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Running head: IPD Meta-Analysis on Neighborhood and Depression

Abbreviations: CES-D, Center for Epidemiological Studies Depression; CI, Confidence Interval; ELSA, English Longitudinal Study of Ageing; HRS, Health and Retirement Study; IPD, Individual participant data; OR, Odds Ratio; SHARE, Survey of Health, Ageing and Retirement in Europe.

ABSTRACT

Although residential environment might be an important predictor of depression among older adults, systematic reviews point to a lack of longitudinal investigations and the generalizability of the findings is limited to a few countries. We used longitudinal data collected after 2012 in three surveys, including 15 European countries and the United States, and comprising 32,531 adults aged 50 and over. The risk of perceived neighborhood disorder and lack of social cohesion on depression was estimated using two-stage individual participant data meta-analysis; country-specific parameters were analyzed by meta-regression. We ran additional analyses on individuals reaching retirement. Neighborhood disorder [Odds Ratio (OR)=1.25] and lack of social cohesion (OR=1.76) were significantly associated with depression in the fully adjusted models. In retirement, the risk of depression was even higher (neighborhood disorder: OR=1.35; lack of social cohesion: OR=1.93). Heterogeneity across countries was low and significantly reduced by the addition of country-level income inequality and population density. Perceived neighborhood problems increased the overall risk of depression among adults aged 50 and over. Policies, especially in countries with stronger links between neighborhood and depression, should focus on improving physical environment and supporting social ties in communities, which can reduce depression and contribute to healthy ageing.

Keywords: Depression, Residence Characteristics, Meta-Analysis, Mental Health, Cohort Studies, Multicenter Studies.

Depression is one of the leading causes of disability worldwide, affecting one out of five individuals during their lifetime (1) and it is associated with large economic burden (2). Over the age of 50, approximately 13.5% of people are suffering from clinically relevant depressive symptoms (3), and this percentage dramatically rises among the oldest-old (4). Due to global ageing, the number of people older than 65 is expected to grow by almost three-fold by 2050 (5), which will significantly increase the disease burden related to depression. These processes present a range of challenges for social, economic and healthcare systems, and require age-specific adaptations to support healthy ageing (6).

In ageing individuals, psychosocial and health-related determinants become more prominent risk factors for the incidence (7) and recurrence of depression (8). Due to increasing morbidities, functional decline and life course transitions (e.g. retirement) older people tend to spend more time in their local area, which affects the pathways through which physical and social characteristics influence their social and psychological well-being (6, 9). Exposure to adverse neighborhood conditions such as vandalism, crime, littering and traffic have been found to increase the risk of depression through direct and indirect pathways (10, 11), while social cohesion or social capital buffers individual distress and weakens the risk of depression (12, 13).

Although there is a growing literature on neighborhoods and mental health, relatively few studies have assessed the longitudinal associations for this age group (9), and evidence is based on a low number of (mainly Anglo-Saxon) economies, limiting the generalizability of the findings. Examining the evidence of neighborhood effects in different settings will provide further insights into the public health significance of the residential environment. In addition, the inclusion of several countries enables the consideration of between country heterogeneity in neighborhood effects. Although, previous studies have shown that the prevalence of depression (14) and its association with social inequality (15) differs by welfare

regimes (i.e. typology indicating how states manage their economy, providing social protection and income transfers; originally introduced by Esping-Andersen (16)), there is no evidence of differential neighborhood effects. Moreover, as micro-, and meso-level social and environmental factors (e.g. population density, green space, air pollution) have been previously associated with mental health, and also interact with each other (9), it is feasible that they will modify neighborhood effects on mental health between countries. Understanding how country-level social, environmental or welfare state differences influence the neighborhood-mental health link can help to prioritise public health policies and interventions at the national-level.

The primary aims of this individual participant data (IPD) meta-analysis were the following: First, we examined the longitudinal associations (2 years) between perceived neighborhood disorder, social cohesion and depressive symptoms among adults aged 50 and over, estimating the risk in a wide range of European and North-American countries. Second, meta-regression explored effect modification by welfare regimes and by other macro-level social or environmental indicators on the country-specific neighborhood effects. In a secondary analysis, we investigated the robustness of our findings for retired individuals, a subgroup of the sample, for whom we assumed stronger associations than in the general sample, as this group tends to spend more time in its residential environment.

METHODS

Data sources

Data were drawn from three representative longitudinal panel surveys of ageing adults: the English Longitudinal Study of Ageing (ELSA) (17), the Health and Retirement Study (HRS) (18) and the Survey of Health, Ageing and Retirement in Europe (SHARE) (19). All studies have comparable designs and contain information on non-institutionalized community-

dwelling adults aged 50 (or 51 for HRS (18)) and over as well as details on their partners irrespective of their age. Individuals were followed-up approximately every second year with regular refreshment samples to compensate for attrition bias and to balance the age structure. The initial HRS cohort was recruited in 1992 in the United States (20) and served as an exemplar for subsequent ageing studies. ELSA, with a representative sample for England was set up in 2002 (17). The first wave of SHARE was conducted in 2004/2005 and the most recent wave in 2015 included 17 European countries and Israel (19). ELSA, HRS and SHARE are harmonized, allowing cross-national comparisons.

Our analytic sample comprised individuals who provided valid measurements of depression at two consecutive waves, and answered at least one question on perceived neighborhood at the baseline wave. We excluded participants if they had depression at baseline, were living in nursing homes, were younger than 50, moved to a new residential address between baseline and follow-up or had missing values for baseline covariates. As data on the neighborhood were not usually collected in all waves, we used the most recently available sweeps in compliance with our criteria: for ELSA wave 7 (2014/2015) and wave 8 (2016/2017), for SHARE wave 5 (2013) and wave 6 (2015). In HRS, since 2006 approximately 50% of the sample is selected for an enhanced face-to-face interview while the other half is interviewed via telephone; the survey mode alternates each wave. Neighborhood perception is part of the psychosocial questionnaire, which is assessed after the face-to-face interviews, once in every four years for the same person (18). Therefore, in order to have information for the entire HRS sample we extracted exposure from two consecutive waves (wave 11 in 2012 and wave 12 in 2014) and link them with matching follow-ups (wave 12 in 2014 and wave 13 in 2016). The attrition rate between baseline and follow-up was 16% for ELSA, 12% and 16% for the two HRS subsamples, and in SHARE ranged from 15% (Switzerland) to 32% (Luxemburg).

Neighborhood

For the measures of perceived neighborhood disorder and lack of social cohesion, we used four similarly operationalised items asking about the *"local area, that is everywhere within a 20 minute walk or about a mile/ a kilometer of your home"*. Neighborhoods were assessed in ELSA and HRS on a 7-point bipolar scale in the self-completion part, while SHARE applied a 4-point Likert-scale in the interview denoting agreement or disagreement with the opposing statement. *A priori,* we assigned two items to the neighborhood disorder domain, capturing 1) vandalism and crime/graffiti, and 2) cleanness of the area. Lack of social cohesion included items on 1) feeling part of the area and 2) receiving help if in trouble. Principal component analysis did not confirm the two-component structure but indicated one underlying score, which provided satisfying internal consistency (Cronbach alpha: 0.57-0.82). In order to make neighborhood variables comparable across studies, we first dichotomized all items (SHARE: 0-1 versus 2-3; ELSA, HRS: 0-1-2-3 versus 4-5-6) to obtain similar response patterns between cohorts. Scales were computed by calculating the average value of the respective items, which ranged between 0 and 1.0 with higher numbers indicating more problems and less cohesion in the residential area.

Depression

Depressive symptoms were assessed with two self-reported symptom scales: Center for Epidemiological Studies Depression (CES-D) was implemented in ELSA and HRS, EURO-D in SHARE. The original CES-D scale with 20 items was developed to detect depressive symptomatology in the general population in the week preceding the interview (21). In ELSA and HRS, a short version of CES-D has been used with 8 items, asking respondents whether they felt depressed, felt that everything was an effort, had restless sleep, were happy, lonely, enjoyed life, felt sad, or could not get going. EURO-D consists of 12 items measuring the

presence of depression, pessimism, wishing death, guilt, sleep, interest, irritability, appetite, fatigue, concentration, enjoyment and tearfulness in the last month (22). Both scales have high internal consistency and test-retest reliability, provide a valid measurement of depression (22, 23), and show high correlation within the same population (23). Binary answers, indicating the presence or absence of depressive symptoms, were summed up with increasing scores for higher levels of depressive symptoms. For an approximation of clinically significant level of depressive symptoms, a cut-off of ≥3 was applied for CES-D (23), and ≥4 for EURO-D (22, 23); thresholds also used in a recent comparative study (24).

Baseline covariates

We adjusted for several sociodemographic and health-related confounders at the baseline wave, relevant to the neighborhood-depression association (10, 12, 25, 26). In addition to sex (male, female), age (due to non-linear relationship with depression this variable was categorized: 50-59, 60-69, 70-79 and 80+), and immigration (born in the country of interview or not), we included three indicators of socioeconomic status: educational attainment, total equalized household net wealth and economic activity. For education, we used the International Standard Classification of Education classification from the harmonized datasets and grouped the highest educational attainment into three categories: primary (level 0 and 1), secondary (level 2, 3 and 4) and tertiary (level 5 and 6). Household non-pension net wealth included financial, physical and housing wealth after all debt has been subtracted. We calculated an equalized measure by dividing the household sum by the square root of benefiting members (27), and categorized it into country-specific tertiles (low, medium and high wealth). Economic activity described whether the respondent was working (employed, self-employed), retired, or out of labor force (homemaker, unemployed, permanently sick or disabled). We included information on partnership (married or cohabiting versus neither) and on current smoking (yes, no). A binary variable described whether respondent reported at

least two out of seven physician-diagnosed chronic diseases or conditions (arthritis, cancer, cardiovascular diseases, diabetes, high blood pressure, lung diseases and stroke). Finally, functional limitations indicated whether the respondent had at least one disability affecting activities of daily living or instrumental activities of daily living (28).

Country-level indicators

Countries were grouped into welfare regimes based on an expanded classification (15) of Ferrera's typology (29), which is considered as a state-of-the-art and often used in cross-national surveys (15). The 1) Scandinavian welfare regimes (Denmark, Sweden) are described with universal coverage and generous social transfers; the 2) Bismarckian (Austria, Belgium, France, Germany, Luxembourg, Switzerland) with earnings-related benefits administrated by the employer and with familialism; the 3) Anglo-Saxon regimes (England, Israel, United States) with minimum welfare provision and strong emphasis on the market (15). The 4) Southern European welfare regimes (Italy, Spain) are characterized as "rudimentary" with services ranging from generous to limited and with high reliance on the family (15, 29). Finally, the 5) Eastern European welfare regimes consist of post-communist countries (Czech Republic, Estonia, Slovenia) which have experienced shifts towards marketization from more universalist Communist welfare states (15).

Macro-level social and environmental indicators were extracted from the World Bank Database (https://data.worldbank.org/) for the closest year of data collection (Web Table 1): Gross Domestic Product at Purchasing Power Parity per capita (in $), Gini index of income inequality, population density (people per km^2), urbanization rate (% of urban population), forest coverage (% of land area) and annual mean air pollution (PM2.5 in $\mu g/m^3$). Before including in the models, we standardized all external raw data. Correlations between indicators are shown in Web Table 2.

Statistical analysis

We conducted a two-stage IPD meta-analysis to estimate the overall associations between perceived neighborhood and depression (30). First, we ran separate logistic regression models for each country, including perceived neighborhood as a continuous independent variable to obtain Odds Ratios (OR) of depression with 95% Confidence Intervals (CI). Second, we derived effect estimates and their variance and pooled them using meta-analysis. Heterogeneity between countries was quantified with I^2, indicating the % of variance explained by countries (31). As the heterogeneity was low (I^2 < 25%), we estimated fixed-effects models with inverse variance pooling, assuming a single underlying true association across countries (30). We present two sets of models: the first controlled for age and gender, the second was adjusted for all confounders (age, gender, country of birth, education, wealth, economic activity, partnership status, current smoking, chronic diseases or conditions and functional limitations). Prior to the main analyses, we tested the linearity assumption by imputing neighborhood variables in categorical form into the models, which was confirmed by the stepwise increasing gradients. Interaction models did not reveal significantly different neighborhood associations among male and female participants; therefore, no gender-stratified results were prepared.

Though heterogeneity was relatively low, we still examined whether the between country variation of the risk estimate might be explained by sample (sample size, % of female participants) or country characteristics (e.g. welfare regime, Gini index, air pollution). We first retained log odds and their standard errors from the fully adjusted logistic models and then performed univariable random-effects meta-regression. Models were fitted with the restricted maximum likelihood method and corrected with the Hartung-Knapp variance estimator.

As multicenter studies can be analyzed in various ways (32), in the sensitivity analyses we provided risk estimates pooled by 1) two-stage IPD with random-effects models, and estimated with 2) one-stage IPD with random intercepts (multilevel logistic models), and 3) one-stage IPD with fixed country effects (logistic models). Although we expected only small differences (30), we report the two-stage IPD meta-analysis as the main results, because in multilevel models at least 30 countries would be required to accurately estimate the country-level parameters (33). Findings on neighborhood disorder and lack of social cohesion are presented in the Results section, while analyses on the composite neighborhood problems score are in the Web material (Web Table 3-4, Web Figure 1). We provided stage one results of the IPD meta-analysis (i.e. covariate adjusted logistic models by countries) for the composite neighborhood problems score in Web Table 3.

All analyses were performed using STATA 13.

Figure 1

RESULTS

After applying all inclusion and exclusion criteria (Figure 1), the pooled analytic sample contained 32,531 participants from 16 different countries: Austria (n = 1,448), Belgium (n = 1,875), Czech Republic (n = 1,645), Denmark (n = 1,491), England (n = 4,634), Estonia (n = 1,713), France (n = 1,250), Germany (n = 1,819), Israel (n = 561), Italy (n = 1,157), Luxemburg (n = 456), Slovenia (n = 1,144), Spain (n = 1,742), Sweden (n = 1,640), Switzerland (n = 1,310) and the United States (n = 8,646). Table 1 reports the sample characteristics by surveys. For the total sample, 55.3% were female and the mean age was 66.7 years. Over half of the sample was retired at the time of data collection (56.8%). Although household wealth was defined as three equally large categories within countries, in the analytic dataset there was an underrepresentation of individuals from the low wealth

group, partly because of censoring at baseline of depression cases. After two years, the incidence of depression was 13.2% with large country variation ($P < 0.001$), ranging between 8.1% (Denmark) and 22.7% (Estonia).

Table 1

The IPD meta-analyses models showed significantly elevated ORs of clinically relevant depressive symptoms by neighborhood disorder (1.44, 95% CI: 1.28, 1.61) and lack of social cohesion (1.99, 95% CI: 1.75, 2.26) after adjustment for gender and age (Web Figure 2). In the fully adjusted models (Figure 2), the pooled OR for neighborhood disorder was 1.25 (95% CI: 1.11, 1.41), ranging between 0.52 and 2.11 and significantly higher than 1 in the Czech Republic, Denmark and the United States. Lack of social cohesion had a pooled OR of 1.76 (95% CI: 1.54, 2.01), ranging from 0.91 to 5.36, significantly elevated in Belgium, Czech Republic, Estonia, France, Germany, Slovenia, England and in the United States. Meta-regression indicated stronger associations between lack of social cohesion and depression in more equal countries (B = -0.174, $P = 0.01$), measured by Gini index. Furthermore, there was a tendency for stronger associations between lack of social cohesion and depression in countries with higher levels of air pollution (B = 0.152, $P = 0.09$) (Table 2).

Figure 2

We repeated the analyses for individuals in retirement. In the gender and age adjusted models, neighborhood disorder had an OR of 1.48 (95% CI: 1.28, 1.72), while the OR of lack of social cohesion was 2.06 (95% CI: 1.73, 2.45) (Web Figure 3). Although after adjustment for all covariates, the pooled ORs decreased, they remained higher in this subsample than in the full sample. The pooled OR of neighborhood disorder was 1.35 (95% CI: 1.16, 1.57), 10% higher when including only participants at retirement compared to all participants aged 50 and over. The pooled OR of lack of social cohesion was 1.93 (95% CI: 1.61, 2.30)

indicating 17% higher odds of depression during retirement (Web Figure 4). Meta-regression analyses found significantly elevated risk of depression by lack of social cohesion in more equal countries (B = -0.188, *P* = 0.04) and in countries with higher population density (B = 0.194, *P* = 0.04). There was a tendency for weaker associations between neighborhood disorder and depression in countries with more forest coverage (B = -0.175, *P* = 0.099), and for stronger associations between lack of social cohesion and depression in countries with higher levels of air pollution (B = 0.205, *P* = 0.07) (Table 2).

Table 2

The pooled neighborhood associations were robust and did not significantly differ when estimated in one-stage (random or fixed country effects) or in random-effects two-stage IPD meta-analysis (Web Table 5). Analyses with the composite neighborhood problems score resulted in comparable risk estimates (full sample: 1.74, 95% CI: 1.49, 2.03; in retirement: 1.96, 95% CI 1.60, 2.40) (Web Figure 1) than the ones calculated for lack of social cohesion. Similarly to the main analysis, we found stronger associations between neighborhood problems and depression in more equal countries (B = -0.160, P = 0.04). In the subsample of retirees there was a tendency for weaker associations between neighborhood problems and depression in countries with more forest (B = -0.248, *P* = 0.095), and for stronger associations by higher population density (B = 0.202, *P* = 0.07) (Web Table 4).

DISCUSSION

This cross-national longitudinal study provides evidence for the link between perceived neighborhood disorder, lack of social cohesion and depression among adults aged 50 and over. These findings are based on the analyses of three representative panel surveys including 32,531 participants across 16 high-income countries. Risk estimates were on average 10-17% higher in a subsample containing only individuals in retirement than in the total sample. We

identified low country-level variation between the risk of depression by neighborhood problems, which could be partly explained by macro-level indicators such as income inequality, population density, forest coverage and air pollution.

Our findings are in line with previous cross-sectional (9), and longitudinal studies exploring the possible effect of perceived neighborhood disorder (10, 11, 26) and social cohesion/ social capital (12, 13, 25, 34) on the risk of depression in older age. As people age and then retire, the geographical extent of their mobility space tends to reduce, and they often become more reliant on their community and local services (9). At the same time, depression trajectories widen by neighborhood quality in ageing individuals (12), leading to stronger associations between neighborhood and depression among retired individuals.

The findings suggest that the broader social, economic and environmental context of the respective country might modify the association between neighborhood characteristics and depression. In Southern European countries, neighborhood disorder and lack of social cohesion did not increase the risk of depression, while in Eastern Europe and Anglo-Saxon countries we often found strong and significant associations. Welfare regimes did not statistically explain differences, which may be because of the low number of countries in each group. However, other unexplored social norms and cultural values predicting the source of social support (community vs. family and close relatives) and the ways of coping with residential stressors, might be better predictors of the modification of the relationship. Meta-regression estimated stronger risks of depression by lack of social cohesion, when people were living in economically more equal countries. Egalitarian countries tend to have better health outcomes, which might be linked via social capital or other aspects of social organization (35). Perceived lack of social cohesion in more equal economies, therefore, violates the normative rules of the society and the general expectation of people with regards of their neighborhoods and neighbors. This perceived discrepancy between reality and

expectations might cause insecurity and lead to higher level of psychological distress. There was also a weak evidence for the modifying role of air pollution on the link between social cohesion and depression, which seems to be important in more polluted countries, where social cohesion can buffer the distress induced by air pollution (36). In addition to income inequality and air pollution, findings among retired individuals revealed that in countries where people live in closer proximity to each other, the lack of social cohesion predicted depression more strongly. The value of the immediate community increases with higher population density, especially for those being more reliant on their surroundings. Finally, neighborhood disorder tended to have higher risk on mental health in countries with less forest. Exposure to nature is protective for mental health by reducing the hazardous effect of environmental distress (37) caused by e.g. neighborhood disorder, traffic noise or air pollution.

We report, for the first time to our knowledge, pooled risks of depression for neighborhood disorder and lack of social cohesion among adults aged 50 and over based on several high-income countries, many of them (e.g. Southern and Eastern European countries) often neglected in research. Presented analyses are based on longitudinal data with baseline and follow-up measures of outcome, placing this paper amongst the few prospective studies in the neighborhood literature. Effect estimates from 16 different countries were pooled together by IPD meta-analyses, taking into account demographic, socioeconomic, and health confounders. Moreover, we provided possible explanations for country-level differences in the risk of depression by neighborhood problems.

The study also has limitations. First, exposure, outcome and covariates are all self-reported measures. Although we excluded possible depression cases at baseline to avoid the potential for underlying depression to distort the perceptions of neighborhood or covariates, we could not completely rule out reverse causation or non-measured psychological mechanism (e.g.

reporting behavior) leading to biased estimates (38). Second, despite the high correlation between outcome measures, they have relevant differences (23): CES-D tends to have stronger associations with social and demographic factors, indicating a more extreme pool of cases, and captures a shorter time interval (one week versus one month). Third, there was a significant number of missing values for neighborhood perception. Although the sample size was not related to the variation between effect parameters, non-response bias might have influenced the results. Missing values for neighborhood are originated from the survey method in ELSA and HRS (e.g. leave-behind questionnaire), while in SHARE only part of the sample (household respondents) were asked about their residential area, providing very different reasons of missingness in the pooled dataset. Fourth, as neighborhood perception was not assessed in each wave, we could not include the same year of baseline and follow-up for all surveys, which meant that it is possible that unknown macro-economic or societal changes may have affected the results. Fifth, several European and North American countries were not included in this study, either due to the lack of data or insufficient data harmonization. We cannot exclude the possibility that the absence of these countries may influence the study's findings.

Future research should make use of comparable multicenter surveys (e.g. Gateway to Global Aging Data), and extend its focus to low- and middle-income countries. Although there are cross-sectional multicenter studies on residential environment and health available in different country settings (39), longitudinal evidence is needed to better understand how macro-level social and environmental indicators shape neighborhood effects. In addition, using objectively measured neighborhood exposure would overcome possible bias related to self-reported measures. Neighborhood environment is a significant determinant of mental health and has the potential to narrow the negative effects of socioeconomic inequalities on health (39). Moreover, it is modifiable and therefore offers policymakers opportunities for

intervention to enhance health among older adults (6). Policies, especially in countries with stronger link between neighborhood and depression should focus on improving physical qualities of the residential areas and supporting social ties in communities, which can reduce mental health problems and related disability, and make positive contributions to healthy ageing.

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ELSA: The data were made available through the UK Data Archive. The English Longitudinal Study of Ageing was developed by a team of researchers based at University College London, the National Centre for Social Research and the Institute for Fiscal Studies. The data were collected by the National Centre for Social Research. The funding was provided by the National Institute of Aging in the United States, and a consortium of UK government departments coordinated by the Office for National Statistics.

HRS: The Health and Retirement Study is sponsored by the National Institute on Aging (grant number NIA U01AG009740) and conducted by the University of Michigan. This

analysis uses Early Release data (for wave 2016), which have not been cleaned and may contain errors that will be corrected in the Final Public Release version of the dataset.

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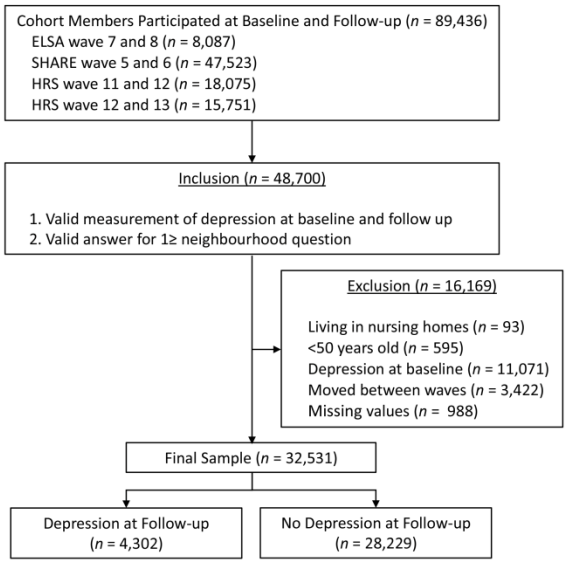
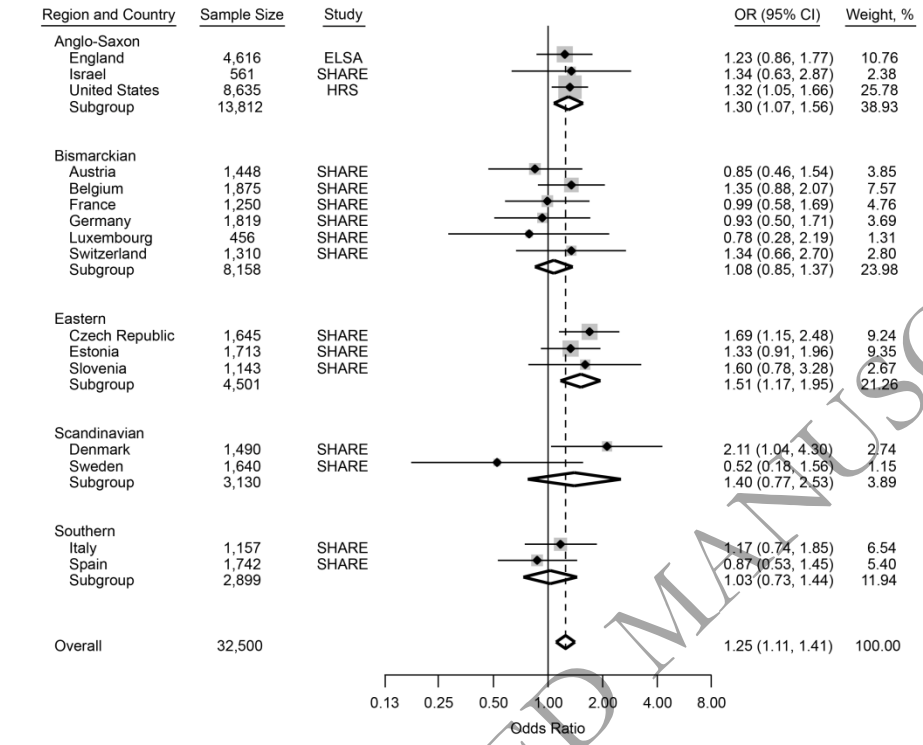
Figure 1. Flowchart of participant selection for the pooled ELSA, HRS and SHARE data set. Pooled data contains information assessed between 2012 and 2017 in 16 different countries. Note that HRS collects information on neighborhood perception from half of the sample in each wave. As the survey mode alternates between waves, we extracted and merged both subsamples. Abbreviations: ELSA, English Longitudinal Study of Ageing; HRS, Health and Retirement Study; SHARE, Survey of Health, Ageing and Retirement in Europe.

Figure 2. Country-specific and pooled associations of A) perceived neighborhood disorder and B) perceived lack of social cohesion with depression among adults aged 50 and over in 16 high-income countries between 2012 and 2017. Models are adjusted for age, gender, country of birth, education, wealth, economic activity, partnership status, current smoking, chronic diseases or conditions and functional limitations; countries are grouped by welfare regimes. The size of each grey square is proportional to the relative weight of the sample in the meta-analysis; diamonds represent the pooled estimates. Odds ratios (OR) > 1 indicate increased, while OR < 1 decreased risk of depression. The overall I^2 was 0.0% ($P = 0.53$) for perceived neighborhood disorder and 23.7% ($P = 0.19$) for perceived lack of social cohesion. CI, Confidence Interval; ELSA, English Longitudinal Study of Ageing; HRS, Health and Retirement Study; SHARE, Survey of Health, Ageing and Retirement in Europe.



A)



B)

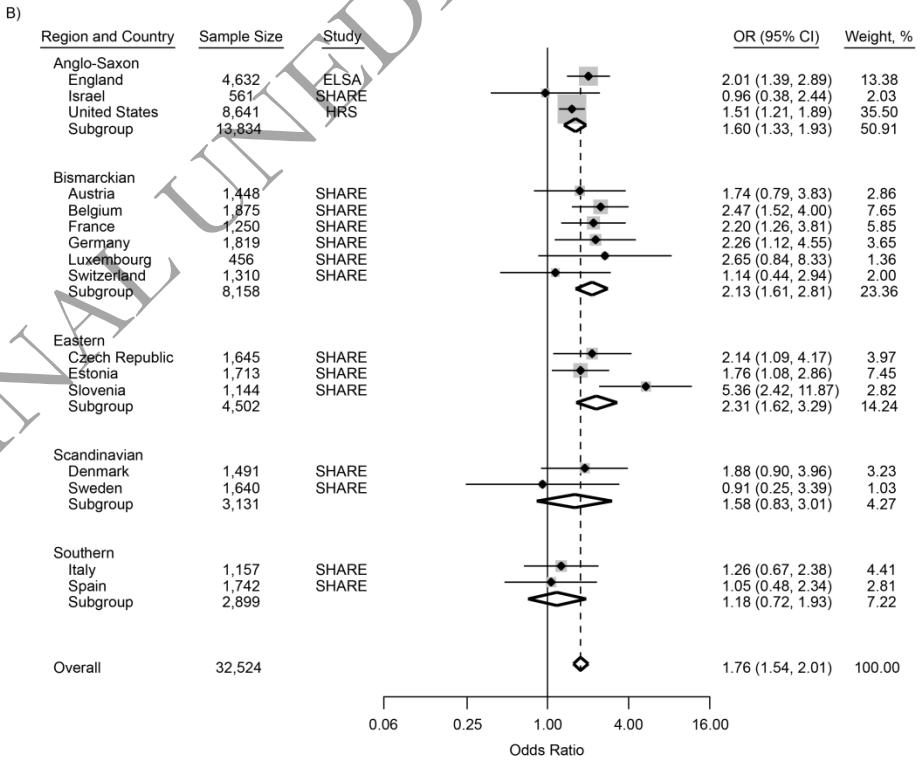


Table 1. Baseline[a] and Follow-up[b] Characteristics (%) of 32,531 Adults Aged 50 and Over in the ELSA (4,634), HRS (8,646) and SHARE (19,251) Studies Between 2012 and 2017.

Characteristics[c]	ELSA	HRS	SHARE	Pooled Data
Gender				
Male	46.3	42.0	45.5	44.7
Female	53.7	58.0	54.5	55.3
Age				
50-59	18.2	26.2	28.4	26.4
60-69	43.3	30.2	37.1	36.1
70-79	29.1	31.1	24.8	27.1
80<	9.3	12.6	9.7	10.4
Country of birth				
Born in the country	94.1	88.6	89.5	89.9
Born outside	5.9	11.4	10.5	10.1
Educational attainment				
Primary	19.2	12.8	17.3	16.4
Secondary	46.2	60.1	55.9	55.6
Tertiary	34.6	27.1	26.8	28.0
Equalized household wealth				
Low	26.1	22.4	30.8	27.9
Medium	35.7	36.2	33.4	34.5
High	38.2	41.4	35.8	37.6
Economic activity				
Employed	30.4	35.4	29.6	31.3
Retired	62.6	49.7	58.7	56.8
Out of labor force	7.0	14.9	11.7	11.9
Partnership status				
In a couple	77.1	68.5	63.9	67.0
Alone	22.9	31.5	36.1	33.0
Current smoking				
No	91.6	89.5	82.8	85.9
Yes	8.4	10.5	17.2	14.1
Chronic diseases or conditions				
Less than two	76.9	41.5	76.3	67.2
Two or more	23.1	58.5	23.7	32.8
Functional limitations				
No	83.4	90.6	90.7	89.6
At least one	16.6	9.4	9.3	10.4
Neighborhood disorder[d]	0.13 (0.004)	0.12 (0.003)	0.15 (0.002)	0.14 (0.002)
Lack of social cohesion[d]	0.09 (0.003)	0.13 (0.003)	0.08 (0.001)	0.09 (0.001)
Composite neighborhood score[d]	0.11 (0.003)	0.13 (0.003)	0.11 (0.001)	0.12 (0.001)
Depression at follow up				
Yes	10.4	10.4	15.2	13.2
No	89.6	89.6	84.8	86.8

Abbreviations: ELSA, English Longitudinal Study of Ageing; HRS, Health and Retirement Study; SHARE, Survey of Health, Ageing and Retirement in Europe.

[a] Baseline measures: ELSA (2014/2015), HRS (2012, 2014), SHARE (2013).

[b] Follow-up measures: ELSA (2016/2017), HRS (2014, 2016), SHARE (2015).

[c] Proportions may not sum to 100, because of rounding errors.

[d] Values are expressed as mean (standard error).

Table 2. Meta-Regression Analysis on the Effect Estimates of Perceived Neighborhood Disorder and Lack of Social Cohesion on Depression in 16 High-Income Countries Between 2012 and 2017.

Country-level indicators[a]	Neighborhood disorder[b]			Lack of social cohesion[c]		
	B	**SE**	***P***	**B**	**SE**	***P***
	Aged 50 and over					
Sample size	0.021	0.038	0.60	-0.059	0.047	0.23
% of female participants	0.098	0.060	0.13	-0.044	0.094	0.65
GDP PPP per capita	-0.065	0.088	0.47	-0.052	0.128	0.69
Gini index	-0.026	0.054	0.64	-0.174	0.061	0.01
Population density	0.002	0.059	0.97	0.089	0.073	0.24
% of urban population	0.016	0.074	0.84	-0.064	0.104	0.55
% of forest coverage	-0.062	0.080	0.45	0.055	0.110	0.63
Air pollution ($PM_{2.5}$)	0.044	0.062	0.49	0.152	0.083	0.09
	In retirement					
Sample size	0.054	0.056	0.35	-0.097	0.063	0.15
% of female participants	0.084	0.083	0.33	-0.186	0.121	0.15
GDP PPP per capita	0.061	0.114	0.60	-0.003	0.158	0.99
Gini index	0.019	0.070	0.79	-0.188	0.082	0.04
Population density	0.044	0.078	0.58	0.194	0.087	0.04
% of urban population	0.133	0.094	0.18	0.096	0.123	0.45
% of forest coverage	-0.175	0.099	0.099	-0.102	0.125	0.43
Air pollution ($PM_{2.5}$)	0.038	0.078	0.64	0.205	0.102	0.07

Abbreviations: GDP PPP, Gross Domestic Product in Purchasing Power Parity; $PM_{2.5}$, Particulate matter of ≤ 2.5 μm in diameter; SE, Standard Error.

[a] Raw data was standardized before meta-regression.

[b] Associations between neighborhood disorder and depression did not differ by welfare regimes (aged 50 and over: $F_{(4,11)} = 1.29$; $P = 0.33$; in retirement: $F_{(4,11)} = 1.18$; $P = 0.37$).

[c] Associations between lack of social cohesion and depression did not differ by welfare regimes (aged 50 and over: $F_{(4,11)} = 1.73$; $P = 0.21$; in retirement: $F_{(4,11)} = 0.71$; $P = 0.60$).