



Formal social participation protects physical health through enhanced mental health: A longitudinal mediation analysis using three consecutive waves of the Survey of Health, Ageing and Retirement in Europe (SHARE)

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ABSTRACT

Introduction: Previous studies have shown that formal social participation may reduce the risk of developing chronic conditions. Yet, the underlying mechanisms are largely unknown. In this study, we assessed the potential mediating roles of quality of life and depressive symptoms using longitudinal data.

Method: We analyzed nationally representative data from three consecutive waves (2011, 2013, 2015) of the SHARE survey, including 28,982 adults from 12 European countries aged 50 years and above at baseline. Measures were self-reported and included formal social participation (i.e. active participation within volunteer organizations, educational institutions, clubs, religious organizations, or political/civic groups), quality of life (CASP-12), depressive symptoms (EURO-D), and chronic conditions. Structural equation modeling was used to construct a focused longitudinal path model.

Results: Formal social participation at baseline was inversely associated with the number of chronic conditions at 4-year follow-up. We identified two significant longitudinal mediation patterns: 1) formal social participation predicted higher levels of quality of life, which in turn, predicted lower levels of chronic conditions; and 2) formal social participation predicted lower levels of depressive symptoms, which, in turn, also predicted lower levels of chronic conditions.

Conclusions: Formal social participation functions as a protective factor against the onset or development of chronic conditions. This association is partially explained by enhanced quality of life and diminished depressive symptoms.

1. Introduction

With aging populations, Europe faces increases in life expectancies, along with accumulating morbidities as people live longer (Rechel et al., 2009). Gaps between life expectancies and healthy life expectancies continue to increase, with recent reports showing that although some populations in Europe live longer, they face considerable years lived in poor health (Swerling, 2019). Population aging and worsening health trajectories therefore implies increasing healthcare demands, while fewer working-age people will be available to support health systems financially. The number of people suffering from multiple chronic conditions (multimorbidity) is increasing dramatically in

Europe as well as around the world, involving complex care needs and both costly and challenging care tasks in medicine (Navickas et al., 2016). It is therefore imperative to identify protective factors that may prevent or delay the onset and increase in chronic conditions and multimorbidity in late-life in order to secure the sustainability of European health and financial systems.

Voluminous research has documented the fundamental role of social connectedness as a protective factor for health (Christakis and Fowler, 2011; Holt-Lunstad et al., 2010; Smith and Christakis, 2008; Thoits, 2011). While social connectedness is a broad concept covering multiple types of being related to and engaged with the social environment, a specific line of research has investigated *social participation*. Although

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agreement is lacking regarding specific definitions (Levasseur et al., 2010), informal social participation generally comprises an individual's interactions with close social ties and personal relationships (friends, family, relatives, neighbors, coworkers, etc.), while formal social participation refers to the active interaction with established organizations (Ertas, 2013). Formal social participation is particularly interesting from a health promotion perspective, as it may be considered a behavioral gateway to other social constructs that are known to constitute essential protective factors for health. Formal social participation may, for example, be instrumental as a means to establishing lasting social relationships (conducive to social support) (Giles et al., 2012; Lim and Putnam, 2010; Wallace et al., 2019), social capital (resources and benefits received through connections with others) (Rodgers et al., 2019), as well as social identification (fostering a sense of belonging to a group or community) (Haslam et al., 2017; Lim and Putnam, 2010). Further, while social participation may constitute a way to keep physically active, previous research have shown that it is not just the physical activity, but rather the productive engagement with others in the process of participating in these activities that confers benefits to health (Maier and Klumb, 2005; Wallace et al., 2019).

While the bulk of previous research has uncovered direct associations between formal social participation and physical and mental health, large-scale longitudinal studies carried out to estimate indirect pathways are scarce (Bath and Deeg, 2005). A literature review investigating the role of formal social participation in health found that the majority of studies showed positive associations between formal social participation and psychosocial wellbeing, physical health, and survival (Adams et al., 2011). Importantly, the authors stress that studies tend not to explore mediating effects of relevant constructs, such as those pertaining to mental/psychological factors, that may illuminate the mechanisms by which formal social participation confers health benefits. Some research indicates that formal social participation, i.e. volunteering specifically, may contribute to enhanced mental health by providing: 1) a sense of meaning and purpose through contribution to the community, 2) psychological and cultural resources, such as competences, skills, and values, and 3) opportunities for social connectedness (Santini et al., 2018b). Formal social participation may therefore benefit physical health through the enhancement of quality of life relating to positive feelings and positive functioning (He et al., 2017), as well as protect against the development or increase in depressive symptoms (Cruwys et al., 2013; Li et al., 2018).

The concept of mental health is viewed as more than the absence of mental disorders (WHO, 2004). In other words, mental health is not just absence of the negative end of a mental health spectrum, but it is also the presence of the positive end (Huppert, 2005). Depression, which is now the single largest contributor to global disability (WHO, 2017), is a mental health state that would generally be located at the negative end of the mental health spectrum. An example of a mental health state located towards the positive end is quality of life (QoL). Quality of life has been defined as “the satisfaction of an individual's values, goals and needs through the actualization of their abilities or lifestyle” (Emerson, 1985). There is widespread agreement that mental health status strongly influences physical health, and that mental health should be a key consideration in changing the health status of a community or population (Patel et al., 2018; Prince et al., 2007). Mental health plays a major role in health behaviors, for example diet, sleep, and exercise, as well as risk behaviors such as the consumption of tobacco, alcohol and drugs, unsafe sexual behavior, or violent behavior (WHO, 2004), all of which may impact on physical health and the risk of developing chronic conditions. Depression may for example reduce or inhibit motivation to engage in healthy behaviors or prioritize one's own health (Allgöwer et al., 2001). Conversely, high quality of life may promote good health by providing people with a sense of optimism and energy to engage in healthy behaviors (Lee et al., 2019; Pressman et al., 2019; Salovey et al., 2000). Thus, mental health may play an important role in the association between formal social participation and health status.

Therefore, the aims of this study were to investigate a) the direct relationship between formal social participation and chronic conditions, and b) the extent to which mental health - in terms of depression and quality of life - mediates the relationship between formal social participation and chronic conditions. To achieve this aim, we conducted a prospective study using data from three consecutive waves (2011, 2013, 2015) of the Survey of Health, Ageing, and Retirement in Europe (SHARE), a community-based survey of twelve European countries. Our main variables were formal social participation, chronic conditions, and validated measures for symptoms of depression and quality of life. To our knowledge, this is the first study to construct and assess a longitudinal mediation model with the variables of interest. It is essential to conduct such large-scale epidemiological studies to understand how formal social participation might protect against the development of chronic conditions in the general population, as well as the role played by mental health in this relationship. Based on previous literature, we hypothesized that formal social participation would predict lower levels of chronic conditions over time, and that quality of life and depressive symptoms would mediate this relationship.

2. Method

Data stem from Wave 4 (2011), 5 (2013), and 6 (2015) of the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE is a European bi-annual, cross-national and longitudinal research project collecting nationally-representative data among community-dwelling participants aged 50 years and above at this study's baseline (2011). To ensure that all waves are representative of the respective countries, the SHARE survey includes refreshment samples to increase net sample size and compensate for attrition in the longitudinal samples. Waves 4, 5, and 6 were conducted in 12 out of 20 countries participating in SHARE: Austria, Germany, Sweden, Spain, Italy, France, Denmark, Switzerland, Belgium, Czech Republic, Slovenia, and Estonia. Wave 4 individual response rates varied from 33.1% for Czech Republic to 58.4% for Estonia (Bergmann et al., 2017). For the longitudinal analysis reported in this paper, we examined the 28,982 participants who took part in Wave 4 and were followed through Waves 5 and 6 (Fig. 1 shows the selection of the study sample). We chose to analyze data from Waves 4–6 because we were interested in three consecutive waves appropriate for a mediation design (three time points for the predictor, mediator, and outcome, respectively), and because Waves 4, 5, and 6 were the three most recent standard SHARE data collections. Throughout the methods and results section, Waves 4, 5, and 6 will be referred to as Time 1 (T1), Time 2 (T2), and Time 3 (T3), respectively.

Ethics approval for the SHARE project was granted by the Ethics Council of the Max-Planck-Society for the Advancement of Science.

2.1. Outcome: chronic conditions

The number of chronic conditions was assessed by the question “has a medical doctor ever told you that you have [condition]?” Responses included 13 conditions: 1) A heart attack including myocardial infarction or coronary thrombosis or any other heart problem including congestive heart failure; 2) High blood pressure or hypertension; 3) High blood cholesterol; 4) A stroke or cerebral vascular disease; 5) Diabetes or high blood sugar; 6) Chronic lung disease such as chronic bronchitis or emphysema; 7) Arthritis, including osteoarthritis, or rheumatism; 8) Cancer or malignant tumor, including leukemia or lymphoma, but excluding minor skin cancers; 9) Stomach or duodenal ulcer, peptic ulcer; 10) Parkinson disease; 11) Cataracts; 12) Hip fracture or femoral fracture; 13) Alzheimer's disease, dementia, organic brain syndrome, senility or any other serious memory impairment. Chronic conditions were coded dichotomously, 0 = no; 1 = yes, and the number of chronic conditions were subsequently summed (range 0–13), with higher scores representing more chronic conditions.

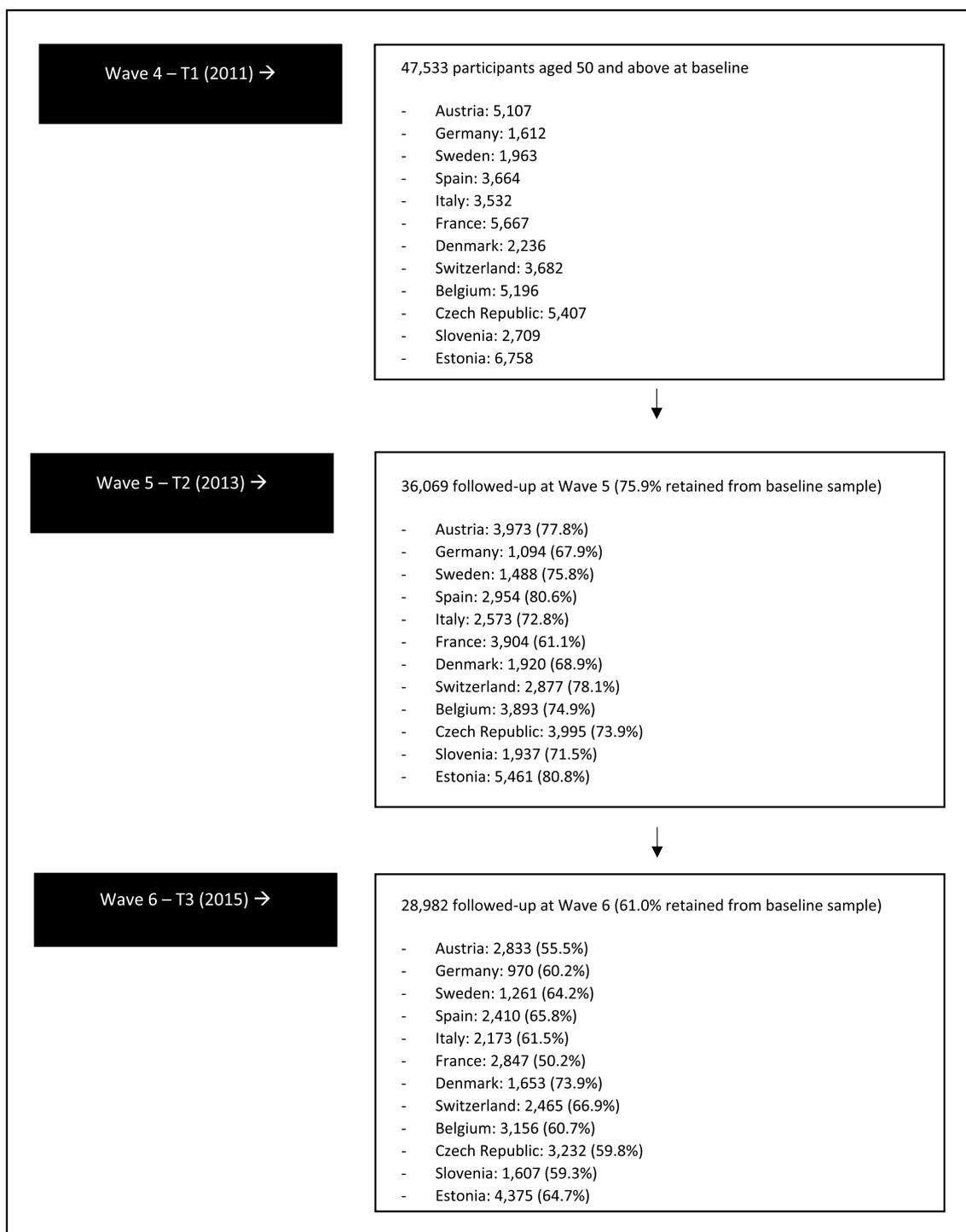


Fig. 1. Flowchart of the study sample.

2.2. Predictor: formal social participation

Formal social participation was assessed by asking participants which of the following five activities they had been engaged with in the past 12 months: 1) Done voluntary or charity work; 2) Attended an educational or training course; 3) Gone to a sport, social, or other kind of club; 4) Taken part in activities of a religious organization (church, synagogue, mosque, etc.); 5) Taken part in a political or community-related organization. Participants were first asked to indicate whether or not they had participated in any of the five activities (0 = no; 1 = yes), and subsequently asked about the frequency of the mentioned

activities (almost daily; almost every week; almost every month; less often). A scale for frequency of formal social participation was created by combining both items where 4 = active almost daily in at least one activity; 3 = active almost every week in at least one activity; 2 = active almost every month in at least one activity; 1 = active less than monthly at least in one activity; 0 = no formal social participation. Consequently, a higher score indicated a higher frequency of formal social participation in at least one of the five types of social activities. The reason for this operationalization was that some participants might be highly engaged in one type of activity, but not at all engaged in other types. Thus, we applied this operationalization in order to avoid the

situation where participants who seldomly participate in many different activities would score higher than someone who is frequently engaged in one or two activities.

2.3. Potential mediator: quality of life

The Control, Autonomy, Self-realization, and Pleasure (CASP) scale examines significant aspects of quality of life in older adulthood (Hyde et al., 2003). The SHARE questionnaire employs the CASP-12, a validated 12-item version of the scale (range 12–48) with higher scores indicating better quality of life (Kim et al., 2015; Pérez-Rojo et al., 2018; Wiggins et al., 2008). Cronbach's α for the CASP-12 scale at T1 was 0.80.

2.4. Potential mediator: depressive symptoms

Depressive symptoms were measured using the EURO-D scale (Prince et al., 1999). The EURO-D is a validated screening tool (Portellano-Ortiz et al., 2018), that covers 12 symptom domains central to depression. Every domain is scored 1 if present, and 0 if absent. The total score is the sum of all the items, leading to a minimum score of 0 and a maximum score of 12, with higher scores indicating more symptoms of depression. Cronbach's α for the EURO-D scale at T1 was 0.71.

2.5. Potential confounders

Sociodemographic characteristics included age at baseline (T1, 2011) and gender (male, female). Marital status had the following six categories: Married and living together with spouse; registered partnership; married, living separated from spouse; never married; divorced; widowed. Education was assessed according to the International Standard Classification of Educational Degrees (ISCED-97) with the following seven categories: None; primary level of education; lower secondary level of education; upper secondary level of education; post-secondary non-tertiary; first stage of tertiary education; second stage of tertiary education. Individual household income was categorized into tertiles: low; middle; high. Occupational status was categorized as: retired; employed or self-employed; unemployed; permanent sick or disabled; homemaker; other. We used the Global Activity Limitation Indicator (GALI), which is a single-item survey instrument to assess health-related activity limitations (Van Oyen et al., 2018). The data was dichotomized into limited and not limited. Finally, a categorical variable included all twelve individual countries.

2.6. Statistical analysis

The statistical analyses were conducted in Mplus Ver 7.3 (Muthén and Muthén, 2015). A descriptive analysis was conducted to demonstrate the baseline sample characteristics including frequencies, means, and standard deviations. Structural Equation Modelling (SEM) with observed variables was conducted to assess associations and statistical mediations among formal social participation (continuous), quality of life (continuous), depressive symptoms (continuous), and chronic conditions (continuous) in a focused longitudinal mediation (see Fig. 2). Since we proposed specific temporal relationships among these variables, we constructed a focused longitudinal mediation model (Jose, 2016) in which two specific longitudinal mediations were tested. As recommended by Hoyle and Panter (1995), we used several fit indices including the Root Mean Square Error of Approximation (RMSEA), the standardised root mean square residual (SRMR), the Comparative Fit Index (CFI), and several other model fit indices. Values greater than 0.95 for the GFI, CFI, and IFI are considered to reflect good model fit. SRMR values of 0.06 or less are considered to indicate good fit, values up to 0.08 are considered acceptable for the RMSEA and Critical N scores above 200 are considered to be good as well (Hu and Bentler,

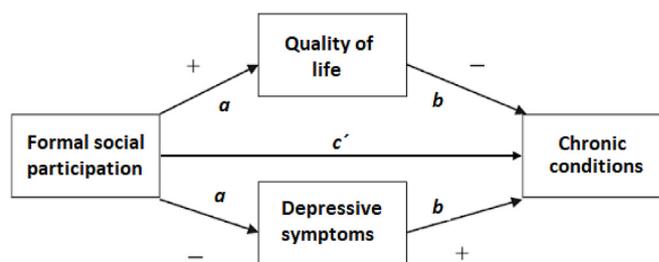


Fig. 2. Hypothesized model.

1999; Jöreskog; Sörbom, 1993).

Seven variables, gender, marital status, education, income, occupation, activity limitations, and country, were entered into the models as categorical, and age was treated as continuous. In all analyses, the sample weighting was taken into account to obtain nationally-representative estimates using the SHARE-provided longitudinal weight. The weight was calibrated against the total national population by gender and age-groups for each country in the sample, and further calibrated to compensate for both problems of unit non-response in the baseline sample, as well as problems of attrition in the samples of the subsequent waves (De Luca and Rossetti, 2018).

A missing values analysis of the data indicated that 4.8% were missing. Little's test, $\chi^2(621) = 1919.76, p < .001$, indicated that data were not missing completely at random. Frequencies showed that slightly more missing data occurred at T2 and T3 of the longitudinal study than at T1. In order to maximize statistical power while minimizing bias (Enders and Bandalos, 2001), the FIML (full information maximum likelihood) option was used to compensate for missing values during analyses.

3. Results

Table 1 shows the characteristics of the study sample at T1, along with descriptive statistics of quality of life and depressive symptoms at T1 and T2, and chronic conditions at T1 and T3. The average age of the analytical sample was 65.9 ($SD = 9.4$) years, and 57.6% were females. In terms of number of chronic conditions at baseline (T1, 2011), 17,058 (59.0%) had one or zero chronic conditions, and 11,873 (41.4%) had two or more chronic conditions. Of those that had one or zero chronic conditions at T1, 3,396 (20.0%) had two or more chronic conditions at 2-year follow-up (T1, 2013), and 4,233 (24.8%) had two or more chronic conditions at 4-year follow-up (T3, 2015). In terms of formal social participation in the past 12 months, 5,074 (17.7%) had done voluntary or charity work, 3,864 (13.5%) had attended an educational or training course, 8,438 (29.4%) had gone to a sport, social or other kind of club, 3,572 (12.4%) had taken part in activities of a religious organization, and 1,784 (6.2%) had taken part in a political or community-related organization.

Table 2 reports the means, standard deviations and correlations among the four key variables: formal social participation, quality of life, depressive symptoms, and chronic conditions. As expected, formal social participation was positively related to quality of life but negatively related to depressive symptoms and chronic conditions, while depressive symptoms and chronic conditions were positively related to each other.

A single focused longitudinal mediation model (Jose, 2016) (see Fig. 2) was constructed with two indirect longitudinal pathways: 1) formal social participation predicting quality of life, and in turn, predicting chronic conditions; and 2) formal social participation predicting depressive symptoms, and in turn, predicting chronic conditions. Eight variables were used as covariates: age, gender, marital status, education, income, occupational status, activity limitations, and country (not depicted in Fig. 2). An important characteristic of longitudinal mediation models is that mediators and outcomes should be residualized in

Table 1
Characteristics of the study sample.

| | Characteristic | Category | N (%) | |
|---|--|--------------------------------|---------------|---------------|
| Time 1 | Unweighted N | | 28,982 | |
| | Age (mean ± SD) | | 65.9 (9.4) | |
| | Gender | Female | 16,688 (57.6) | |
| | Marital status | Married, living with spouse | | 11,792 (64.6) |
| | | Registered partnership | | 270 (1.5) |
| | | Married, separated from spouse | | 265 (1.5) |
| | | Never married | | 1149 (6.3) |
| | | Divorced | | 1990 (10.9) |
| | | Widowed | | 2797 (15.3) |
| | | None | | 827 (2.9) |
| | Education | Primary level | | 5020 (17.6) |
| | | Lower secondary | | 5268 (18.5) |
| | | Upper secondary | | 9711 (34.1) |
| | | Post-secondary non-tertiary | | 1499 (5.3) |
| | | First stage of tertiary | | 5923 (20.8) |
| | | Second stage of tertiary | | 242 (0.9) |
| | | Lowest tertile | | 7452 (31.3) |
| | Individual household income | Middle tertile | | 8250 (34.3) |
| | | Highest tertile | | 8299 (34.5) |
| | | Retired | | 16,289 (56.6) |
| | Occupational status | Employed or self-employed | | 8078 (28.1) |
| | | Unemployed | | 883 (3.1) |
| | | Permanent sick or disabled | | 917 (3.2) |
| | | Homemaker | | 2353 (8.2) |
| | | Other | | 274 (1.0) |
| | Activity limitations | Limited | | 13,383 (46.3) |
| | Formal social participation | No formal social participation | | 14,471 (50.7) |
| Active less than monthly in at least one activity | | | 2079 (7.3) | |
| Active monthly in at least one activity | | | 2820 (9.8) | |
| Active weekly in at least one activity | | | 7412 (25.8) | |
| Active daily in at least one activity | | | 1850 (6.4) | |
| Depressive symptoms ^a (mean ± SD) | | 2.4 (2.2) | | |
| Quality of life ^b (mean ± SD) | | 37.6 (6.2) | | |
| Chronic conditions (mean ± SD) | | 1.5 (1.4) | | |
| Time 2 | Depressive symptoms ^a (mean ± SD) | | 2.4 (2.2) | |
| | Quality of life ^b (mean ± SD) | | 37.8 (6.2) | |
| | Chronic conditions (mean ± SD) | | 1.5 (1.4) | |
| Time 3 | Chronic conditions (mean ± SD) | | 1.6 (1.4) | |

Data are unweighted N (%) unless otherwise specified.

^a Based on the 10-item EURO-D scale.

^b Based on the 12-item Control, Autonomy, Self-realization, Pleasure scale (CASP-12).

order to “ensure that the main predictor predicts *change in the mediator*, and the mediator predicts *changes in the outcome*” (Jose, 2016). Both mediators and the outcome variable were residualized. The outcome variable, chronic conditions at T3, was residualized on both T1 and T2 times of measurement. The mediators were residualized on T1 times of measurement. Thus, the model tests the predictions that formal social participation will predict higher levels of quality of life and lower levels of depressive symptoms, and these mediators, in turn, will predict lower levels of chronic conditions.

We first examined the direct effect, i.e., the pathway from formal social participation T1 to chronic conditions T3, termed the c prime path, which was a significant negative association, $\beta = -0.03$, $p < .001$. We then examined the direction and size of the *a* (predictor to mediator) and *b* (mediator to outcome) paths in both proposed

longitudinal indirect pathways. As expected, formal social participation at T1 predicted higher levels of quality of life at T2, $\beta = 0.12$, $p < .001$, and quality of life predicted lower levels of chronic conditions at T3, $\beta = -0.06$, $p < .001$. Similarly, as expected, formal social participation at T1 predicted lower levels of depressive symptoms at T2, $\beta = -0.06$, $p < .001$, and depressive symptoms predicted higher levels of chronic conditions at T3, $\beta = 0.04$, $p < .001$. Based on these significant *a* and *b* paths, we expected that we would find empirical confirmation for our two predicted longitudinal mediation predictions. The model with estimated coefficients is depicted in Fig. 3, and it yielded a good fitting model, SRMR = 0.04; GFI = 0.98; IFI = 0.95; CFI = 0.95; RMSEA = 0.075; Critical N = 256.

The two hypothesized longitudinal mediations were tested with 5000 bootstrapped iterations, a 95% confidence interval in Amos, and

Table 2
Descriptive statistics on the path model variables.

| | T1 formal social participation | T2 Quality of life | T2 Depressive symptoms | T3 Chronic conditions |
|--------------------------------|--------------------------------|--------------------|------------------------|-----------------------|
| T1 formal social participation | | .136 | -.053 | -.030 |
| T2 Quality of life | | | -.489 | -.143 |
| T2 Depressive symptoms | | | | .149 |
| Mean | 1.30 | 37.65 | 2.42 | 1.55 |
| Standard deviation | 1.45 | 6.24 | 2.20 | 1.41 |

Note. Coefficients are zero-order correlations after covarying out associations with the covariates. All coefficients are statistically significant at $p < .001$. N = 28,982.

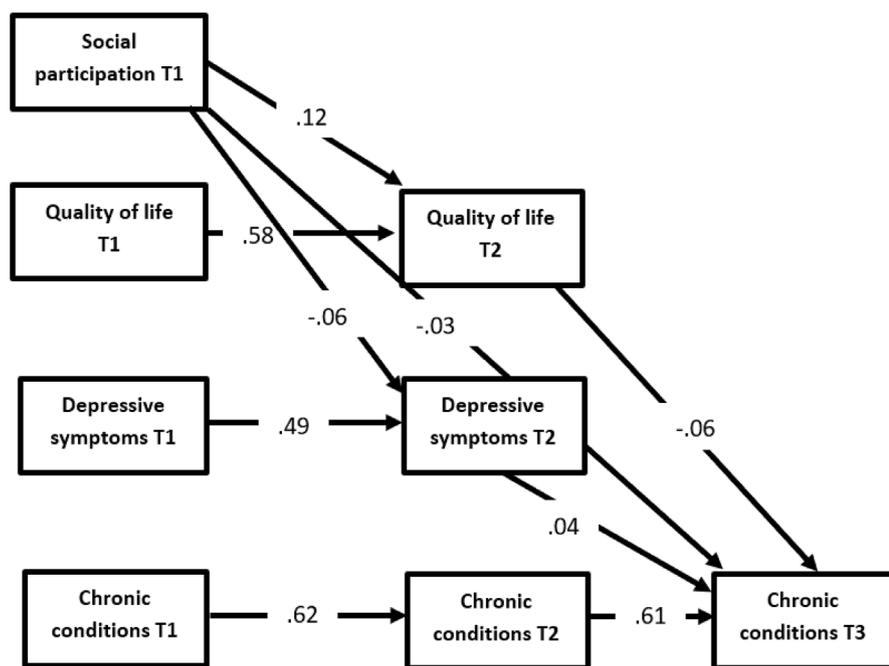


Fig. 3. Focused longitudinal mediation with standardised regression coefficients. *Note.* The eight covariates were covaried with the exogenous variables but for the sake of brevity are not shown in the figure; Covariances were estimated among the covariates, among the four T1 variables, and between the three T2 variables. All coefficients were statistically significant at $p < .001$.

Note. The eight covariates were covaried with the exogenous variables but for the sake of brevity are not shown in the figure; Covariances were estimated among the covariates, among the four T1 variables, and between the three T2 variables. All coefficients were statistically significant at $p < .001$.

Monte Carlo estimates of the p-value. The first predicted relationship began with formal social participation at T1 to quality of life at T2 to chronic conditions at T3, and it was empirically supported: indirect effect = -0.006 , $SE = 0.001$, 95% CI = $[-0.007, -0.005]$, $p < .001$. The second predicted relationship began with formal social participation at T1 and proceeded to depressive symptoms at T2 and then onto chronic conditions at T3, and it was empirically supported as well: indirect effect = -0.003 , $SE = 0.001$, 95% CI = $[-0.003, -0.002]$, $p < .001$. Thus, empirical support was obtained for our hypothesis which suggested that formal social participation would predict higher levels of quality of life, which, in turn, would predict lower levels of chronic conditions. Similarly, empirical support was obtained for our hypothesis which proposed that formal social participation would predict lower levels of depressive symptoms, which, in turn, would predict higher levels of chronic conditions. We acknowledge that the amount of new unique variance explained by the mediations on the dependent variable was small, but such effect sizes are typical in longitudinal mediation analyses of data collected over annual or longer times of measurement.

At the same time, effect sizes of the longitudinal mediations, relative to the direct effect, are illuminating, and these were computed using MacKinnon's formula of indirect/total effect (Mackinnon, 2012), and yielded a ratio of 19% for quality of life and 12% for depressive symptoms, suggesting that formal social participation to a greater extent protected against chronic conditions through increases in quality of life than through decreases in depressive symptoms. Effect sizes of 12% and 19% are small to moderate, suggesting that although quality of life and depressive symptoms explained a sizeable amount of the total indirect effect, other mediating variables are likely to account for significant variance in the ability of formal social participation to predict levels of chronic conditions over time. Other such potential mediators involved (which we could not assess in this study) could for example be higher levels of physical activity associated with participation activities, reduced loneliness, or received support from relationships

established through social/community interaction and involvement. Subsequent analyses (data available upon request) suggest that the optimal protective effect of social participation is brought about by weekly engagement, which reduces the risk of developing a chronic condition by 7.6%, as compared to not engaging in any social participation. Of those that had less than two chronic conditions at baseline, weekly social participation was associated with a 22.2% reduced risk of having 2 or more chronic conditions at 4-year follow-up, as compared to no social participation.

4. Discussion

The current study investigated longitudinal associations between formal social participation (i.e. active participation within volunteer organizations, educational institutions, clubs, religious organizations, political/civic groups) and chronic conditions, and the mediating role of quality of life and depressive symptoms among European community-dwelling older adults aged 50+. According to our expectations, we found a significant direct negative pathway between formal social participation at baseline and the number of chronic conditions four years later. Further, in line with our initial hypothesis, we found that quality of life and depressive symptoms both significantly mediated this relationship (see Fig. 3). In other words, formal social participation appears to protect against the development or increase in chronic conditions, and it does so partly by promoting quality of life and reducing depressive symptoms.

The strengths of this study include the large sample size, a prospective design, the use of multi-country European nationally representative data, and validated scales for quality of life and symptoms of depression. Some limitations should be considered when interpreting the results. First, these findings were based on self-reported data, which implies the possibility for self-report bias and issues pertaining to common-methods variance. That said, it must be kept in mind that variables pertaining to mental health and social behaviors are

commonly assessed through self-report, as there are seldom other viable alternatives (i.e. one cannot assess if a person participates socially or how a person is feeling without asking). Second, the presence of chronic conditions was assessed by participants' recollection of having been diagnosed by a medical doctor. The results may have differed if clinical or register-based data had been available to us. Third, although we used weights to account for attrition throughout the waves, missing data and loss to follow-up could have introduced some bias as well by affecting to some degree the extent to which the subsample reflects the European countries they represent.

4.1. Contextualization of findings

In the 1960s, unusually low occurrences of heart disease and other somatic illnesses were reported in Roseto, an Italian-American locality in Pennsylvania. Extensive studies to determine the cause were carried out, but neither genetics, diet, or exercise could account for the low incidence and prevalence rates in disease outcomes. Rather, 'community' appeared to be the defining feature that accounted for the phenomenon, involving close-knit social structures and high levels of social participation and community involvement (Stout et al., 1964). More recently, in a key research study involving a nationally representative sample of American older adults, researchers assessed health classes characterized by significant vulnerabilities that affect chances of dying or becoming incapacitated within five years (McClintock et al., 2016). Of particular relevance to this study, the authors found that social wellbeing was more important than specific medical diagnoses (cancer and hypertension) and health behaviors (smoking) when defining vulnerable health classes. Our findings build on previous research documenting the essential role of social well-being and connectedness in health, as well as confirm previous literature suggesting that formal social participation in older adulthood exerts health benefits (Adams et al., 2011; Pressman et al., 2009). While there may be several reasons for this, we were able to uncover two indirect pathways through mental health, one that protected against depressive symptoms and one that promoted quality of life, both ultimately benefiting physical health.

Mental health is central in protecting against physical health outcomes. On the one hand, poor mental health, such as depression, has been shown to a) increase the risk for developing chronic conditions and worsen prognosis once these conditions have developed; b) contribute to unintentional and intentional injuries as well as risk behaviors; and c) compromise health behaviors, help-seeking, patient engagement and compliance (Prince et al., 2007). On the other hand, positive aspects of mental health, such as quality of life, have been shown to a) benefit physiology, including the immune system, b) operate as emotional information that guide health-oriented behaviors, c) confer psychological resources engendered by positive feeling states (e.g. resilience) that may reinforce health in the face of challenges, d) motivate health-relevant behaviors, and e) elicit social support (positive moods may attract peers and strengthen social connectedness), which may be instrumental in sustaining and promoting health (Boehm and Kubzansky, 2012; Lee et al., 2019; Pressman et al., 2019; Salovey et al., 2000). Our study demonstrates that one way to protect against chronic conditions may be to promote mental health through formal social participation. Formal social participation may help older adults to maintain an active lifestyle, and indeed, "feeling active" has recently been found to be crucial in terms of improving physical health and longevity (Petrie et al., 2018; Pressman, 2019). Conversely, even short periods of inactivity have been shown to damage physical health and increase the risk of serious health conditions, such as cardiovascular disease (Bowden Davies et al., 2018).

4.2. Implications for policy and practice

From a public health and social policy standpoint, this study has important implications for the prevention of chronic conditions, as well

as the protection and promotion of mental health in the transition to older adulthood. Public mental health interventions and initiatives may be able to prevent deteriorating mental health by encouraging formal social participation, and by extension, protect against the development and increase in chronic conditions. It is critical to counteract adverse physical health outcomes in the general population by the promotion of behaviors known to enhance mental health, such as through the maintenance of 1) active lifestyles, 2) social connectedness, and 3) meaningful commitment or contribution to society. While there is a multitude of behavioral factors that may benefit mental health, a number of studies have shown that these three behavioral domains - known as Act-Belong-Commit - promote positive mental health as well as protect against mental, neurological, and alcohol use disorders (Nielsen et al., 2017; Santini et al., 2017, 2018c). Along these lines, the results of current study serve as yet another example of how mental health promoting behaviors may confer overall health benefits. Act-Belong-Commit, also referred to as *the ABCs of mental health*, is a mental health campaign and framework for doing mental health promotion, and is currently being deployed in different parts of the world (Koushede et al., 2015; Santini et al., 2018a). It may be implemented throughout local communities and within clinical settings (Donovan and Anwar Mchenry, 2014). That said, no strategy should be considered sufficient in and of itself, and comprehensive sustainable strategies must be accomplished through holistic, cross-sectoral, whole-of-government approaches that together promote all aspects of healthy aging (IJERPH, 2017).

5. Conclusions

Older adults are increasingly aging independently in their long-term residential community, and communities vary in the extent to which they provide opportunities for social engagement and cohesion. Characteristics of the residential neighborhood are critical factors for older adults coping with late life changes such as retirement, bereavement, and functional health declines, which often compromise social connectedness and facilitate feelings of loneliness and isolation. Strategies designed to structurally optimize opportunities for social interaction and participation within communities are strongly needed as a means to reduce or delay the onset or development of chronic conditions in late-life, and particularly strategies that do not require heavy investments from governments. In this study, we examined the direct and indirect pathways from formal social participation to chronic conditions, including the mediating role of mental health in this relationship. Our findings suggest that formal social participation predicts higher levels of quality of life as well as lower levels of depressive symptoms over time, which in turn protects against the development of or increase in chronic conditions. Public mental health interventions and initiatives may prioritize strategies to encourage and promote formal social participation, as a means to enhance mental health, and ultimately protect against the development of chronic conditions and multimorbidity in the aging population. This presents one viable solution that may complement comprehensive efforts to sustain and promote healthy aging.

Ethics

Ethics approval for the SHARE project was granted by the Ethics Council of the Max-Planck-Society for the Advancement of Science.

Data is publicly available (upon application), therefore we do not share the data.

Funding

Nordea-Fonden

Contributor statement

All authors have contributed to the work submitted.

Transparency declaration

The manuscript is an honest, accurate, and transparent account of the study being reported. No important aspects of the study have been omitted. Any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Declaration of competing interest

No conflicts of interest declared.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2020.112906>.

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