Social networks and mental health among older Europeans: are there age effects?

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Abstract This study examined different components of personal social networks—structure, interaction, and quality—and the extent to which each is related to mental health among a 65+ sample ($n = 26,784$) taken from the fourth wave of the Survey of Health, Ageing, and Retirement in Europe. The first aim of the study was to determine which network components had the strongest associations with the number of depressive symptoms, measured on the EURO-D scale. Secondly, the study considered if and how age impacted the associations between social network and depression, using interaction terms that paired age category (age 65–79; age 80+) with the score on each network component. Hierarchical OLS regressions revealed that social network quality and network structure were both negatively related to the number of depressive symptoms. The association between network size (structure) and depression was even greater among those 80+. Age differences were also found for network interaction. More frequent contact with the network was related to a greater extent of depressive symptoms, but only among respondents aged 80 and older. Closer geographic proximity was related to having fewer depressive symptoms, but only among respondents aged 65–79. The findings imply that the association between meaningful personal relationships

and depression in late life is nuanced by both network characteristics and by age.

Keywords SHARE · Depression · Network size · Network satisfaction · Proximity

Introduction

The study presented in this article examines the inter-relationship between social network and mental health in late life (Kawachi and Berkman 2001). The inquiry attempts to bring greater clarity to this domain by identifying the relative contribution of different network components in relation to a key mental health outcome—the number of depressive symptoms. Moreover, in order to avoid discrepancies regarding the boundaries of the network construct in our analyses, we focus exclusively upon personal networks (Stevens and Van Tilburg 2011), derived by means of a state-of-the-art name generator (Cornwell et al. 2009). In addition, we take age into account, insofar as social networks tend to work differently among individuals at different stages of later life (Litwin and Stoeckel 2013). We distinguish, in this regard, between the young-old (65–79) and the old-old (80+), according to Menec and Chipperfield (1997).

Personal or ego-centered networks are the most accessible and supportive of the social milieus in which older people are embedded (van Tilburg 1998). Such interpersonal constellations are related to a range of health and well-being outcomes (Fiori and Jager 2012). However, the nature and the boundaries of the personal social network are still not commonly accepted by all social scientists (Litwin 1996). Discrepancies abound as to whether it is the structure of the network that determines its effect, the

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interactions that take place within the network domain, or the quality of the relationships that comprise it.

Network structure may be differentiated by size, composition, and a host of other architectural characteristics (Cornwell et al. 2009). Network interaction may be variously expressed by means of the geographic proximity of its members to the focal network member, the frequency of contact with those in the network, the extent of interpersonal affinity, the emotional closeness felt toward network members, and so on (Litwin 2007). Network quality, in contrast, reflects how people feel about the relationships that they have. People derive different levels of satisfaction from similar network architecture and interactions as a function of their own subjective expectations, appraisals, and wants (Berg et al. 2006).

Another aspect by which personal social networks may differ is the mode by which the networks are derived. Two different means are described in the literature. Indirect modes define the personal network through the enumeration of its role relations (e.g., the number of siblings, friends or neighbors, and so on). Pescosolido (2011) describes such measures as sociodemographic proxies. In contrast, the direct approach identifies the specific individuals who are important to a given respondent and then extracts additional information about them (Burt and Gullarte 1986; Cornwell et al. 2009; van Tilburg 1994). Those who favor direct assessment of the personal social network claim it to be a more accurate reflection of one's interpersonal milieu than the estimation based primarily on role relation counts.

Analyses using the Longitudinal Aging Study Amsterdam (LASA) in which a name generated social network was collected have found, for example, that a smaller size network was associated with anxiety disorders among older Dutch adults (Beekman et al. 1998) and that those with a small network and with little emotional support were more often depressed (Sonnenberg et al. 2013). A study based on data from the fourth wave of SHARE revealed that co-resident caregivers who named their care recipient as a member of their personal networks experienced fewer depressive symptoms than co-resident caregivers who did not name the care recipient as such (Litwin et al. 2014).

Above and beyond the different network components and their mode of measurement lies a range of contextual factors that further nuance network effects, such as gender, age, socioeconomic status, and race or ethnicity (Litwin and Shiovitz-Ezra 2011). The literature supports the impression that the social network construct is shaped by context and culture. Thus, for example, a study based on the first wave of the Survey of Health, Ageing, and Retirement in Europe (SHARE) found that the associations between network structure, interaction, and quality, on the

one hand, and depressive symptoms, on the other hand, varied according to gender and region (Litwin 2010).

A subsequent SHARE-based analysis revealed that the associations between social network structure and interaction and two well-being outcomes—the CASP quality of life scale and a global life satisfaction probe—varied by age (Litwin and Stoeckel 2013). These two SHARE-based studies were both based upon variables derived via the indirect approach for social network measurement, however, as was the practice in the early waves of the SHARE survey. In contrast, the current inquiry addresses network variables that were gathered through the direct approach, which was administered for the first time in SHARE's wave 4. As such, we hope to shed new light on the inter-relationship between age, network, and mental health.

Personal social networks and depressive symptoms

The respective contributions of network structure, interaction, and quality in relation to depressive symptoms among older people have been variously studied and conflicting conclusions have been drawn. Some literature suggests that it is the network structure rather than perceived quality of the network ties that has the greatest association with depression symptom outcomes in later life. For instance, Litwin (2011) examined depressive symptoms in relation to both a composite network structure and interaction variable—social network type—and to network relationship quality indicators. The results revealed that the network quality indicators were unrelated to the presence of a high level of depressive symptoms after controlling for sociodemographic characteristics and health, while network type maintained an association with the depression outcome.

Other literature, however, underscores the role of positive relationship quality, in addition to network size, in relation to mental health outcomes. For example, one analysis in the greater Detroit area found that having larger network size and more positive characteristics in the spousal relationship were associated with fewer depressive symptoms (Fuller-Iglesias et al. 2008). A Swiss study of major depressive disorder and depressive symptoms revealed that reports of being lonely and having unmet emotional support had the largest and most consistent associations (Barger et al. 2014). These findings led the investigators in that study to conclude that both quality and frequency of social relationships are associated with mental health. Finally, a study of social relations in France, Germany, Japan, and the United States also found that negative social interactions were associated with higher levels of depressive symptoms (Antonucci et al. 2002).

Age differences in the associations between social network and depressive symptoms

We turn now to the inter-relationship between age, network, and mental health. Some studies provide initial support for the presence of an age effect. For example, Cornwell and Waite (2009) discovered that the oldest-old feel more isolated than the young-old, all things considered. Park et al. (2014) found that the oldest-old in Korea were more likely than young-old adults to be embedded in restricted networks and that those in all non-restricted networks reported lower depressive symptomatology. A study in China revealed that depressed affect reacted more strongly to social support and to negative interactions among the older-old (70+ years) than among the young-old (60–69 years) (Li and Liang 2007).

Other studies note additional age-related nuances in the wider network/mental health nexus. In a study of older English adults, for example, it was found that network size (i.e., having a social network of at least three people) was relatively less important in predicting happiness among the oldest-old than among younger-old persons (Cooper et al. 2011). A study of older Australians found no association between social group contact frequency and risk of psychological distress for those aged 85 years and older (Phongsavan et al. 2013). In another study of Australians, positive exchanges were found to buffer the effect of negative exchanges among younger-old adults, but not among the older-old (Fiori et al. 2013).

Given the varied findings in the literature, the current study does not pose specific hypotheses. Instead, we ask a more general research question: Which of the components of personal social networks are most strongly related in late life to poor mental health, as measured by depressive symptoms. More specifically, does network structure, interaction, or quality yield the strongest association with depressive symptoms? A second aim of the current inquiry is to clarify whether the associations between the respective components of personal social network and depressive symptoms vary by age group.

Methods

Data are drawn from the fourth wave of the Survey of Health, Ageing, and Retirement in Europe (SHARE), collected in 2010 in Austria, Belgium, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Italy, the Netherlands, Poland, Portugal, Slovenia, Spain, Sweden, and Switzerland. The SHARE survey collects data on persons aged 50 and older and their spouses regardless of age. The current analysis was limited to respondents aged

65+ who answered the non-proxy mental health module, in order to focus on the mental health of older adults ($n = 28,756$).

Cases with missing data on one or more of the study variables were excluded from the analysis. The excluded cases comprised 1124 persons who named no network members and another 2387 who were missing other data. The final analytical sample thus numbered 25,245 respondents. Comparison of the excluded cases with the respondents in the sample revealed that those with no named network members were at greater risk of having poor mental health compared to those with a social network. Respondents excluded because of other missing data were not found to differ in terms of network proximity and contact. However, they did have smaller networks, less emotional closeness, and less satisfaction with the network, on average.

Measures

The dependent variable in the analysis was mental health, operationalized as the number of depressive symptoms as indicated on the EURO-D scale. Developed from the Geriatric Mental State (GMS) for purposes of comparing depression across European countries, the EURO-D has strong validity and internal consistency (Prince et al. 1999). Twelve domains of depressed symptoms are included in the scale: depressed mood, pessimism, suicidal thoughts, guilt, sleep, interests, irritability, appetite, fatigue, concentration, enjoyment, and tearfulness. The EURO-D score is an overall sum of these twelve depressive symptom domains (range 0–12). Higher scores are indicative of more depressive symptoms and poorer mental health. Insofar as the EURO-D scores were skewed, as usually occurs, we employed a log transformation of the score in the current analysis (Tabachnick and Fidell 2013; Cornwell and Laumann 2015).

The independent variables in this analysis encompassed a range of characteristics of respondents' self-reported social network. The fourth wave of SHARE introduced a name generated social network module which was based upon a similar instrument that was employed in the National Social life, Health, and Aging Project (Cornwell et al. 2009). The name generator asked respondents to identify up to six persons with whom they discussed personal matters and one additional person who was important for any reason (Litwin et al. 2013). Supplemental information was gathered on each named person, including geographical proximity to the respondent, frequency of contact, and extent of emotional closeness. In addition, respondents were asked to rate on a global measure that ranged from 0 to 10, the degree to which they were satisfied with the persons they had named. These data allowed

the calculation of several social network variables reflecting structure, interaction, and quality.

Network structure was operationalized through social network size (0–7). Network interaction was reflected by three variables: *geographical proximity*, *frequency of contact*, and *emotional closeness*. Proximity scores ranged from “more than 500 km away” (1) to “in the same household” (8); contact scores ranged from never (1) to daily (7); emotional closeness scores ranged between “not very close” (1) and “extremely close” (4). The analysis employed mean scores for each of these network interaction indicators. Lastly, network quality was considered through *satisfaction with the social network*, a self-report measure ranging from 0 to 10, on which higher scores reflected greater satisfaction.

Interaction terms were employed to take into account how age and each of the social network characteristics jointly intersect with the mental health outcome. Age was measured as a dummy variable (0 = 80+, 1 = 65–79). We chose 80-years old as the cut-point for age in order to distinguish between the young–old (65–79), on the one hand, and the old–old (80+), on the other hand (Menec and Chipperfield 1997). The respective interaction terms were the product of the age dummy variable and the mean score on each of the network characteristic variables. This analytic strategy permitted consideration as to whether the associations between the social network variables and depressive symptoms differed among the old–old respondents in comparison with the young–old group.

The analysis included several sociodemographic and health-related control variables. The sociodemographic controls included gender, marital status, number of children, education, financial status, and country. Gender was classified as male (0) and female (1). Marital status was coded as dummy variables distinguishing between those (a) married or partnered (0–1), (b) widowed (0–1), and (c) other, including divorced and never married (0–1). Number of children was a count from 0 to 14. Education was coded according to the International Standard Classification of Education 1997 (ISCED-97). Respondents were identified through the following dummy variables: primary schooling or less (ISCED-97 score = 0–2), secondary education (ISCED-97 score = 3), and post-secondary education (ISCED-97 score = 4–6). Financial status was addressed using overall household income divided into five equal quintiles, as calculated on the SHARE sample prior to sample selection specific to this analysis. Country dummy variables were also controlled to account for the cultural diversity represented in the SHARE survey. The aim of the analysis was not to systematically consider these country differences, however, as that was beyond the scope of the study.

The health-related controls included physical symptoms, mobility dependence, functional dependence, and memory

(we looked also at chronic conditions, but they were not significantly associated with depressive symptoms when controlling for the other physical health variables). The number of physical symptoms that had troubled survey respondents in the previous 6 months ranged from 0 to 12 and included such symptoms as incontinence, back pain, chest pain, and shortness of breath. Mobility dependence counted the number of activities difficult to perform (0–10) because of poor health, such as climbing stairs, standing up from a seated position, and walking distances more than 100 m. Functional dependence controlled for the number of daily living activities (ADL) that respondents reported having difficulty doing alone (0–6), such as bathing, dressing, and toileting. Higher scores in each of these measures represented poorer function or greater dependence. Memory was measured according to verbal learning and recall. The measure was calculated as the sum of words correctly recalled by respondents from a 10-word list, queried immediately and again after a 5-min delay (Ayalon et al. 2010). The combined score ranged from 0 to 20; higher scores represented better cognitive functioning.

Statistical analysis

A two-stage analysis was performed to answer the research questions outlined in the literature review. First, the sample was described using univariate descriptives, sample means and standard deviations for continuous variables and percentages for categorical variables. The relationship between each of the independent variables and the dependent variable, EURO-D symptoms, was also considered. In the second stage of the analysis, a hierarchical OLS regression was executed. In Model 1, the logged EURO-D symptom count was regressed on the social network variables. Next, the control variables were entered. In the third and final model, five different regressions were conducted for the five interactions. In each model, one interaction term was introduced to consider if the association between that particular social network components and the logged EURO-D symptom count alters by age. We show the effect of the 80+ age group in the relevant table. The corresponding effect for the 65–79 age group was similarly calculated, where the age category dummy coding was reversed (age 65–79 = 0, age 80+ = 1) in order to determine what main effect network characteristics are significantly associated with EURO-D symptoms among the young–old (Figueiras et al. 1998).

Results

The descriptive analysis of the respondent sample is displayed in Table 1. Approximately, one-fifth of the sample was aged 80+, slightly more than half was female, two-

Table 1 Univariate description of study variables by age group

Variables	Total sample (%)	Age 65–79	Age 80+	
<i>Sociodemographic</i>				
Age group		78.5	21.5	
Gender				
Male	43.8	44.9	39.7	
Female	56.2	55.1	60.3	
Marital status				
Married/partnered	66.9	71.9	49.2	
Never married/divorced	10.25	10.9	7.8	
Widowed	22.78	17.2	43.0	
Education				
Primary	49.0	45.7	61.3	
Secondary	28.7	30.5	22.3	
Post-secondary	22.3	23.9	16.4	
Household income				
First quintile (lowest)	19.9	20.0	19.4	
Second quintile	20.5	19.9	22.8	
Third quintile	23.0	21.9	26.7	
Fourth quintile	20.4	20.6	19.5	
Fifth quintile	16.2	17.5	11.6	
	Mean (SD)	Age 65–79	Age 80+	Range
No. of children	2.2 (1.4)	2.2 (1.3)	2.1 (1.6)	0–14
<i>Health</i>				
EURO-D	2.7 (2.3)	2.5 (2.3)	3.2 (2.5)	0–12
Physical symptoms	2.3 (1.3)	2.1 (2.0)	3.0 (2.4)	0–13
Mobility dependence	2.2 (2.5)	1.8 (2.3)	3.4 (2.8)	0–10
ADL	0.3 (0.9)	0.2 (0.8)	0.2 (1.3)	0–6
Memory	7.9 (3.6)	8.5 (3.5)	5.9 (3.4)	0–20
<i>Social network</i>				
Structure: size	2.5 (1.5)	2.6 (1.5)	2.4 (1.4)	0–7
Interaction				
Geographic proximity	5.7 (1.6)	5.8 (1.6)	5.6 (1.6)	1–8
Contact frequency	6.1 (0.9)	6.1 (0.9)	6.0 (1.0)	1–7
Emotional closeness	3.2 (0.6)	3.2 (0.6)	3.2 (0.7)	1–4
Quality: satisfaction	8.9 (1.3)	8.9 (1.3)	8.9 (1.4)	0–10

n = 25,245; country findings available upon request

thirds were married, one quarter was widowed, and about a tenth was never married or divorced. The mean number of children per respondent was slightly more than two. Nearly half had attained up to a primary level of education only, while slightly more than one-fifth had been awarded post-secondary education degrees. Household income in the analytical sample divided fairly evenly across the quintiles of the same in the entire SHARE 50+ sample. The health description revealed that respondents had an average of 2–3 physical symptoms that were bothersome, 2–3 mobility tasks that were difficult to perform, and less than one ADL limitation. Sample respondents had a mid-range level of memory.

In terms of the key variables in the current analysis, the average number of depression symptoms (not logged) was 2.7 out of a possible 12 symptoms. The average social network was comprised of 2–3 meaningful persons with relatively high mean scores for geographical proximity, contact and emotional closeness. Respondents had a high level of satisfaction with their social network as a whole. Table 2 displays the bivariate analyses of each of the study variables with depressive symptoms. The table shows that the vast majority of the variables were associated with EURO-D symptoms (not logged).

The first part of the hierarchical OLS regression findings are presented in Table 3. Both models used logged EURO-

Table 2 Bivariate associations of the study variables with depressive symptoms (Euro-D)

Variables	<i>T</i>	<i>F</i> ^a	<i>r</i>
<i>Sociodemographic</i>			
Age group	−19.79***		
Female	−33.27***		
Marital status		296.50*** ^a	
Education		387.35*** ^a	
Household income		109.00*** ^a	
No. of children			NS
<i>Health</i>			
Physical symptoms			0.51***
Mobility dependence			0.47***
ADL			0.32***
Memory			−0.26***
<i>Social network</i>			
Structure: size			−0.03***
Interaction			
Geographic proximity			−0.04***
Contact frequency			NS
Emotional closeness			−0.07***
Quality: satisfaction			−0.10***

n = 25,245

*** <0.001

^a Bonferroni correction significant threshold = 0.05/# comparisons

D scores. Model 1, in which the depressive symptoms were regressed exclusively on the social network characteristics, accounted for only about 2 % of the variance. Network size, mean proximity, mean emotional closeness, and satisfaction with social ties were all negatively associated with depressive symptoms. However, mean contact frequency was associated with more symptoms.

With the introduction of the sociodemographic, country, and health controls in Model 2, the variance explained reached 32 %. The significant associations between most of the social network variables and the EURO-D symptoms in the previous model remained, albeit lessened somewhat in strength. However, the mean contact frequency variable lost significance. Among the control variables, respondents aged 65–79 had more depressive symptoms than those aged 80+, and women had more than men. Having fewer depressive symptoms was associated with being never married or divorced and with education. Higher numbers of physical symptoms, as well as greater mobility dependence and ADL limitation, were associated with a greater number of depressive symptoms. Having better memory was associated with reporting fewer depressive symptoms.

The next part of the regression analysis added the interaction terms, examining the associations between social network characteristics and age group in relation to

Table 3 Social network associations with EURO-D and interactions with age: OLS regression

	Model 1 Standardized β	Model 2 Standardized β
<i>Social network</i>		
Structure: size	−0.037***	−0.031***
Interaction		
Geographical proximity	−0.099***	−0.041**
Contact frequency	0.079***	0.011
Emotional closeness	−0.068***	−0.035***
Quality: Satisfaction	−0.083***	−0.068***
<i>Sociodemographic</i>		
Age 65–79 ^a		0.016*
Female ^b		0.109***
Marital status ^c		
Never married or divorced		−0.012*
Widowed		0.11+
Education ^d		
Secondary		−0.025***
Post-secondary		−0.014*
Household income quintiles ^e		
Second quintile		0.005
Third quintile		−0.005
Fourth quintile		−0.007
Fifth quintile		−0.002
No. of children		−0.003
<i>Health</i>		
Physical symptoms		0.315***
Mobility dependence		0.154***
ADL		0.027***
Memory		−0.096***
<i>R</i> ²	0.019	0.320

n = 25,245

*** < .001, ** < .01, * < .05, + < .07

Model adjusted for country – findings available upon request. Reference Categories: ^a Age 80+, ^b Male, ^c Married, ^d Primary, ^e 1st Quintile (lowest)

depressive symptoms (Table 4). The findings for respondents aged 80+ are presented in the top part of the respective columns in the table. The interactions appear in the lower part of the same columns and show which network characteristics vary in their associations with depressive symptoms by age group. The graphs presented in Fig. 1A–E illustrate the key findings by plotting the respective associations between the network characteristic in question and the logged depression scores separately for each age group. As may be seen in Table 4, the use of the age-based interaction terms did not change the extent of the variance explained by the regression. They serve, therefore, mainly to underscore the dynamics of the inter-relationship between age, network, and depressive symptoms.

Table 4 Social network associations with EURO- and interactions with age: OLS regression

	Model 1 Standardized β	Model 2 Standardized β	Model 3 Standardized β	Model 4 Standardized β	Model 5 Standardized β
Structure: size	−0.062***	−0.031***	−0.031***	−0.031***	−0.031***
Interaction					
Geographical proximity	−0.040***	−0.010	−0.040***	−0.040***	−0.040***
Contact frequency	0.010	0.010	0.036**	0.010	0.010
Emotional closeness	−0.035***	−0.035***	−0.035***	−0.035**	−0.035**
Quality: satisfaction	−0.068***	−0.068***	−0.068***	−0.068***	−0.065***
Interactions with age 80+					
Structure: size	0.045**				
Interaction					
Geographical proximity		−0.067**			
Contact frequency			−0.094**		
Emotional closeness				−0.013	
Quality: satisfaction					−0.013
R^2	0.320	0.320	0.320	0.320	0.320

$n = 25,245$

*** < .001, ** < .01

The findings show that significant age differences occurred in the associations between some of the social network variables and depressive symptoms. Having more people in the social network (a network structure variable) was related to fewer depressive symptoms among the old–old ($\beta = -0.062$), whereas this same association among the young–old was also negative, but weaker ($\beta = -0.023$, not shown) (Fig. 1A). In comparison, greater average social network proximity (a network interaction variable) was associated with having fewer depression symptoms among the young–old ($\beta = -0.050$, not shown) (Fig. 1B), but not among the old–old. This last age outcome was reversed in relation to mean contact frequency (another network interaction variable). That is, a significant positive association between mean contact frequency and depressive symptoms emerged among the old–old ($\beta = 0.036$), but not among the young–old (Fig. 1C). The remainder of the interaction findings presented in Table 4 reveal that age did not differentiate the negative associations that were generally observed between emotional closeness, the third interaction variable, and EURO-D symptoms (Fig. 1D), or between satisfaction (a network quality variable) with the network and the same depression outcome (Fig. 1E).

Discussion

This research examined social network structure, interaction, and perceived quality in relation to depressive symptoms among older Europeans. The data for the study were obtained by means of a name-generating social

network module that was employed in SHARE, in 2010. The second aim of the study was to ascertain if the associations between the respective network components and depressive symptoms varied by age, comparing respondents aged 65–79 with those aged 80 and older.

The first finding of note was that social network quality, measured as the extent of satisfaction with one's social ties, emerged as the network component with the strongest association with mental health in this sample of older Europeans. Network satisfaction was inversely associated with the number of depressive symptoms, and it was the variable that had the largest effect on the number of depressive symptoms, even after controlling for a range of possible confounders. These findings provide additional empirical support to previous literature that has cited the importance of the quality of relationships when assessing the role of social networks in relation to mental health outcomes (Barger et al. 2014; Fuller-Iglesias et al. 2008).

An added point of interest in this regard is that the interaction term for network satisfaction and age was not statistically significant in the current analysis. This particular result indicates that, on the whole, relationship quality was equally important for respondents of all ages in the sample. The first main observation of the current study seems to suggest, therefore, that it may be less important as to who “one is with” in late life. What matters most is how people feel about the person or persons who surround them.

The second main finding of the present study is that the results also align with previously published literature that cites the importance of social network structure in relation to late-life mental health (Litwin 2010). Social network

Fig. 1 The associations between network components and depression symptoms by age group. **A** Network size, **B** geographic proximity, **C** frequency of contact, **D** emotional closeness, **E** satisfaction with network

structure was operationalized in the current analysis as a count of named social network members. The results showed that this variable maintained a significant negative association with depressive symptoms, even after taking the sociodemographic and health characteristics into account. In other words, the more people with who the older Europeans sampled in this study maintained close

and personal relationships, the better their mental health was. Thus, although the quality of social relationships is important, their number is also important in promoting good mental health.

Going beyond the previous literature, however, the current analysis also examined the role of age in the relationship between network structure and depressive

symptoms. The age interaction terms of the model showed that network structure was differentially related to depression. Specifically, the results revealed that a larger network size was indeed beneficial for those under age 80. However, the negative association between network size and depressive symptoms was even stronger among those aged 80 and older. This finding emphasizes the importance of having a sufficient number of meaningful people with whom to interact in the latest stage of life, a period in which secondary relationships and other peripheral links tend to diminish (Fingerman 2004). It also suggests that there may be a critical minimum of meaningful social ties that is needed in order to maintain good mental health among the oldest members of society.

The third and last social network component that was examined in this study was the nature of the interactions with social network members. The findings regarding this network component further highlight the nuances of how social network characteristics intersect with mental health and specifically, the role of age in these associations. Three aspects of network interaction were examined: geographic proximity, frequency of contact, and emotional closeness.

Geographic proximity emerged as the characteristic that had the strongest negative association with depressive symptoms among the three network interaction variables. However, examination of the age interaction model revealed that the association between depressive symptoms and geographical proximity of the social network did vary by age category. The findings suggest that for the old–old, having a geographically proximal social network was unrelated to depressive symptoms, while among the young–old, having close friends and family nearby was associated with having fewer depressive symptoms.

This finding is, at first, counter-intuitive. One might expect geographical proximity of the network to matter more for the mental health of older-old adults, those who may be less mobile. A possible explanation for the current unexpected finding may be drawn from the work of Connidis (2010: 229) who writes that “The significance of proximity reflects the more voluntary nature of...relationships when compared to the more obligatory ties...” That is, having a range of close ties (beyond the immediate family) that live close by is what promotes mental health. The young–old tend to maintain more such elective ties than older-old adults do, as has already been referred to earlier (Fingerman, 2004). This could explain why proximity is depression reducing among the young–old but not among the old–old. The networks of the old–old tend to have more obligatory ties and fewer elective ones.

A different pattern was found regarding frequency of contact with the network. Average contact frequency was positively associated with depressive symptoms when considered in relation to the other social network factors

only. After holding sociodemographic and health characteristics constant, however, the amount of contact with social network members was not seen to significantly alter the number of depressive symptoms. Introduction of the age interaction term into the analysis clarified the association and revealed that significant differences by age group do exist. Examination of the main effects of the age groups showed a positive association between contact frequency and depressive symptoms only among those aged 80 and older. For the young–old, frequency of contact with important people in their lives became essentially unrelated to depressive symptom outcomes. Thus, frequency of contact with those closest is not intrinsically related to mental health among the young–old. However, the positive association with depressive symptoms among respondents aged 80 and older infers that having more frequent contact with those persons identified as part of the social network may actually be related to worse mental health outcomes. It could well be that the more frequent contact in question stems from the need to provide care and support to someone in the network which, in turn, may negatively affect one's mental state (Thompson et al. 2008). We find this to be a plausible explanation insofar as the effect of the respondents' own health on the depressive symptoms outcome was already controlled in the multivariate procedure.

As for the third network interaction variable, we found that emotional closeness between respondents and their social network members was negatively associated with depressive symptoms. The higher the average emotional connection between the survey respondents and their identified network members, the fewer depressive symptoms were indicated. This association existed independently of age, suggesting that the emotional nature of relationships provided similar benefit for all the older Europeans in the sample. This finding goes hand in hand, therefore, with the findings on network satisfaction. Indeed, felt emotional closeness might be considered to be as much a network quality indicator as it is an interactional characteristic of the interpersonal milieu, insofar as it reflects a partially subjective appraisal of one's relationships.

The findings of this research need to be interpreted within a framework sensitive to the limitations of the study. The direct approach of collecting social network information in SHARE was implemented only in the latest wave for which data have been released for public use. This limitation means that the cross-sectional findings presented here can indicate associations between depression and the different components of social network, but they cannot yet provide explanations of cause and effect.

A related limitation of the cross-sectional design of this study is its inability to determine the ordering of the experience of depressive symptoms and social network. That is, reverse causality might be at play here.

Specifically, although social networks are believed to affect depression, it could be that depression has an effect on important aspects of the network as well. For example, recent analysis of LASA data revealed that depression reduced network size (Houtjes et al. 2014). Future studies should take into account the change in depression symptoms over time to better ascertain if and how the social network influences depression outcomes among older Europeans, and vice versa. This longitudinal approach will be possible in the future, using SHARE wave 6, in which the social network module will again be administered.

Yet another possible limitation stems from the choice of the network variables that were addressed in this analysis. Some studies consider the functional characteristics of social network, such as provided or perceived available support. In our opinion, provided support is a potentially equivocal variable because not everyone needs support at the specific time of a given survey and hence do not receive it. Similarly, the measure of perceived available support is equally problematic because it may not reflect the actual support potential. For this reason, we chose to highlight geographic proximity as an objective measure of support potential.

A final limitation concerns the respondents removed from the analysis due to missing data. About eight and a half percent of respondents with a social network were excluded from the analysis. As noted, they were shown to report somewhat smaller networks and less satisfaction with their networks, but they did not differ on some of the other network measures. These reservations should be kept in mind when considering the findings. We also mentioned earlier that those with no network at all (and hence were excluded from the present analysis) reported a greater number of depressive symptoms. Once again, longitudinal analysis would be required to determine whether it was the lack of a network that increased the number of depressive symptoms in their case or whether it was the greater number of depressive symptoms that caused the absence of meaningful personal relationships.

In conclusion, we found that the association between personal social networks and depression in late life is nuanced by both network characteristics and by age. Some components of the personal social network, particularly structure and interaction, differ in how they seem to affect the mental health of the young-old and the old-old. That is, different network components matter differently at different points in late life. Social scientists should be aware of these age differences in their analyses of the effects of social network on mental health in late life. Practitioners who work with older people should be sensitive to these differences as well, when they plan interventions in relation to the interpersonal milieu of their older clients.

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