spurious association between social participation and depression.

Fixed effects models have been advocated as a useful approach to control for the impact of these permanent characteristics (19-22). Fixed effects estimators, sometimes called 'within' estimators, control for unobserved individual heterogeneity that may be correlated with the explanatory variable. They exploit the longitudinal nature of the data by assessing the association between changes in the explanatory variable and changes in the outcome variable within individuals, thus controlling for permanent characteristics that vary across individuals. This is in contrast to the more commonly applied random effects or 'between' estimators, which combine variation 'between' as well as 'within' individuals for estimation. While confounding by unmeasured time-varying characteristics is also a potential concern in fixed effects models, they can provide additional insights into the potential causal association between social participation and depression by controlling for individual heterogeneity.

Earlier studies linking social participation to depressive symptoms primarily focused on single populations or countries (5, 6, 13, 23-25). Levels of both depressive symptoms and social participation vary considerably across countries, possibly due to cross-national variations in the availability of state-provided support and services, family and social structures, or policies that promote or discourage social participation and mental well-being (3, 26, 27). A potential hypothesis is that the social significance of different forms of social participation is context-dependent, so

that the mental health benefits of social participation vary across countries or European regions. For example, in Southern European countries with stronger family networks, voluntary work may be less relevant to health than in Northern European countries where family support roles have been replaced by formal care, and the social benefits of voluntary work may be larger (28).

Building up on earlier work (29), this paper examines how changes in different forms of social participation predict changes in depressive symptoms in older individuals using fixed effects models. In addition, we explore whether the association between various forms of social participation and depressive symptoms differs across European regions.

METHODS

Study design

Data for this study were drawn from the Survey of Health, Ageing and Retirement in Europe (SHARE) (30). In SHARE, information on health, social networks and economics were collected among adults aged 50 years and older using computer-assisted personal interviews (CAPI). During the first wave (2004/05), 31,115 participants were included across twelve countries, with a total household response of 62%, varying between 38.8% in Switzerland to 81.0% in France. We included respondents who entered SHARE in wave 1 (2004/05) and who were followed-up in wave 2 (2006/07), and wave 4 (2010/2011) (n=10,706). Data from wave 3 (2008/2009) were excluded because depressive symptoms were not assessed. Ten countries contributed to all three waves of the longitudinal sample: Austria, Belgium, Denmark, France, Germany, Italy, Spain, Sweden, Switzerland and the Netherlands.

Social participation

In each wave, respondents were asked whether they engaged in the following activities during the last month: 1) voluntary or charity work; 2) educational or training course; 3) sport, social or other kind of club activities; 4) religious organizations; and 5) political or community organizations. For each activity, an additional question was asked about the frequency of participation using the four response options “almost daily”, “almost every week”, “almost every month”, and “less often”. In wave 4, the recall period for participation in social activities was altered to refer to the last twelve months. To maintain consistency in the recall

period, our analysis focused on changes in social participation between waves 1 and 2 only.

Depressive symptoms

Depressive symptoms were assessed in all three waves, and were measured by the EURO-Depression scale (EURO-D) (31). The EURO-D consists of twelve items: depression, pessimism, death wish, guilt, sleep, interest, irritability, appetite, fatigue, concentration, enjoyment, and tearfulness. Each item is scored 0 (symptom not present) or 1 (symptom present), and item scores are summed (0-12). Previous studies have demonstrated the validity of this measure against a variety of criteria for clinically significant depression, with an optimal cut-off point of 4 or above (31, 32).

Background variables

Educational level was based on the highest educational degree obtained. National levels were re-classified according to the 1997 International Standard Classification of Education into: lower education (classifications 0-2), medium education (classifications 3-4) and higher education (classifications 5-6) (33). Countries were classified into Northern Europe (Sweden and Denmark), Southern Europe (Italy and Spain) and Western Europe (Austria, Belgium, France, Germany, Switzerland, the Netherlands). Marital status was defined as 1) married; 2) divorced, separated or unmarried; and 3) widowed. Household size was categorized into a one-, two-, three-, and a four-or-more-person household. Concerning employment status, respondents were either 1) employed, including self-employment, 2) unemployed,

including permanently sick or disabled and homemakers, or 3) retired. Financial difficulties, which measured to what extent respondents were able to make ends meet with their income, included four response options ranging from “with great difficulty” to “easily”. Self-rated health was measured using a 5-point scale with response options: “excellent”, “very good”, ”good”, “fair”, and ”poor”. Long-term illness was assessed by self-reports of having a long-term health problem, illness, disability or infirmity. The Global Activity Limitation Index, limitations with activities of daily living and limitations with instrumental activities of daily living were used to describe the respondents’ functioning and disability (34, 35). Each limitation index was dichotomized based on whether respondents had limitations with one or more activities. Occurrence of diseases diagnosed by a doctor was assessed for heart attack, high blood pressure or hypertension, stroke, diabetes or high blood sugar, and chronic lung disease.

Statistical analysis

We applied fixed effects models (19-21) to assess whether within-individual changes in social participation were associated with within-individual changes in depressive symptoms. Fixed effects control for potential time-invariant confounders that vary across individuals, such as sex, family background, and pre-existing health and levels of depression. In essence, fixed effect models use each individual as his or her own control, by comparing an individual’s depression score when he or she is exposed to a given level of social participation, with the same individual’s depression score when he or she is exposed to a different level of social participation. Assuming that intra-individual changes in exposure are uncorrelated with changes in other

variables, the difference in depression scores between these two periods is an estimate of the effect of social participation on depressive symptoms for that individual. Averaging these differences across all persons in the sample yields an estimate of the average 'treatment effect', which controls for all stable characteristics of the individual. Although it does not control for time-varying variables such as employment and marital status, these can be handled conventionally by incorporating them into the regression model. Fixed effect models have two requirements. First, the dependent variable must be measured for each individual in a comparable fashion and metric on at least two points in time. Second, the exposure variable of interest must change across these two occasions for at least a fraction of the sample (36).

Our basic model specification was as follows:

$$Eurod_{it} = \mu_t + \beta_1 social\ participation_{it} + \beta_2 x_{it} + \propto_i + \varepsilon_{it} \quad (1)$$

where $Eurod_{it}$ indicates EURO-D scores for individual *i* at time *t*, $social\ participation_{it}$ is a vector of indicator variables for social participation, x_{it} is a vector of supplementary control regressors, and ε_{it} is the error term. μ_t accounts for time effects constant across individuals, while $\propto_i$ controls for time-invariant individual characteristics.

To minimize the potential impact of reverse causality, we implemented fixed effects models that use lagged social participation and examined whether changes in social

participation indicators between waves 1 and 2 were associated with changes in depressive symptoms between waves 2 and 4. In the online supplement, we also show results from contemporaneous models that examined the association between changes in social participation between waves 1 and 2 and changes in depressive symptoms over the same period (Web Table 1 and Web Figure 1).

In addition to the fixed effects models, we implemented a series of random effects models. We followed standard approaches and conducted a Hausman specification test (37), which tests the null hypothesis that estimates from the fixed effects model are not different from estimates in the random effects model. Our results yielded a significant Hausman test ($P < 0.0001$), which indicated that, at conventional levels of significance, the assumption of no correlation between explanatory variables and individual characteristics was violated in the random effects model. We reported estimates from random effects models in the online supplement (Web Table 2).

To report population descriptive statistics, we used appropriate weights to account for the sampling design, nonresponse and attrition. Weights were calibrated against the national population by age group and sex, as well as for mortality in-between waves. The analytical sample was limited to respondents with valid weights for the balanced panel (n=9,491). Respondents were dropped if information was missing for depressive symptoms at waves 2 or 4 (n=363), or for social participation at waves 1 or 2 (n=132); this resulted in an analytical sample of 9,068 individuals.

We followed a step-wise approach in the construction of the fixed effect models, starting with a basic model that controlled for age and time (wave) only. Models additionally incorporated controls for time-varying marital status, household size, employment status, financial difficulties, self-rated health, long-term illness, limitations and self-reports of major diseases diagnoses for heart attack, high blood pressure or hypertension, stroke, diabetes or high blood sugar, and chronic lung disease. We did not apply weights in regression models, because when sampling probabilities vary only on the basis of explanatory variables, weighting would be unnecessary for consistency, and potentially harmful for precision (38). Nonetheless, we reported estimates from weighted regressions in the online supplement (Web Table 3). Due to the low efficiency in fixed effects models, estimates from weighted models were very imprecise and we therefore decided to emphasize unweighted results. Robust standard errors were applied to account for non-independence clustering at the individual level. All analyses were carried out using Stata Statistical Software, release 13 (StataCorp, College Station, Texas).

RESULTS

The mean age at baseline was 63 years (Table 1). Less than half of respondents were male (44.9%) and about half were lower educated (50.6%). Educational attainment varied across European regions, with the highest share of lower educated living in Southern Europe (78.6%). Almost half of the study population was retired (48.3%) and 41.1% reported having difficulties to make ends meet. Over 50% reported to have a long-term illness; a doctor's diagnosis of hypertension was the most often reported condition (33.0%), followed by heart attack (10.3%) and diabetes (9.6%).

Social participation levels varied markedly across regions (Table 2). Respondents from the Southern European countries reported to be least participative. This difference was most pronounced for participation in sports, social or other kind of club activities (7.5% in Southern Europe, 26.5% in Western Europe, 32.6% in Northern Europe). Although the prevalence increased slightly for several measures, social participation was very similar across the two waves for all regions and measures. There was great variation in the prevalence of depressive symptoms across regions as well as over time (Figure 1). In wave 1, 26.0% of the respondents had a depressive symptom score of ≥4 points, the cut-off indicative of clinical depression symptomatology, but levels varied from 15.5% in Northern Europe to 34.6% in Southern Europe. There was a small decline in the prevalence of depressive symptoms between waves 1 and 2, whereas an increase in depressive symptoms was observed between waves 2 and 4. Within types of social participation, the lowest baseline prevalence of depressive symptoms was found for participating in

political activities (18.0%) and highest for participating in religious activities (23.2%) (data not shown). For all types of activities the prevalence of depressive symptoms was highest among those who were not active.

In models that assessed the contemporaneous association between changes in social participation and depressive symptoms between waves 1 and 2 and controlled for confounders, participation in sports, social or other kind of club and participation in political or community organizations predicted a decline in depressive symptoms (β for sports/social club =-0.102, 95% confidence interval (CI): -0.186, -0.019; β for political/community =-0.170, 95% CI: -0.319, -0.022) (Web Table 1 and Web Figure 1). However, many of these associations did not hold in lagged fixed effect models. As shown in Table 3, only increased participation in religious organizations was associated with a decline in depressive symptoms four years later, even after controlling for all confounders (β =-0.190, 95% CI: -0.365, -0.016). In addition, increased participation in political/community organization was associated with higher depressive symptom scores (β =0.222, 95% CI: 0.018, 0.428).

To explore whether there were differences in the association between social participation and depressive symptoms across Europe, stratified analysis were carried out by European region (Figure 2). There was no evidence of significant or systematic differences between European regions in these associations, although this was partly due to wide confidence intervals in each region.

DISCUSSION

Our findings suggest that social participation is associated with depressive symptoms, however, the strength and direction of the association depend on the type of activity. Participation in religious activities was the only form of social engagement associated with a decline in depressive symptoms four years later. Participation in a political or community organization was instead associated with an increase in depressive symptoms. The mechanisms linking social participation to mental health in old age may thus differ for different activities.

Our results offer mixed support for the previously observed association between social participation and depressive symptoms (5, 6, 11, 13-15, 23-25, 39). We did not find significant associations for participation in voluntary or charity work, or educational or training course. This finding seems to be in contrast with results from previous research (40, 41). In models that were only adjusted for age and time, we did find contemporaneous associations between volunteering and depressive symptoms. However, these associations were not robust to controlling for time-varying confounding, and these activities did not predict changes in depressive symptoms four years later. Similarly, changes in participation in sport, social and club activities were associated with a contemporaneous decline in depressive symptoms, but did not predict changes in depressive symptoms four years later. A possible explanation is that short-term benefits arising from these forms of social participation diminish over time, or that they reflect the impact of depression on the likelihood of participating in social activities.

Earlier research has found that religiously active individuals have better mental health than the religiously inactive (24, 42). Our findings suggest that this association might reflect a causal association. Participation in religious organizations may protect mental health through several pathways, including influencing lifestyle, enhancing social support networks, and offering a mechanism to cope with stress (24, 42). For example, religion has been shown to serve as a copying mechanism during a period of illness in late life (43, 44). Through attendance to religious activities, individuals may also become more attached to their community, preventing social isolation, a predictor of old-age depression. Spirituality has also been proposed as an important promoter of mental health, but this construct is not well defined and its relationship with depression is not well understood (24). By contrast, individuals may not accrue the same social support, lifestyle and copying benefits from participation in sport, social and club activities, which may explain the fact that these forms of social participation did not predict depressive symptoms four years later. Although we expected stronger associations between social participation and depressive symptoms in Northern and Western European countries, the lack of regional differences in the associations across Europe, support findings from Di Gessa & Grundy (17).

We found that participation in a political or community organization was associated with an increase in depressive symptoms four years later. Insights from the effort-reward balance theory may provide a partial explanation. Participation in political or community organizations could be beneficial for health when reciprocity is expected

(45), which may partly explain the positive association in contemporaneous models. Respondents may experience a higher sense of reward when starting participation in a political or community organization. In the long run, however, the balance may shift towards higher effort and lower reward, which may trigger depressive symptoms. Another potential explanation for contemporaneous associations is reverse causality, i.e., depressed individuals may be less likely to participate in political or community organizations. Lagged models are less susceptible to reverse causality, as they relate current changes in social participate to subsequent changes in depressive symptoms. In our study, however, that there was relatively little change in participation in a political or community organization, so that fixed effects may not be the best method to assess the impact of this particular form of social participation.

Some limitations should be considered in our paper. Changes in social participation may be correlated with changes in other variables associated with depressive symptoms. For example, older individuals may increase or initiate participation in religious activities after the birth of a grandchild, the death of a child or sibling, or the onset of illness. The influence of several of these variables on our estimates is difficult to anticipate, however, as several of them might increase rather than decrease depression, leading to an underestimation of the association of participation in religious activities on depression. Another concern is reverse causation. Although we found that participation in a religious organization was associated with decreased depression scores over a four-year period, we cannot completely rule out that this association may be due to the impact of depression on

social participation. However, sensitivity analysis that excluded respondents who had four or more depressive symptoms at baseline, confirmed our finding for participation in religious organizations, diminishing concerns for reverse causation (β =-0.306; 95% CI: -0.481, -0.131). Next, as with other longitudinal studies, SHARE suffered from attrition, resulting from both mortality and non-response. This may have led to sample selection bias, potentially compromising internal validity (30). Earlier substudies of the SHARE project showed that although health and living arrangements at baseline predicted initial survey participation and panel retention, there were no systematic differences in response and attrition rates by key characteristics such as sex, age and employment status (46, 47). While there is no fully satisfactory way to address this, we incorporate in our models these and other time-varying variables, and focus our interpretation on these models. Finally, a limitation of fixed effect models is that estimation is based only on the small fraction of individuals that change exposure over the follow-up period. For example, between waves 1 and 2, only 6.8% of the sample changed their participation in political/community organizations, resulting in large standard errors. Changes were more common for participation in voluntary/charity work (15.0%), education/training (11.9%), sport/social club (20.1%), and religious activities (10.6%).

In conclusion, our findings suggest that increased social participation is associated with depressive symptoms. However, the strength and sometimes direction of the association varies by social participation activity. We found that increased participation in religious activities is associated with subsequent declines in depressive symptoms, suggesting the possibility of a causal association. Our results

highlight the importance of distinguishing different types of social participation to understand how social engagement influences mental health and wellbeing. Further research is required to identify the specific mechanisms that explain the association between participation in religious activities and depressive symptoms. If proven causal, however, our results may suggest that policies that encourage or enable older individuals to maintain their affiliation to religious communities (e.g., by facilitating their attendance to their religious communities via public transport) may result in reduced depressive symptoms among older persons.

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Table 1. Weighted General Characteristics at Baseline (2004/05) by Geographical Region Among SHARE Longitudinal Respondents Aged 50 Years and Older.

	Total (%)	Western Europe (%)	Northern Europe (%)	Southern Europe (%)
	N=9,068	N=5,459	N=1,673	N=1,936
Age[a]	62.9 (8.8)	62.9 (8.9)	62.7 (9.3)	63.1 (8.7)
Sex, male	44.9	44.1	45.9	45.8
Educational level[b]				
Lower	50.6	32.4	34.8	78.6
Medium	30.8	41.1	34.0	15.6
Higher	18.6	26.4	31.2	5.9
Marital status[c]				
Married	70.1	68.1	64.1	73.9
Divorced, separated or unmarried	14.4	16.5	21.8	10.4
Widowed	15.5	15.5	14.1	15.7
Household size				
One person	21.5	24.7	30.8	15.7
Two persons	50.9	57.1	57.6	41.0
Three persons	14.8	10.4	6.7	22.1
Four or more persons	12.9	7.8	4.9	21.2
Employment status				
Employed	29.1	32.4	45.3	22.2

Unemployed	22.6	18.5	7.1	30.5
Retired	48.3	49.1	47.6	47.3
Financial difficulties[d]	41.1	27.0	19.8	63.6
Less than very good self-rated health	74.0	73.0	45.8	79.1
Long-term illness[c]	50.9	50.0	52.2	52.0
Limitations (GALI)	39.8	40.2	38.9	39.3
ADL limitations[e]	7.2	7.1	5.8	7.4
IADL limitations[e]	10.4	9.7	9.5	11.5
Heart attack[f]	10.3	11.2	9.8	9.2
Hypertension[f]	33.0	32.0	29.1	35.0
Stroke[f]	2.6	2.9	2.9	2.1
Diabetes[f]	9.6	9.1	6.7	10.7
Lung disease[f]	5.5	4.7	3.2	6.9

Abbreviations: SHARE, Survey of Health, Ageing and Retirement in Europe; GALI, Global activity limitation index; ADL, activities of daily living; IADL, instrumental activities of daily living

[a] expressed as mean (standard deviation); [b]n=8,998; [c]n=9,067; [d]n=6,460; [e]n=9,066; [f]n=9,065

Table 2: Weighted Prevalence (%) of Social Participation Frequency by Geographical Region Among SHARE Longitudinal Respondents Aged 50 Years and Older, Wave 1 and Wave 2 (N=9,068)[a], 2004/05–2006/07.

	Wave 1 (2004/05) (%)			Wave 2 (2006/2007) (%)		
	Western Europe	Northern Europe	Southern Europe	Western Europe	Northern Europe	Southern Europe
Voluntary/charity						
Never	81.6	78.0	92.9	80.7	74.5	91.8
<1 per week	6.3	9.3	2.6	6.9	10.0	2.4
≥1 per week	12.2	12.7	4.5	12.4	15.5	5.8
Educational/training						
Never	91.8	85.5	98.5	91.6	83.0	97.4
<1 per week	4.9	9.5	0.7	4.4	8.8	0.6
≥1 per week	3.4	5.1	0.8	4.0	8.2	2.0
Sport/social club						
Never	73.5	67.4	92.5	72.1	62.8	89.9
<1 per week	7.8	6.8	1.9	7.2	4.8	2.0
≥1 per week	18.7	25.7	5.7	20.7	32.4	8.2
Religious						
Never	89.3	93.7	91.4	88.4	87.8	90.3
<1 per week	4.1	1.8	2.9	4.3	5.9	2.1
≥1 per week	6.6	4.5	5.7	7.3	6.3	7.6
Political/community						

Never	94.1	94.4	96.9	94.1	94.1	98.2
<1 per week	4.2	3.1	1.6	3.8	3.8	0.9
≥1 per week	1.8	2.5	1.6	2.1	2.1	0.9

Abbreviation: SHARE, Survey of Health, Ageing and Retirement in Europe

[a] Sample size varied by type of activity by 0 to 3 missing values

Table 3: Lagged Associations Between Changes in Social Participation and Changes in Depressive Symptom Score Among Respondents Aged 50 Years and Older in the SHARE Longitudinal Sample, 2004/05–2010/11.

	Model 1[a] (n=9,068)		Model 2[b] (n=7,385)	
	β	Robust 95% CI	β	Robust 95% CI
Voluntary/ charity work	0.085	-0.022, 0.193	0.020	-0.112, 0.152
Educational/ training	0.023	-0.096, 0.141	0.041	-0.101, 0.183
Sport/ social club	0.097	0.004, 0.190	0.081	-0.036, 0.199
Religious	-0.145	-0.281, -0.010	-0.190	-0.365, -0.016
Political/ community	0.111	-0.051, 0.273	0.222	0.018, 0.428

Abbreviation: SHARE, Survey of Health, Ageing and Retirement in Europe

CI, confidence interval

[a] Model 1: social participation (mutually adjusted), age, time

[b] Model 2: social participation (mutually adjusted), age, time, household size, marital status, employment status, financial difficulties, self-rated health, long-term illness, limitations, diagnosed heart attack, high blood pressure or hypertension, stroke, diabetes or high blood sugar, chronic lung disease

Figure 1: Weighted Prevalence Estimates (%) and Standard Errors of ≥4 Depressive Symptoms Among Respondents Aged 50 Years and Older in Western, Northern and Southern Europe in the Survey of Health, Ageing and Retirement in Europe (SHARE) Longitudinal Sample for Wave 1 (N=9,027), Wave 2 (N=9,068) and Wave 4 (N=9,068) , 2004/05–2010/11. White bars represent wave 1 (2004/05), grey bars represent wave 2 (2006/07), black bars represent wave 4 (2010/11).

Figure 2: Lagged Associations (β with robust 95% confidence interval (CI)) Between Changes in Social Participation and Changes in Depressive Symptom Score by European Region Among Participants Aged 50 Years and Older in the Survey of Health, Ageing and Retirement in Europe (SHARE) Longitudinal Sample (N=7,385) , 2004/05–2010/11. White bars represent Northern Europe, grey bars represent Western Europe, black bars represent Southern Europe.