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The Role of Social Networks on Mental Health

An empirical study of population over 50 years old in Spain

Master Thesis

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I hope you enjoy,

Enrique.

Abstract

Among the social determinants of mental health, the social networks of individuals have been found to have an important effect, especially relevant at older ages. However, little is known about which aspect of the social networks (structure, interactions, or quality) is more critical for this link and how this relationship is shaped by sociodemographic characteristics in the Spanish context. This study attempts to address this gap in the literature using the Convoy Model of Social Relationships with a sample of Spanish population aged 50 and older. Linear regression analyses has been performed using data from the SHARE dataset. The findings show that the quality, composition (understood as the share of family members in the network), frequency of contact and emotional closeness are the dimensions of social networks more strongly associated to depression symptomatology (Euro-D scale). In addition, this relationship holds equally at all ages and for both sexes.

Keywords: Social networks, Mental health, Depression, Family, Spain, SHARE dataset.

1. Introduction.

During the last decades, the topic of mental health has received increasing attention in Europe due to its impact on individuals' lives and the overall health status of societies. The report elaborated by the Organisation for Economic Co-operation and Development and the European Union (OECD/EU, 2018) serves as an illustration of the extent to which the topic of mental health needs to be considered: In 2016, more than one in six people in the EU had a mental health problem and more than 84 thousand people died due to mental illness or suicide. In addition, the number of deaths from mental health problems has been found to increase with age, being the age groups from 50 years old onwards those most severely affected (OECD/EU, 2018). Therefore, given that mental health problems concern individuals and societies, research on its social determinants contributes to the improvement of health policy and, consequently, public health.

Among the variety of causes that lead to poor mental health in older adults, research has found that their social networks have an important effect. The social networks of individuals have already been proven to shape several dimensions of health, such as physical health (Fiori & Jager, 2012), self-rated health (Litwin, 2006), life satisfaction (Lim & Putnam, 2010), well-being (Wang & Kanungo, 2004), quality of life (García et al., 2005) or different dimensions of mental health such as depression (Börsch-Supan & Schuth, 2014; Litwin et al., 2015), anxiety (Litwin & Levinsky, 2021) or dementia (Fratiglioni et al., 2000). These studies show that, despite the heterogeneity of indicators used for both the measurement of social networks and different health outcomes, this relationship still holds to the point that the influence of social relationships is comparable with other well-known risk factors of mortality such as smoking (Holt-Lunstand, Smith & Layton, 2010). On top of that, research shown that the loss of social networks is especially important at old ages due death or impairment of friends and relatives and increasing mobility difficulties (Litwin et al., 2015).

Therefore, following the path of research that focuses on the implications that social networks have for the health of individuals and societies, this paper addresses the relationship between the different dimensions of social networks -structure, interactions, and quality (Litwin et al., 2015), further explained in the next section - and mental health for the elderly. As social networks are likely to change over the life course (Antonucci et

al., 2014), and the loss of social networks is especially important at higher ages, studying its effect on mental health for the elderly is a first step to tackle the problems of loneliness or social isolation and a path for policy-makers to improve the overall mental health status of individuals.

Parallely, research has shown that several sociodemographic characteristics are likely to shape the relationship between social networks and mental health, namely age, gender, socioeconomic status, and ethnicity (Litwin & Shiovitz-Ezra, 2011). Therefore, a second aim of this paper is to explore which are the sociodemographic characteristics that shape this relationship in order to enhance the scope and accuracy of policies attempting to improve mental health.

Furthermore, the context of Spain is an interesting scenario to explore social network's dynamics given its peculiarities compared to the rest of Europe. The Spanish caring model, alongside other South European countries, has been often defined as familistic referring to the role of families -especially women (Cais & Folguera, 2013)-, in providing informal care given the limited coverage of public policy (León & Migliavacca, 2013). This has been confirmed by research that categorizes Spain as one of the most familistic countries in Europe in relation to intergenerational support (Kalmin & Saraceno, 2008). In addition, the Mediterranean countries as a whole have been found to have larger families, a greater amount of children in the household, and more assistance exchanges within the household (Litwin, 2010). In contrast to other European countries that count on effective elder-care policies, the case of Spain is especially paradigmatic as a lack of social networks could entail the lack of care. This is already the case as several studies have pointed out that in Spain the older population has the highest likelihood of suffering loneliness and social isolation, being women especially vulnerable (Abellán et al., 2018), and mental health directly affected (Courtin & Knapp, 2017; Mushtaq et al., 2014).

To illustrate this, the European Survey of Health in Spain (EASE) (Instituto Nacional de Estadística, INE, 2020) gives an insight into the state of mental health in Spain: Approximately a 12% of the population over 15 years old presents some kind of depressive symptomatology. However, this number increases dramatically with age, reaching 24% for the 75-84 age group and almost 36% for the people over 85 years old.

Therefore, this study contributes to the scientific literature linking social networks and mental health by analyzing the case of Spain using the Survey of Health, Ageing and

Retirement (SHARE), as the number of studies considering the role of social networks in Spain is scarce (see García et al., 2005; Escobar-Bravo et al., 2012), and none of them explores its relationship with mental health for the entire Spanish population (Lahuerta et al., 2004; Zunzunegui et al., 2003).

Therefore, this paper tries to answer the following research questions:

- Which of the dimensions of social networks are most strongly associated to poor mental health outcomes for people over 50-year-old in Spain?
- How is this relationship shaped by sociodemographic characteristics in this context?

To this purpose, this thesis first presents a literature review addressing the relationship between social networks and mental health and the conceptual model that serves as an analytical tool for this study. Secondly, the SHARE dataset and the methods of analysis, alongside the conceptualization of the variables of interest as found in the literature, are explained in detail. Thirdly, the results are described and analyzed, providing an answer to the research questions. Then, a discussion in which the findings are contrasted to those in other studies, showing how the familistic nature of Spain might be of relevance in the relationship between social networks and mental health, alongside the potential implications of the findings and limitations of the study are explained in detail. Lastly, a final section declares the main conclusions of the study.

2. Literature review

2.1. The relationship between social networks and mental health

Before the studies addressing the relationship between social networks and mental health are presented, the concepts among which this paper builds must be defined. Social networks must be distinguished from other concept related to the study of social relationships which is social support. The latter refers to the functional content of social networks, the degree to which the social network provides assistance to individuals. This concept is usually subdivided between the actual support exchanged, referred to as actual support, and the subjective perception of the support referred to as perceived support (Fuller, Ajrouch & Antonucci, 2020). On the other hand, social networks refer only to the structural characteristics of social relationships (Santini, Koyanagi & Tyrovolas, 2015), which is the focus of this study. Its proper study covers the size and composition of the network, the interactions that take place, and the degree at which the individual is satisfied with it (Litwin et al., 2015). This distinction is of great relevance as both concepts operate together: it is through its ability to provide social support that the social network can shape the mental health of individuals. This is especially important at older ages due to the loss of friends and family members in the social network. However, its study requires different approaches: in contrast to social support studies, the study of social networks requires a characterization of the web of social relations around an individual that includes who the contacts are and the nature of the ties that connect them (Smith & Christakis, 2008).

2.2. The relationship between social networks and mental health

The relationship between social networks and mental health for the elderly has already received attention in the academic literature. The findings suggest that there is a relationship between social networks and mental health, but differences in the conceptualization of social networks, the mental health outcome studied, and varying cultural contexts make it difficult to compare and draw conclusions between studies. Therefore, in what follows, the findings in the literature on social networks and mental health are presented, followed by the few studies that study this relationship in the Spanish context.

So far, we know that the structure of the network, which covers its size and composition, plays an important role on mental health, as early studies focused on social networks included only indicators of its structure. For example, in the context of Europe, Börsch-Supan & Schuth (2014) studied how social networks moderate the relationship between early retirement and cognition for adults above 50 years old using the SHARE dataset. They just looked at the size, measured as the number of individuals mentioned as close confidants, and the composition of the network, including only friends and colleagues, and found that individuals whose social networks decrease due to retirement lose cognition and have increased depressive symptoms.

In the Chinese context, Meng & Xue (2020) looked at how the size of the network, measured by asking how to many people respondents sent greetings by any means during the Chinese New Year, affects mental health, measured with the General Health Questionnaire of 12 questions (GHQ-12). Their findings suggest that individuals who are able to create a wide social network are less likely to suffer from mental health problems.

However, as the study of social networks evolved, researchers started to include the interactions with the network as a key aspect to explore. In this line, only a few studies have focused on the Spanish context.

Puga et al. (2007) compared the social networks of older people in Costa Rica, Spain and England and found that the presence of strong family ties with frequent contact in the social network reduces the chances of experiencing depressive symptomatology, being the family especially important in Spain.

Lahuerta et al. (2004) assessed the influence of social networks on the mental health of the elderly in the city of Barcelona. Their findings suggest that a low frequency of contact with friends has a negative effect on mental health -measured using the GHQ-12 just like Meng & Xue, (2012)-, especially important for individuals above 75 years old.

Zunzunegui et al. (2003) examined the role of social networks, social integration and social engagement on cognitive decline in a Spanish Community-Dwelling and found that frequent contact with family and friends has beneficial effects in maintaining cognitive function at old ages.

Some other studies have used a pattern-centered approach to find typologies of social networks in certain populations (as opposed to the previously presented studies that use a variable-centered approach). For example, Litwin (2001) explored the link between the social networks of older Jewish persons in Israel and their morale using variables relating to the structure and frequency of contact of the social network. Among his findings, he showed that a high frequency of contact with a variety of friends might be more psychologically beneficial than frequent interaction with kin. This finding is contradictory to other studies that suggest the opposite direction: a larger share of friends in the social network is less beneficial than a large share of kin (for example, Teo et al.(2013) in the US context). However, these differences are very likely to be due to cultural characteristics related to the role of the family in the exchange of support (Litwin, 2010).

Lastly, recent research focused on the link between social networks and mental health has emphasized the relevance of including indicators assessing the quality of the social network, usually conceptualized as the subjective satisfaction with the network. In this line, Litwin et al. (2015) study how social networks affect the mental health (measured as a number of depressive symptoms) of older adults in Europe at different ages. They conceptualize social networks as including structure, interactions, and quality dimensions which are differently associated with mental health. They found that the quality of the network is the most strongly associated with depressive symptomatology at all ages, suggesting that a large network (structure) with frequent interactions that is perceived as low quality might be unable to provide enough (perceived) support to maintain good mental health even if there is a generous amount of actual support exchanged. In addition, they found a negative association between the network size and the number of depressive symptoms.

In this line, Berg et al, (2006) investigate the factors shaping the life satisfaction of individuals above 80 years old in the context of Sweden. In relation to social networks, their findings suggest that it is not the frequency of contact that makes a difference on life satisfaction. Instead, perceiving the social networks as being of high quality at oldest-old ages (80+) is the most important factor, without gender differences.

Thus, this literature review has shown the link between the different aspects of social networks and mental health. However, research has also shown that this relationship, and more specifically the relationship between social networks and depression, is shaped by different sociodemographic characteristics that must be considered in this study. Among these, age has been found to have an important effect on depression (Litwin et al., 2015) as aging typically entails changes in the structure and interactions of the networks. In addition, different stages of the life course could change how the availability of social networks affects depression. For example, an individual between 50 and 64 in the context of Spain is very likely to be still working, which entails daily activity and much less dependence on the members of his/her social networks. On the other hand, oldest-old individuals (80+) have higher chances of having lost a big share of their social network due to mobility problems that reduce the frequency of contact, death, or impairment. From this argument, it could be hypothesized that the older an individual is, the less protective his/her social network will be and, therefore, the more chances of experiencing depression. However, Litwin et al. (2015) show that even though the structure and interactions with the social network matter, the quality is the most strongly associated with depressive symptomatology at all ages. Then, despite the loss of social networks derived from aging, its protective effect from depression might remain if the social networks available are considered of good quality. Therefore, this study remains exploratory about the effect of age.

Another important sociodemographic characteristic to be included is gender. The study of Zunzunegui et al. (2003) shows that in the Spanish context the protective effect of the social network -in this case, the interactions that take place-, on mental health varies by gender, being effective for women but not for men, even though the empirical analysis of Dalgard et al. (2006) shows that in Spain men and women receive a similar amount of social support. This could be explained by the findings of Belle (1991), who states that women maintain more close relationships than men and mobilize more of the resources of their social network. However, following this argument, the loss of social networks able to provide social support would mean a greater shock for women than for men, increasing the risk of depression (Kendler et al, 2005).

In addition, research has shown that socioeconomic status also plays a role in the relationship between social networks and mental health and must be considered in this analysis (Litwin & Shiovitz-Ezra, 2011).

Lastly, several studies have emphasized the relevance of cultural differences in the construction of social networks and their relation to health outcomes (Litwin, 2006; Litwin, 2010; Wang & Kanungo, 2004). As there are cultural differences with regard to the role of families in the exchange of social support when compared with other European countries, this study is exclusively based in Spain, which is an interesting scenario given its peculiarities:

In the first place, the Spanish caring model, alongside other European countries such as Italy, Greece, or Portugal, has been often defined as familistic. This term refers to the role of families, and especially women (Caïs & Folguera, 2013), in providing informal care given the limited coverage of public policy (León & Migliavacca, 2013). The family, then, has the responsibility to take care of the elderly when no other option is available, which has taken Spain to be categorized as one of the most familistic countries due to the great amount of intergenerational support that is exchanged within families (Kalmin & Saraceno, 2008). Secondly, the structure of the family in Spain (and the Mediterranean) presents significant variations when compared to other non-Southern European countries. Among these, an aging population, larger families, a greater number of children in the household, and more assistance exchanges within the household (Litwin, 2012), characterize a scenario where the role of families is vital, especially for the elder. The lack of members of the family, hardly replaceable by friends in this context, could entail a lack of care for older adults, leading to an already pessimistic scenario of loneliness and social isolation at old ages (Abellán et al., 2018) with severe consequences for mental health.

Therefore, Spain is an optimal scenario for the study of social networks given its particularities. However, only a few studies have addressed the relationship between social networks and mental health outcomes in the Spanish context. Among these, the already mentioned work of Zunzunegui et al. (2003) in a Spanish community-dwelling in Leganés, Madrid, and the study of Lahuerta et al. (2004) in the city of Barcelona are the most remarkable studies addressing the link between social networks and mental health outcomes for older people in Spain and serve to guide this study. Therefore, studying how the different components of social networks affect the mental health of the elderly in a representative sample of the Spanish population fills a gap in the literature. In addition, by understanding which sociodemographic characteristics shape this relationship in the

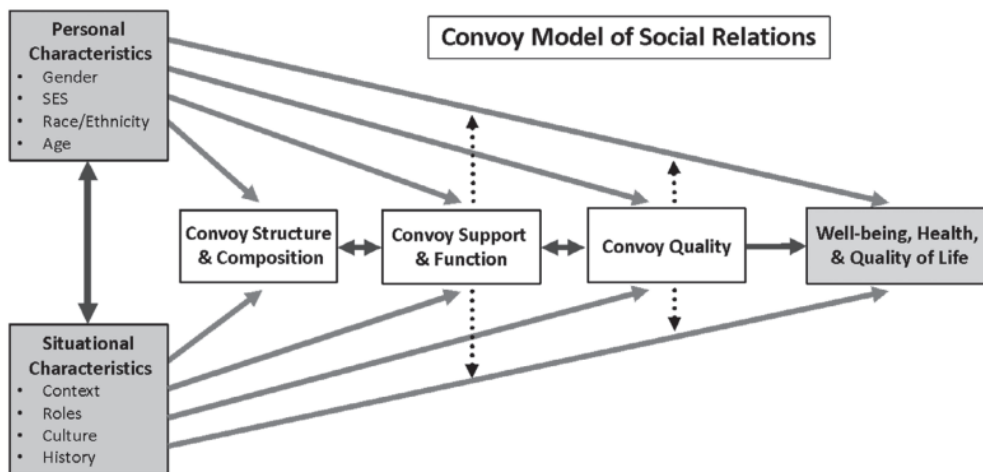
context of Spain, this study enhances the scope of policy targeting to improve the overall mental health status of society.

2.3. Theoretical framework

To understand how social networks might affect the mental health of individuals, this study draws from the framework of the convoy model of social relations developed by Kahn and Antonucci (1980). The convoy model of social relations states that “individuals are surrounded by supportive others that move with them over the life course” (Antonucci et al., 2014:84), forming the convoy. In this model, social relations are conceptualized as multidimensional including structure (the characteristics of the social network), function (the social support that is actually exchanged), and quality (the subjective evaluation of the support received) dimensions. The main contribution of this model is that these dimensions, while shaped by personal - individual factors that include age, sex, ethnicity, and socioeconomic status - and situational characteristics -referring to the context in which people live, including roles, norms, and expectations-, have important implications for physical and mental health, well-being and the quality of lives of individuals (Fuller, Ajrouch & Antonucci, 2020).

The Convoy Model of Social Relations has a great pragmatism from a multidisciplinary perspective as it considers the social factors, on the personal and contextual level, that shape the relationship between social relations and mental health. It was elaborated to unify the evidence regarding the relationship between specific aspects of social relations and different health indicators, while guiding future research in multiple disciplines. Among its advantages there is the fact that both longitudinal and cross-sectional studies can build from this framework. While longitudinal studies are able to capture the life course and life span shifts of the convoy, which is likely to change as the individual ages; cross-sectional studies can focus on some of the specific aspects of the model and elaborate accurate studies that shed light on the complex nature of social relations -as presented in Figure 1, which shows the cross-sectional visualization of the model-. Therefore, using its cross-sectional approach, this model is perfect to address the relationship between social networks and mental health of the elderly in this study.

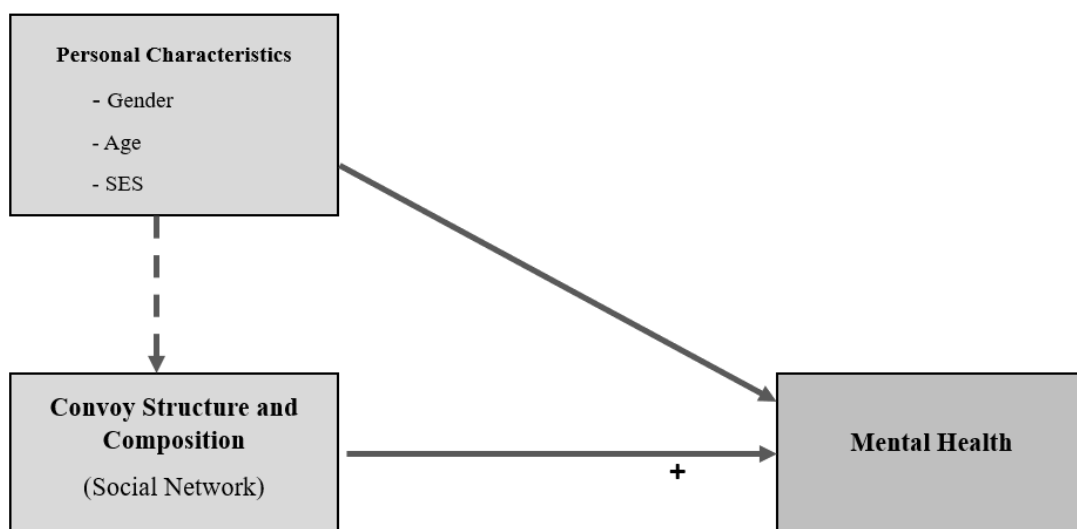
Figure 1. Convoy Model of Social Relations



Source: Fuller, Ajrouch & Antonucci (2020).

For the aim of this study, the focus is on the Convoy Structure and Composition which represents the social networks as such. Being the focus of this paper exclusively on social networks, and given the complexity of its conceptualization, the other two dimensions of the convoy (Convoy Support & Function and Convoy Quality) are removed from the analysis in order to clarify the concepts. With these changes, the conceptual model for this study is represented in Figure 2.

Figure 2. Conceptual model.



Source: Own elaboration based on Fuller, Ajrouch & Antonucci (2020).

This model, following the pathway of the Convoy Model of Social Relations, suggests that the different aspects of social networks have an effect on the mental health of individuals that is shaped by personal characteristics. The plus sign in the arrow that relates social networks and mental health indicates that this relationship is expected to be positive. The shaped line between the personal characteristics and the social networks suggests that while the relationship between social networks and mental health is shaped by personal characteristics, the latter could be also influencing the structure and composition of the social network itself. Lastly, this study is concerned that the relationship between social networks and mental health follows a double direction: While social networks might influence mental health, the mental health status of individuals could also influence the way in which their social networks have evolved. This limitation is further explained in the discussion.

In addition, in order to fully understand the complexity of the study of social networks, this paper elaborates from the previously mentioned work of Litwin et al. (2015) who divides social networks into three dimensions: The structure of the network, which accounts for its size and composition; the interactions that take place; and the quality of the network.

Therefore, to answer the first research question, this paper attempts to measure the disaggregated effect of each of the aspects of social networks to understand which aspect should be the focus of policy-makers in order to improve the overall mental health status of the elderly in Spain.

Following research, the quality of the network is expected to be the aspect most strongly associated with mental health, having a positive association: the better the quality of the social network, the better the mental health of individuals. Then, in relation to the structure, the size of the social network is expected to have a positive link with mental health as the larger the social network, the more social support it should be able to provide and, consequently, the better the mental health. Additionally, the composition is expected to influence mental health positively when it is formed by a larger share of family ties, when compared to a larger share of friends ties, given the familistic nature of the Spanish context. Lastly, in relation to the interactions with the social network, the more frequent, proximal, and closer the interactions are, the better the mental health of individuals.

Then, the personal characteristics shaping this relationship are explored in order to understand which sociodemographic profile has to be the target of policies attempting to enhance the mental health of the elderly. To do it, the focus is on how gender moderates the relationship between different aspects of social networks and mental health. This is due to previous findings that suggest differences in the protective role of social networks on health due to gender (Dalgard et al., 2006).

To sum up, this literature review has shown that social networks do have a moderating role on the mental health of individuals which varies according to the aspect of social network studied, the sociodemographic profile of individuals and the situational context in which they live. In addition, the suitability of the Convoy Model of Social Relations as a framework to understand how the different dimensions of social networks and the personal and situational characteristics of individuals affect mental health has been shown. Hereinafter, the data and methods of analysis used in this study to answer the research questions are shown and explained in detail.

3. Data and methods

3.1. The Share dataset

The data used in this study is drawn from the Survey of Health, Ageing and Retirement in Europe (SHARE). The SHARE dataset is a multidisciplinary panel that collects microdata in the individual and household level about health, socioeconomic and living conditions of a representative sample of adults aged 50 and older in 28 European countries and Israel. It attempts to capture the implications of ageing from diverse perspectives, including different modules that collect information relevant for several disciplines (Börsch-Supan et al., 2013)..

Since 2004, eight waves have been collected using computer-assisted personal interviewing (CAPI) and asking the same respondents that could be reached from previous waves. This format provides the SHARE dataset with both, a longitudinal approach that allows researcher to test the consequences of ageing in terms of health and socioeconomic conditions over the life-course, and a cross-sectional approach intended to make research comparable between and within countries (Börsch-Supan et al., 2013).

This study uses the 8th wave of the SHARE dataset, as it is the last wave available that contains information about the mental health and social networks of individuals. However, despite being still comparable to the previous waves, this wave is different because the data collection had to be stopped at 70% of all expected interviews due to the rise of the Covid-19 pandemic in March 2020. At this point, its developers decided that it was not feasible to keep doing face-to-face interviews and launched a new dataset labelled SHARE Corona Survey that was collected via computer-assisted telephone interviews (CATI). This new version of the SHARE contains some of the previously used items and also a new battery of Covid-specific questions that attempted to capture the peculiarities of the moment. However, the inclusion of new variables was balanced with the omission of some of the old ones, making these new waves hardly useful if the topic to study is not related to the consequences of Covid-19 (Börsch-Supan, 2022)

The original sample of Spanish population contained N= 2129 observations. After dropping those observations that fail to answer any of the variables used in this study, the sample contains N = 1750 observations.

Additionally, this dataset fits the purpose of this study due to several reasons:

Firstly, it is easily available for education purposes (such as conducting a Master' thesis) and it only requires identifying with an institutional email to access the data.

Secondly, it provides different thematic modules that can be easily merged into one big dataset through an individual identification variable. This way, data can be easily tidied and analyzed using smaller files. For the purpose of this study, the subsets of mental health, sociodemographic characteristics, isced, gv_imputations and social networks were needed. Compared to other datasets, the SHARE dataset makes it easy to study social networks given the above-mentioned module. In addition, given that it is not easy to conceptualize mental health using survey data, the module provided by this dataset allows to use the Euro-D scale for the study of depressive symptomatology on older adults, as it is deeply explained in the following section.

Thirdly, even though this study looks only at Spain, the SHARE dataset facilitates the comparison between countries and provides a possibility for further research to replicate the study on a different context.

Lastly, this dataset considers the needs and peculiarities of using the elderly as the target of research. This is a great advantage as other datasets accounting for the whole population structure do not take into account variables such as memory or cognitive decline that are of great relevance at this old ages.

3.2. Conceptualization of mental health

To measure the mental health status of the individuals in the sample, this article uses the Euro-D scale developed from the Geriatric Mental State Examination (GMS), one commonly used indicator to evaluate the mental health of older adults (Prince et al., 1999). This scale is an indicator of the number of depressive symptoms that an individual has and it is constructed through twelve different items that ask respondents to report if they have experienced any of the following depressive symptoms in the last month: Depression/sadness, pessimism, suicidality, guilt, sleep problems, lack of interest, irritability, appetite, fatigue, concentration, enjoyment, and tearfulness. Then, according to the number of responses "Yes", the Euro-D scale ranges from 0 to 12, being the higher the score, the poorer the mental health of respondents.

The Euro-D scale has been found to be internally consistent and valid for comparison across countries (Prince et al., 1999; Maskileyson et al., 2021) and reliable in detecting probable cases of depression of older population in Spain (Larraga et al., 2006). In addition, it has already been used in studies of the social determinants of depression (i.e. Richardson et al., 2020; Buber & Engelhardt, 2008) and studies addressing the link between social networks and depression (Litwin, 2010; Litwin et al., 2015).

Other depression scales, such as the Center for Epidemiological Studies Depression scale (CES-D) or the Hospital Anxiety and Depression scale for depression (HADS-D), are also commonly used in studies addressing the link between social relationships and depression. However, the Euro-D scale seems to be the best option for this study as the SHARE dataset provides a module on mental health that makes its conceptualization easy. Before the creation of the scale, the correlation matrix of the variables included can be seen in Table 1. It shows that all variables follow the same direction, which is a good indicator of the validity of the scale.

Table 1. Correlation matrix of the variables used to create the Euro-D scale.

	Sad	Hop	Suici	Guil	Sleep	Int	Irrit	App	Fati	Con	Enj	Tear
	...	...	de	ty	...	...	...	...	...	...	...	...
Sad	1.00											
Hopes	0.19	1.00										
	82	00										
Suicide	0.28	0.26	1.000									
	69	36	0									
Guilty	0.16	0.03	0.219	1.00								
	00	81	7	00								
Sleepproblem	0.32	0.07	0.155	0.12	1.000							
	21	87	8	33	0							
Interest	0.28	0.27	0.249	0.10	0.211	1.00						
	33	73	7	75	3	00						
Irritability	0.31	0.08	0.223	0.20	0.230	0.18	1.00					
	12	84	6	64	5	21	00					
Appetite	0.21	0.17	0.192	0.05	0.148	0.24	0.10	1.00				
	83	68	9	27	6	53	69	00				
Fatigue	0.30	0.17	0.206	0.11	0.240	0.27	0.19	0.25	1.00			
	73	59	2	26	7	38	46	19	00			
Concentration	0.21	0.17	0.147	0.10	0.173	0.27	0.13	0.14	0.20	1.00		
	93	63	5	58	8	19	26	25	71	00		
Enjoyment	0.17	0.28	0.219	0.04	0.110	0.28	0.09	0.21	0.17	0.23	1.00	
	43	22	2	74	9	32	52	85	03	00	00	
Tearfulness	0.50	0.12	0.210	0.13	0.289	0.26	0.28	0.22	0.23	0.18	0.15	1.000
	35	11	1	60	4	41	76	16	96	81	00	0

Source: Own elaboration from SHARE dataset.

To further test the validity of this scale, a Cronbach Alpha test has been run in order to assess the internal consistency of the scale in this sample (more specifically, the Cronbach

Alpha test estimates the share of variance in the scale scores that can be attributed to true score variance). If all variance is consistent through the items of the scale, the resulting Cronbach Alpha would be equal to one. (Brown, 2002)

In this case, as displayed in Table 2, the scale has a Cronbach Alpha of 0.7505, meaning that the scale has internal consistency in this sample (the scale is 75.05% reliable) (Brown, 2002).

Table 2. Results of Cronbach Alpha test.

Item	Obs	Sign	item-test correlation	item-rest correlation	average interitem covariance	alpha
sad	1750	+	0.6770	0.5458	.0277589	0.7107
hopes	1750	+	0.4667	0.3127	.0326198	0.7431
suicide	1750	+	0.5081	0.4092	.0330688	0.7331
guilty	1750	+	0.3170	0.2217	.0358763	0.7491
sleepproblem	1750	+	0.5292	0.3726	.0311574	0.7362
interest	1750	+	0.5818	0.4669	.0310247	0.7244
irritability	1750	+	0.5032	0.3600	.0320073	0.7368
appetite	1750	+	0.4619	0.3453	.0333843	0.7383
fatigue	1750	+	0.5771	0.4207	.0299441	0.7298
concentration	1750	+	0.4726	0.3453	.0329524	0.7382
enjoyment	1750	+	0.4518	0.3379	.0336169	0.7391
tearfulness	1750	+	0.6092	0.4757	.0296972	0.7217
Test scale					.0319257	0.7505

Source: Own elaboration from SHARE dataset..

Lastly, this scale is skewed to the right. To improve its validity for OLS analysis, a log transformation of the variable has been carried out, following the pathway of previous studies that also employ the EURO-D scale (i.e. Litwin et al., 2015).

3.3. Conceptualization of social networks. The main predictors

The conceptualization of social networks is complex. Nevertheless, the SHARE dataset provides a social network module with an innovative tool: a name-generated social network. This works as follows: Respondents are asked to name up to six persons with whom they discuss important issues, with the possibility of including a seventh person if

the respondent thinks it is necessary for any reason. Then, more information is asked about each person mentioned, including gender, relationship type, geographic proximity, frequency of contact and emotional closeness. Lastly, respondents are asked to rate the level of satisfaction they have with the people that they had named.

This tool allows us to identify the social networks of respondents by their own words. Therefore, using this tool, the three dimensions of social networks (structure, interactions and quality) are conceptualized using several variables:

For the structure, the *size* and *composition* of the social networks must be considered. The size is measured as the number of persons that respondents are able to name, which goes from 0 to 7. The composition is measured as the share of family members that form the social network and is calculated as the number of family members in the social network divided by the size of the network. This measure ranges from 0, for individuals that do not have any family member in the network; to 1, for individuals whose network is fully composed by family members.

For the interactions, three variables are used: the *frequency of contact* with the individuals of the network, the *geographical proximity*, and the *emotional closeness*. Frequency of contact ranges from (1) “Daily contact” to (8) “Never”. Proximity ranges from (1) “Same household” to (8) “More than 500km”. Lastly, emotional closeness ranges from (1) “Not very close” to (4) “Extremely close”. Given that one response is provided for each member of the network on the three different indicators, the analysis uses mean scores variables (i.e. the mean frequency of contact within the members of the network).

Finally, the *quality* of the network is assessed by using the self-reported network satisfaction. This measure ranges from 0 to 10, being the higher the score, the higher the network satisfaction.

3.4. Socio-demographic variables

In addition, several sociodemographic variables are included in this analysis. These include: sex, coded as (0) male and (1) female; age, which is added as a continuous variable ranging from 50 to 100; education, which follows the ISCED-97 standards (UNESCO, 2003) and ranges from (0) “pre-primary education”, to (6) “second stage of

tertiary education”; and marital status as a dummy that accounts for (0) those that are married or with a partner, and (1) for those that are widowed, divorced or never married.

3.5. Control variables

In addition, two variables are included in order to control for the health status of the individuals in the sample. These are: a dummy variable assessing the memory of respondents and codified as (0) “Good memory” and (1) “Not that good memory”; and a dummy variable reporting the self-perceived health of respondents distinguishing between those with a good-excellent health and those with a fair-poor self reported health.

3.6. Statistical analysis

The analysis begins by providing univariate description of the variables relating to mental health, social networks and sociodemographic variables in order to provide an illustration of the state of the sample in these domains. Following this, a correlation matrix shows how this variables relate to each other and serves as first step to detect the presence of multicollinearity.

Detecting the presence of multicollinearity is important because this study performs Ordinary Least Square (OLS) regressions in order to answer the research questions. This method of analysis allows us to understand how (in terms of direction and strength) the different dimensions of social networks affect the number of depressive symptoms of individuals while taking into account other relevant factors (sociodemographic characteristics and previous health status) (Mehmetoglu & Jakobsen, 2017). Additionally, the presence of heterokedasticity is also tested to ensure the correctness of the assumptions. Therefore, a first model (M1) using the number of depressive symptoms (Euro-D scale) as the dependent variable and the variables accounting for the dimensions of social networks as independent variables, alongside the sociodemographic variables and the health cofounders, allows us to answer the first research questions. Among those variables that are found to have an effect on the number of depressive symptoms, the model shows which of them are more strongly associated.

As a second step, two more models (M2 and M3) are run in which interaction terms are included between the variables relating to the structure of the network (size and composition) and gender. This allows us to test how the effect of the size and composition of the network on the number of depressive symptoms varies according to gender, answering to the second research question. To understand this information, a graphic visualization of the interactions is presented

Lastly, this study uses the software Stata 17.0 SE to perform the statistical analysis.

Therefore, the following section presents the results of this analysis. First, by providing univariate description of the variables included in the model. Then, the three models are presented, and the research questions answered.

4. Results

4.1. Descriptive Statistics

The results section of this study provides some descriptive statistics of the different sets of variables used in order to provide insight of the dataset. Table 3 shows these descriptive statistics by providing information about the number of observations, mean score, standard deviation and range of data for the mental health indicator, the set of social network variables, the sociodemographic characteristics and the cofounders. In what follows, more in detail descriptive statistics are presented for each of the group of variables.

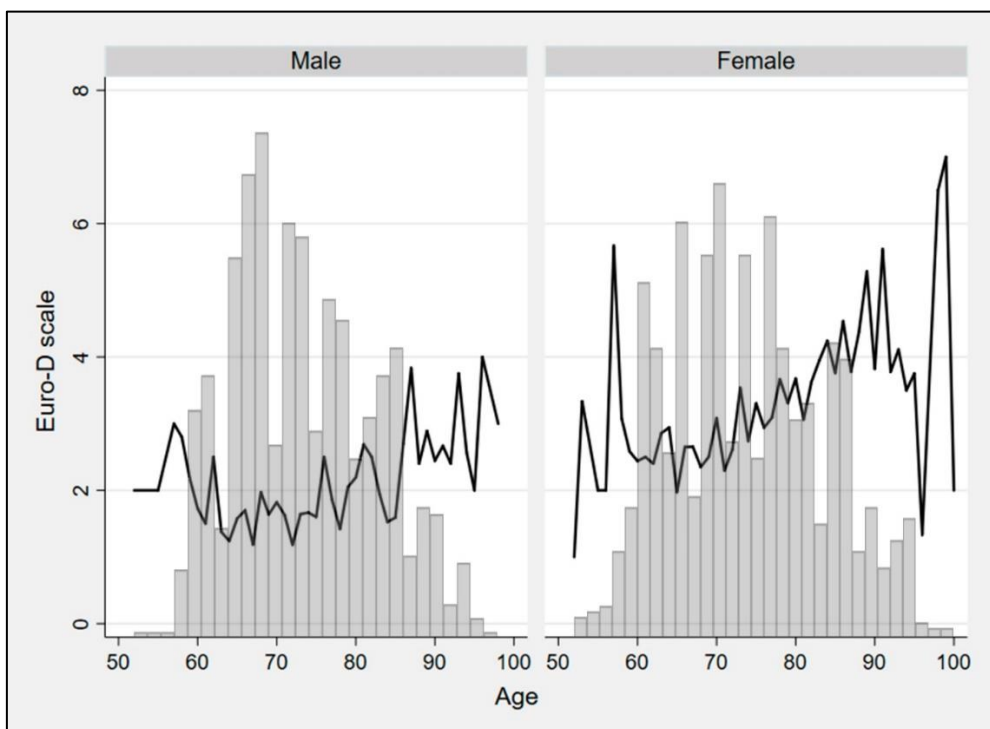
Table 3. Descriptive Statistics

Variable	N.	Mean	Std. Dev.	Min	Max
<i>Mental Health</i>					
Euro-D scale	1750	2.625	2.475	0	12
<i>Social networks</i>					
Structure					
Size	1750	2.821	1.51	1	7
Composition	1750	.839	.282	0	1
Interactions					
Frequency of Contact	1750	1.484	.67	1	6
Geographical Proximity	1750	2.949	1.378	1	8
Emotional Closeness	1750	3.387	.5	1	4
Quality (Satisfaction)	1750	9.141	1.168	0	10
<i>Sociodemographic</i>					
Age	1750	73.733	9.492	52	100
Sex	1750	.577	.494	0	1
Partner	1750	.18	.384	0	1
Education	1750	1.776	1.509	0	6
<i>Health</i>					
Memory	1750	.386	.487	0	1
Self-perceived health	1750	.419	.494	0	1

4.1.1. Mental health

First, mental health as measured with the Euro-D scale assessing the number of depressive symptoms of individuals shows differences by age and gender. Figure 3 shows these differences by plotting the mean score in the Euro-D scale at every age for males and females in the sample of the SHARE dataset. In addition, a histogram is presented for each sex showing the density of observations at every age. According to this graph, the overall number of depressive symptoms increases with age for both, men and women, which is something that could have been expected. However, Figure 3 suggests that individuals aged between 50 and 60 years old have higher scores than the immediately older age groups, being this pattern more pronounced in the case of females. Overall, the number of depressive symptoms is relatively high for the 50-60 age group, lower for the 60-70 age group but following an increasing trend that peaks in the oldest age groups. This trend is similar for both sexes. Nevertheless, the most pronounced scores are located at the youngest and oldest ages where the density of observations is smaller as shown by the histogram. This low share of observations could entail an overestimation of the number of depressive symptoms and, therefore, must be taken with caution.

Figure 3. Score in Euro-D scale by sex and age and histogram by sex.



Source: Own elaboration from SHARE dataset.

On the other side, the differences by sex in absolute terms are evident from the data visualization. Females report an overall higher number of depressive symptoms at almost all ages and a more dispersed distribution, while men report lower scores more evenly distributed.

4.1.2. Social networks

The descriptive statistics of the social networks in the final sample can also be seen in table 3.

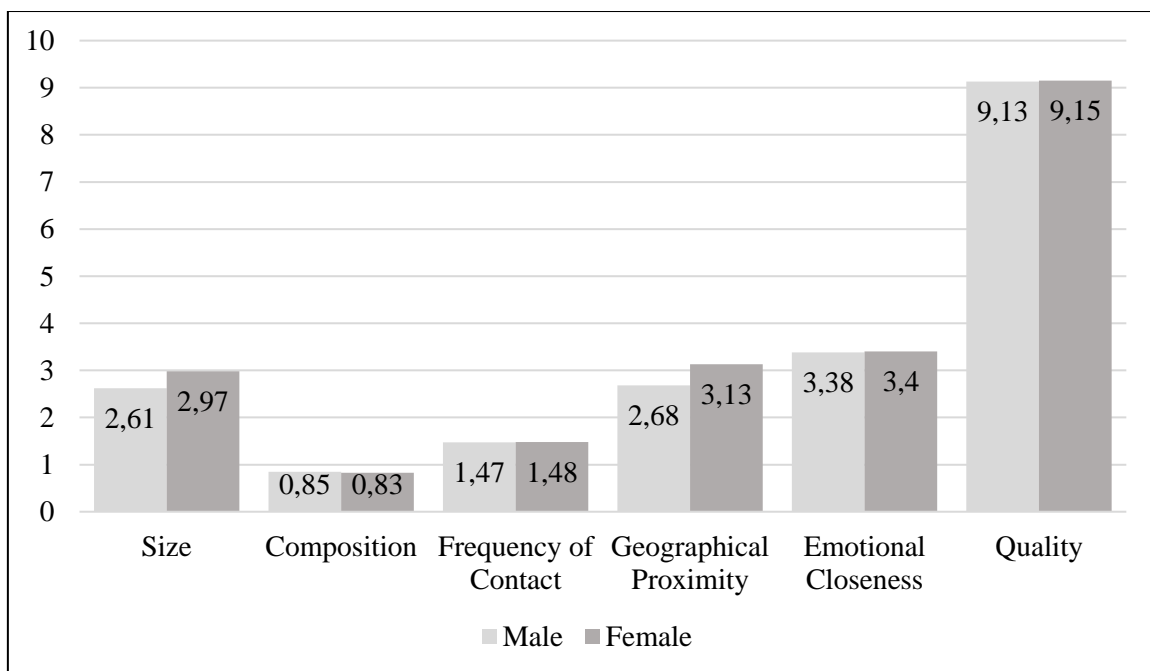
Concerning the structure, the mean size of the network is 2.8 members, and none of the respondents reported having less than one member in the network. Additionally, only 13% of the sample reports having a social network larger than four members. Regarding its composition, the mean share of friends in the network is 84%. Even though there are no references to understand how large this number is in comparison with other samples, it seems reasonable in the familistic Spanish context. On top of this, only 5% of the sample reports having no relatives in the social network while the 69% affirms having social networks entirely formed by family members.

In relation to the interactions with the network, around 46% of the sample reports an average daily frequency of contact, meaning that the frequency of contact with each of the members of the social network is daily. Given these numbers, it is unsurprising that around 88% of the sample reports an average frequency of contact of several times per week. On the other side, only around 3% report having less than one contact per week on average with the members of their network showing the relevance of having frequent interaction to be considered a member of the social network. Regarding the geographical proximity, around 59% of the sample has their social network located on average at less than 1km, and almost 20% state that all the individuals in their network are living in the same household. Lastly, concerning the emotional closeness with the members of the network, the results are not surprising. More than 30% of the sample define their relationship with all the members of the network as extremely close and almost 57% report being on average at least very emotionally close to the members of their network.

Lastly, in terms of quality, the sample reports high levels of satisfaction. The majority (almost 53%) of the sample reports being completely satisfied (10) with their social network, and almost 75% of the sample is highly satisfied (8-10) with the network.

Surprisingly, hardly any difference by gender can be found in the different variables addressing social networks. Figure 4 shows the mean values of response on these variables by gender and only the size and geographical proximity are clearly differentiated, although the divergence is rather small. Females score higher in size of the network (2.97 for females compared to 2.61 for men) and geographical proximity, meaning that the social networks of females are on average bigger and more dispersedly located.

Figure 4. Scores in Social Network Variables by sex



Source: Own elaboration from SHARE dataset.

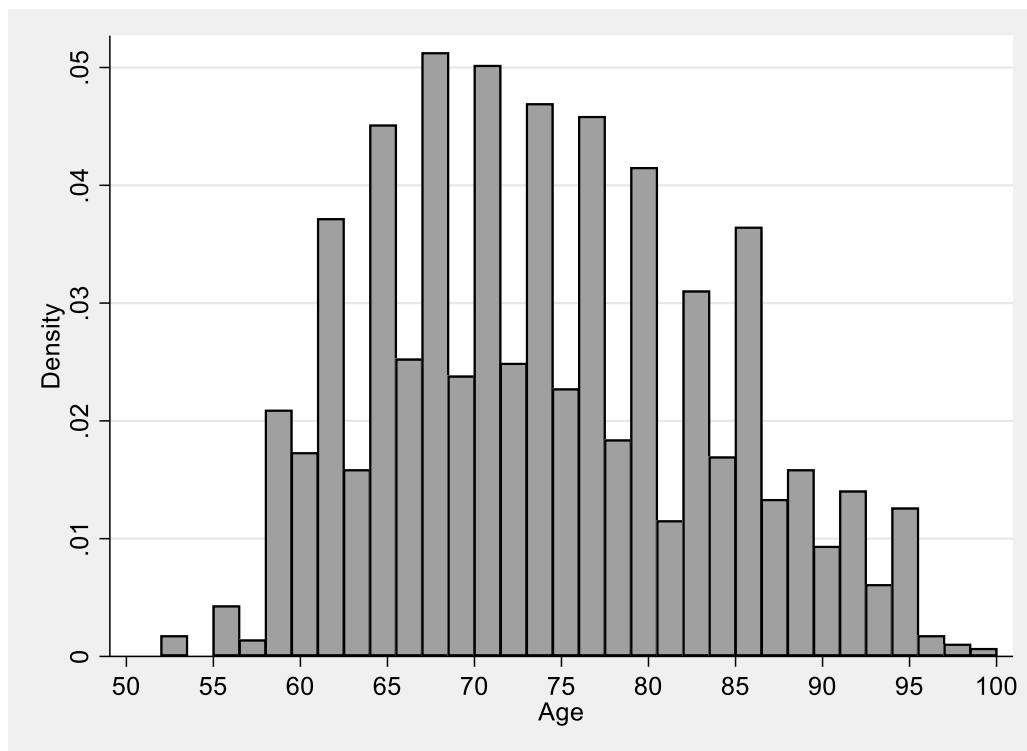
4.1.3. Sociodemographic characteristics and control variables

Lastly, the descriptive statistics of the sociodemographic characteristics and control variables are presented in this section.

By gender, the sample is comprised on a 42.6% by males (N=786) and a 57.4% by females (N=1059). This structure in terms of gender is what could be expected from an ageing population, as the number of men is usually smaller at higher ages due to their higher mortality rates.

In terms of age, Figure 5 shows the distribution of the observations of the sample by age. As it can be seen, the sample is normally distributed regarding age. However, a slight skew to the right can be appreciated as the number of observations drops from the age of 87 and gets higher from the age of 58. The mean age for the whole sample is 73.9 with a standard deviation of 9.6. The median is found at the age of 73, and the mode at the age of 68 which accounts for 4.17% of the sample.

Figure 5. Density of observations by age



Source: Own elaboration from SHARE dataset.

Considering the differences by sex, the sample of women is slightly older (mean age of women is 74.1 compared to 73.7 for men). The median age is equal for both, men and women (73), and the mode is higher for women, being 67-68 for men and 71 for women.

The variable of education reports that 53% of the sample has achieved a maximum level of primary education, while only a 12% of the sample has achieved some tertiary education. This is not surprising given the age of the sample and the low likelihood of achieving tertiary education in the Spanish context more than 50 years ago.

The variable concerning the availability of a partner shows that most of this sample (82%) currently has a partner, while the rest (18%) does not.

Lastly, the descriptive statistics of the control dummy variables included in the model are presented in Tables 4 and 5. Regarding self-perceived health, 57.47% of the sample reports having at least good self-perceived health while the other 42.53% considers having a fair-poor health. Table 4 displays these descriptive statistics by gender and shows that men report better self perceived health with a 62.58% of the male sample reporting good health compared to a 53.59 of the female sample.

Regarding memory, the majority of the sample (61.27%) reports good memory. In this case, the differences by sex are small and women report slightly better memory conditions than men (65.29% of women report good memory compared to 59.9% of men).

Table 4. Self-perceived health by sex*

Self-perceived health.	Sex		
	Male	Female	Total
Good	490 (62.58)	567 (53.59)	1057 (57.41)
Poor	293 (37.42)	491 (46.41)	784 (42.59)
Total	783 (100.0)	1058 (100.0)	1841 (100.0)

Table 5. Memory status by sex*

Memory	Sex		
	Male	Female	Total
Good	469 (59.90)	659 (62.29)	1128 (61.27)
Poor	314 (40.10)	399 (37.71)	713 (38.73)
Total	783 (100.0)	1058 (100.0)	1841 (100.0)

*For both tables, the data is presented in absolute and relative (in parenthesis) terms .

Being the descriptive statistics of the data used for this study presented, this paper proceeds now to show the results of the regression model.

4.2. Analysis

As stated in the methods section, the analysis includes three models, which are presented in table 6. The three models have the same sample size (n=1750) and similar r-squared ($r^2=0.29$). The first model (1) attempts to respond the first research question and includes as the dependent variable the Euro-D scale and as main predictors the variables relating to social networks and the cofounders to control.

The following equation is the linear regression equation of model 1:

$$\text{Euro-D} = \beta_0 + \beta_1 \text{size} + \beta_2 \text{composition} + \beta_3 \text{frequency} + \beta_4 \text{proximity} + \beta_5 \text{closeness} + \beta_6 \text{quality} + \beta_7 \text{age} + \beta_8 \text{sex} + \beta_9 \text{partner} + \beta_{10} \text{education} + \beta_{11} \text{memory} + \beta_{12} \text{perceived health} + \varepsilon$$

This model shows that, among the variables regarding social networks, only the composition, frequency of contact, emotional closeness, and quality of the network have an effect on the number of depressive symptoms. Among these, the composition and the quality of the network are the most strongly associated to the number of depressive symptoms at a 99% confidence interval ($p>0.01$), while emotional closeness is associated at a 95% ($p>0.05$) and frequency of contact at a 90% ($p>0.1$).

Regarding the sociodemographic variables, age and sex are significantly associated with the number of depressive symptoms while education and partnership status show no relation with the dependent variable. Lastly, the health-status cofounders are also significantly associated to the number of depressive symptoms and are, alongside sex, quality and composition, the variables that are more strongly related to the Euro-D scale in this sample ($p<0.05$).

This model has been tested for multicollinearity using the Variance Inflation Factor (VIF) whose results can be checked in the Table 6 in the Appendix. The mean VIF is 1.22 and the highest is found in the frequency of contact variable (1.61). As all its coefficients are far below 5, it can be assessed that multicollinearity is not a problem in this model. Also,

a Breusch-Pagan / Cook-Weisberg test for heteroskedasticity has been performed in order to check if the assumption of uniform variance holds in this model. Given that its p-value is 0.6447, the null hypothesis of constant variance cannot be rejected at a 95% confidence interval ($p < 0.05$) and, therefore, homoscedasticity is assumed. The distribution of the residuals can be assessed in Figure 7 in the appendix. Additionally, a quantile-quantile plot (Q -Q plot) can be seen in Figure 8 in the appendix, showing the normal distribution of the residuals.

The second (2) and third (3) model show the inclusion of interaction terms between the variables relating to the structure of the social network (size and composition) and sex.

The following equation is the linear regression of model 2:

$$\begin{aligned} Euro-D = & \beta_0 + \beta_1 size + \beta_2 composition + \beta_3 frequency + \beta_4 proximity + \beta_5 closeness + \\ & \beta_6 quality + \beta_7 age + \beta_8 sex + \beta_9 partner + \beta_{10} education + \beta_{11} memory + \\ & \beta_{12} perceived\ health + \beta_{13} sex * size + \varepsilon \end{aligned}$$

And model 3:

$$\begin{aligned} Euro-D = & \beta_0 + \beta_1 size + \beta_2 composition + \beta_3 frequency + \beta_4 proximity + \beta_5 closeness + \\ & \beta_6 quality + \beta_7 age + \beta_8 sex + \beta_9 partner + \beta_{10} education + \beta_{11} memory + \\ & \beta_{12} perceived\ health + \beta_{13} sex * composition + \varepsilon \end{aligned}$$

Even though none of the coefficients of the interactions reports a significant association with the number of depressive symptoms, meaning that the effect of size/composition on the number of depressive symptoms is equal for both sexes, model 2 shows that the inclusion of the interaction term between size and sex has an effect on the coefficient of size which turns to be significantly related to the Euro-D scale at a 90% confidence interval. This suggests that sex moderates the relationship between the size of the network and the number of depressive symptoms for certain sizes but not for others. A graphic visualization of how the size of the network influences the dependent variable can be seen in Figure 9 in the appendix. This figure suggests how the effect of size on the number of depressive symptoms is moderated by sex, with women having a constant effect non-

Table 6. Results of OLS (M1, M2 and M3)

VARIABLES	(M1)	(M2)	(M3)
Size	-0.0110 (0.0102)	-0.0300* (0.0159)	-0.0111 (0.0102)
Composition	-0.150*** (0.0540)	-0.151*** (0.0540)	-0.173** (0.0794)
Frequency of contact	-0.0495* (0.0259)	-0.0490* (0.0259)	-0.0490* (0.0260)
Geographical proximity	0.0150 (0.0130)	0.0168 (0.0131)	0.0147 (0.0130)
Emotional closeness	-0.0649** (0.0312)	-0.0660** (0.0312)	-0.0649** (0.0312)
Quality	-0.0349*** (0.0127)	-0.0356*** (0.0127)	-0.0345*** (0.0128)
Age	0.00343** (0.00165)	0.00348** (0.00165)	0.00342** (0.00165)
Sex	0.303*** (0.0297)	0.218*** (0.0618)	0.270*** (0.0901)
Memory	0.228*** (0.0309)	0.227*** (0.0308)	0.228*** (0.0309)
Self-rated health	0.515*** (0.0307)	0.517*** (0.0307)	0.515*** (0.0307)
Education	-0.0166 (0.0104)	-0.0169 (0.0104)	-0.0165 (0.0104)
Partner	-0.0560 (0.0384)	-0.0581 (0.0384)	-0.0563 (0.0385)
Sex#Size		0.0304 (0.0194)	
Sex#Composition			0.0386 (0.102)
Constant	1.087*** (0.195)	1.140*** (0.198)	1.104*** (0.200)
Observations	1,750	1,750	1,750
R-squared	0.290	0.291	0.290

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

depending on the number of depressive symptoms and a more important variation for men, being especially important when the size of the network is small.

For the interaction term between sex and composition included in model 3, a similar graphical visualization is displayed in Figure 10 in the appendix. In this case, not only the interaction term is not significantly associated with the dependent variable, but also reduces the intensity of the association between the composition and the number of depressive symptoms ($p < 0.05$). In addition, the graph shows accurately the lack of effect of the interaction: the effect of composition on the number of depressive symptoms is constant for men and women. This is suggested by the parallel behaviour of the lines of men and women, being the difference derived from the coefficient of sex ($\beta = 0.27$).

Lastly, for the shake of curiosity, the analysis has included interaction terms between sex and the rest of social network variables and age and the social networks variables and none of these are significantly associated with the number of depressive symptoms.

Therefore, being the results of the analysis already presented, the upcoming section discusses the findings and its relation to previous literature alongside its limitations and recommendations for further research.

5. Discussion

To finalize, this chapter further explains and provides the context of the findings that have resulted during the research process. In addition, it presents a critical assessment of the data and methods used, explaining its limitations and suggesting potential improvements that have been noticed during the analysis. Lastly, it shows the limitations of the research.

5.1. Key findings, implications, and recommendations

This study has attempted to find which of the dimensions of social networks (structure, interactions, or quality) is more strongly related to mental health in the context of an aging population in Spain, which has received little focused attention despite its peculiarities in terms of the nature of its social support networks and the remarkable role of families.

Among the findings, the first one is the association between social networks and mental health, which had been already stated by previous literature (i.e., Börsch-Supan & Schuth, 2014; Meng & Xue, 2020; Puga et al., 2007; Berg et al., 2006) but was less clear in the Spanish context (see Lahuerta et al. (2004) for Barcelona or Zunzunegui et al. (2003) for a community-dwelling in Madrid). Relating to the research questions and supporting the findings of previous literature addressing the relationship between social support networks and mental health (Litwin et al., 2015), this study has shown that the quality of the network (understood as the subjective level of satisfaction with the members of the network) is the dimension of the social networks most strongly related to mental health outcomes, also in the context of an ageing population in Spain.

In addition, the findings suggest that the structure of the network also plays an important role in mental health. Nevertheless, it is not the size of the network that influences the mental health of individuals as suggested by previous studies (Meng & Xue, 2020; Börsch-Supan & Schuth, 2014), it is the composition (conceptualized as the share of family members in the network) the aspect of the structure which is significantly associated to mental health. This finding goes in line with the findings of Teo et al. (2013) in the US context, but contradicts what Litwin (2001) found in Israel, which suggests the relevance of cultural differences in the role of friends and family in the exchange of support able to prevent poor mental health outcomes (Litwin, 2010; Wang & Kanungo, 2004). Following these findings, in the context of the aging Spanish population, a social

network formed by family members reduces the chances of experiencing depressive symptomatology as opposed to a social network mostly composed of friends. This might be useful for future research addressing the relationship between social networks and mental health in the context of Spain, as the focus should be more on the composition and less on the size of the network. Furthermore, it encourages future research to test if the family is as important for mental health in other European countries as it is in the familistic Spanish context.

Lastly, the interactions that take place with the network members also matter, but to a lesser extent. Among these, the emotional closeness with the members of the network is the most significantly associated to the Euro-D scale, followed by the frequency of contact, as previously stated by Puga et al. (2007), Lahuerta et al. (2004) and Zunzunegui et al. (2003). On the other side, the geographical proximity is not related to the number of depressive symptoms in this context. Given that previous studies do find an association between geographical proximity of the members of the network and depressive symptomatology (i.e. Litwin et al., 2015), this could be an indicator of how society has evolved and the availability of communication tools (such as Internet, mobile phones, etc) can serve as an alternative to the traditional face-to-face interaction, even if the elderly in Spain is less adapted to new technologies than other European countries (Oñate et al., 2015). These findings are important to elaborate on policy attempting to tackle the problems associated with loneliness or social isolation on older adults. They suggest that emotional closeness and frequent interaction are more important than geographical proximity for mental health and, therefore, the interaction (needed to ensure a good mental health) via communications tools, which are now more easily available than they have ever been, could be encouraged through governmental campaigns.

These findings give an answer to the first research question of this study: The dimensions of social network most strongly related to mental health are, from most to least, the quality of the network, its composition (more family is better), the emotional closeness to its members, and lastly, how frequent are the interactions with the network.

For the second research question, the findings are less promising. As it has been shown, sex is significantly associated with the number of depressive symptoms while controlling for the social network variables, being women who have higher scores on the Euro-D scale. However, the inclusion of interaction terms has shown that sex does not act as a moderator between the variables of social networks and mental health. Instead, the

protective effect of social networks seems to be equal for both sexes, supporting the findings of Berg et al. (2006), but in opposition to what could Zunzunegui et al. (2003) found in the context of Barcelona.

Similarly, age is also significantly associated with the number of depressive symptoms, but its effect is rather small. As it happens with sex, the inclusion of interaction terms with the variables of social networks does not provide any extra information, even if it is included as a categorical variable accounting for different age groups. Therefore, contrary to what previous studies had suggested (Litwin et al., 2015), the relationship between the different dimensions of social networks and mental health is neither moderated by age, at least when the age is above 50 years old in the Spanish context.

To sum up, this study has shown that social networks are directly related to the mental health of older adults measured with the Euro-D scale in the context of people over 50 years old in Spain. In addition, it has shown that the quality of the network is the dimension of social networks most strongly related to mental health, followed by the composition, emotional closeness and frequency of interaction. Lastly, this association is not moderated by gender or age and, accordingly, policy should not necessarily be elaborated differently for these different demographic groups.

5.2. Limitations

This study does, however, have some limitations which make the results need to be taken with caution.

Firstly, some limitations have to do with the SHARE dataset. From the $N = 2129$ initial observations in the Spanish sub-set, after removing those that are missing information on any of the variables of interest for this study, only $N = 1750$ observations remain. Even though this sample size is still suitable for the purpose of this study, a higher amount of observations would improve the validity of the results. Another limitation has to do with the way social networks are conceptualized. The name-generator is an innovative tool that has the advantage of allowing respondents to “create” an image of their social networks by their own means. However, how the name generator is structured and contextualized in the survey and how the name generator specific question is redacted

might bias the answers of respondents (Yousefi-Nooraie et al., 2019). In this case, the variables of social networks are constructed by asking the respondents who they share their main problems and concerns with. From this question, different interpretations could lead to name different people, what could entail different results.

The next limitation has to do with the design of the study. While for the purpose of this study cross-sectional data was the best option -an exception is found in the variable of marital status, which uses data from previous wave when no changes have taken place-, using the longitudinal component of the SHARE dataset would provide further information about how social networks evolve over time, and how these change the mental health of individuals. In addition, the Convoy Model of Social Relations provides a perfect theoretical framework to this purpose. Therefore, this leads to recommend future research on the relationship between social networks and mental health to use longitudinal data and focus on the relative changes of social networks over time and their effect on mental health.

Another limitation has its roots in the relationship between social networks and mental health. This study has assumed that the different components of social networks influence the mental health of older adults. However, the opposite direction could take place too: A poor mental health status could have direct implications on the social networks of individuals, by reducing the frequency of contact or the size of the network. Again, further studies on this relationship should consider the double direction of causality and use longitudinal data to improve the validity of the results.

Lastly, this study is based on Spanish population aged 50 years old and over. Therefore, its conclusions cannot be assumed to be equal for other populations or age groups. At the same time, given the limitations already mentioned in this study, results should not be generalized and interpreted with caution.

6. Conclusions

This research has focused on the relationship between social networks and mental health. More specifically, the focus has been on the relationship between the different dimensions of social networks (structure, interactions, and quality) and depression, measured using the Euro-D scale, at old ages in the Spanish context. The main research question attempted to understand which of these dimensions is more strongly related to mental health and, as a second research question, which sociodemographic characteristics shaped this relationship in this context.

The analysis has shown that the quality of the network is the dimension most strongly related to depression, as previous research had already suggested. However, this study has found that the structure of the network, covering its size and composition, also plays an important role. In the Spanish context, it is not the size of the network that can prevent negative mental health outcomes. Instead, it is the composition that matters: a social network composed by a large share of family members has an important effect on the number of depressive symptoms. This finding is original of this study, as most of research does not take into account the composition of the network, and gives an important insight of the relevance of the family in the Spanish context. Additionally, the frequency of contact with the members of the network and the degree at which an individual feels emotionally close to them also are also important dimensions. Lastly, this study has found that this relationship is not shaped by gender nor age. Therefore, this research can provide understanding to future policy or programmes attempting to tackle the problem of mental health at old ages in the Spanish population

References

- Abellán, G., Ayala, A., Pérez, J., & Pujol, R. (2018). *Un perfil de las personas mayores en España, 2018. Indicadores estadísticos básicos*. Informes Envejecimiento en red, 17.
- Alegría, M., NeMoyer, A., Falgàs Bagué, I., Wang, Y., & Alvarez, K. (2018). Social determinants of mental health: where we are and where we need to go. *Current psychiatry reports*, 20(11), 1-13.
- Antonucci, T. C., Ajrouch, K. J., & Birditt, K. S. (2014). The convoy model: Explaining social relations from a multidisciplinary perspective. *The gerontologist*, 54(1), 82-92.
- Barger, S. D., Messerli-Bürgy, N., & Barth, J. (2014). Social relationship correlates of major depressive disorder and depressive symptoms in Switzerland: Nationally representative cross-sectional study. *BMC Public Health*, 14(1). <https://doi.org/10.1186/1471-2458-14-273>
- Bauman, Z. (2000). *Liquid Modernity*. Polity Press.
- Belle, D. (1991). Gender differences in the social moderators of stress. In A. Monat & R. S. Lazarus (Eds.), *Stress and coping: An anthology* (pp. 258–274). Columbia University Press.
- Börsch-Supan, A. (2022). Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 8. Release version: 8.0.0. SHARE-ERIC. Data set. DOI: 10.6103/SHARE.w8.800
- Börsch-Supan, A., & Schuth, M. (2014). Early retirement, mental health, and social networks. *Discoveries in the Economics of Aging*, 225.
- Börsch-Supan, A., Brandt, M., Hunkler, C., Kneip, T., Korbmacher, J., Malter, F., Schaan, B., Stuck, S. and Zuber, S. (2013). Data Resource Profile: The Survey of Health, Ageing and Retirement in Europe (SHARE). *International Journal of Epidemiology* DOI: 10.1093/ije/dyt088.
- Brown, J. D. (2002). The Cronbach alpha reliability estimate. *JALT Testing & Evaluation SIG Newsletter*, 6(1).
- Buber, I., & Engelhardt, H. (2008). Children's impact on the mental health of their older mothers and fathers: findings from the Survey of Health, Ageing and Retirement in Europe. *European Journal of Ageing*, 5(1), 31-45.
- Caïs, J., & Folguera, L. (2013). Redefining the dynamics of intergenerational family solidarity in Spain. *European Societies*, 15(4), 557-576.
- Courtin, E., & Knapp, M. (2017). Social isolation, loneliness and health in old age: a scoping review. *Health & social care in the community*, 25(3), 799-812.

Dalgard, O. S., Dowrick, C., Lehtinen, V., Vazquez-Barquero, J. L., Casey, P., Wilkinson, G., ... & Dunn, G. (2006). Negative life events, social support and gender difference in depression. *Social psychiatry and psychiatric epidemiology*, *41*(6), 444-451.

Escobar-Bravo, M. Á., Puga-González, D., & Martín-Baranera, M. (2012). Protective effects of social networks on disability among older adults in Spain. *Archives of gerontology and geriatrics*, *54*(1), 109-116.

Fiori, K. L., & Jager, J. (2012). The impact of social support networks on mental and physical health in the transition to older adulthood: A longitudinal, pattern-centered approach. *International Journal of Behavioral Development*, *36*(2), 117-129.

Fiori, K. L., Antonucci, T. C., & Cortina, K. S. (2006). Social network typologies and mental health among older adults. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences*, *61*(1), 25–32. <https://doi.org/10.1093/geronb/61.1.P25>

Fratiglioni, L., Wang, H. X., Ericsson, K., Maytan, M., & Winblad, B. (2000). Influence of social network on occurrence of dementia: a community-based longitudinal study. *The lancet*, *355*(9212), 1315-1319.

Fuller, H. R., Ajrouch, K. J., & Antonucci, T. C. (2020). The Convoy Model and Later-Life Family Relationships. *Journal of Family Theory & Review*, *12*(2), 126-146.

García, E. L., Banegas, J. R., Perez-Regadera, A. G., Cabrera, R. H., & Rodriguez-Artalejo, F. (2005). Social network and health-related quality of life in older adults: a population-based study in Spain. *Quality of life research*, *14*(2), 511-520.

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: a meta-analytic review. *PLoS medicine*, *7*(7), e1000316.

Instituto Nacional de Estadística (INE)(2020).

Kahn, R. L., & Antonucci, T. C. (1980). Convoys over the life course: Attachment, roles, and social support. In P. B. Baltes & O. B. Brim (Eds.), *Life-span development and behavior* (Vol. 3, pp. 253–268). New York, NY: Academic Press.

Kalmijn, M., & Saraceno, C. (2008). A comparative perspective on intergenerational support: Responsiveness to parental needs in individualistic and familialistic countries. *European Societies*, *10*(3), 479-508.

Kendler KS, Myers J, Prescott CA (2005) Sex differences in the relationship between social support and risk for major depression: a longitudinal study of opposite-sex twin pairs *Am J Psychiatry* *162*:250–256

Lahuerta, C., Borrell, C., Rodríguez-Sanz, M., Pérez, K., & Nebot, M. (2004). La influencia de la red social en la salud mental de la población anciana. *Gaceta Sanitaria*, *18*(2), 83–91. <https://doi.org/10.1157/13059278>

León, M., & Migliavacca, M. (2013). Italy and Spain: Still the case of familistic welfare models? *Population Review*, 52(1).

Litwin, H. (2001). Social network type and morale in old age. *Gerontologist*, 41(4), 516–524. <https://doi.org/10.1093/geront/41.4.516>

Litwin, H. (2006). Social networks and self-rated health: A cross-cultural examination among older Israelis. *Journal of Aging and Health*, 18(3), 335–358. <https://doi.org/10.1177/0898264305280982>

Litwin, H. (2010). Social networks and well-being: A comparison of older people in Mediterranean and non-Mediterranean countries. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences*, 65 B(5), 599–608. <https://doi.org/10.1093/geronb/gbp104>

Litwin, H., Stoeckel, K. J., & Schwartz, E. (2015). Social networks and mental health among older Europeans: are there age effects? *European Journal of Ageing*, 12(4), 299–309. <https://doi.org/10.1007/s10433-015-0347-y>

Maskileyson, D., Seddig, D., & Davidov, E. (2021). The EURO-D Measure of Depressive Symptoms in the Aging Population: Comparability Across European Countries and Israel. *Frontiers in Political Science*, 3(August), 1–12. <https://doi.org/10.3389/fpos.2021.665004>

Mehmetoglu, M. & Jakobsen, T. (2017) *Applied statistics using Stata: a guide for the social sciences*. Sage.

Meng, X., & Xue, S. (2020). Social networks and mental health outcomes: Chinese rural–urban migrant experience. *Journal of Population Economics*, 33(1), 155–195. <https://doi.org/10.1007/s00148-019-00748-3>

Mushtaq, R., Shoib, S., Shah, T., & Mushtaq, S. (2014). Relationship between loneliness, psychiatric disorders and physical health? A review on the psychological aspects of loneliness. *Journal of clinical and diagnostic research*, 8(9), WE01.

OECD/EU (2018), *Health at a Glance: Europe 2018: State of Health in the EU Cycle*. OECD Publishing, Paris. https://doi.org/10.1787/health_glance_eur-2018-en

Oñate, C. G., Peyró, C. F., & Lorenzo, F. C. (2015). Use, consumption and knowledge of new technologies by elderly people in France, United Kingdom and Spain. *Comunicar. Media Education Research Journal*, 23(2).

Prince, M. J., Reischies, F., Beekman, A. T., Fuhrer, R., Jonker, C., Kivela, S. L., ... & Copeland, J. R. (1999). Development of the EURO–D scale—a European Union initiative to compare symptoms of depression in 14 European centres. *The British Journal of Psychiatry*, 174(4), 330–338.

Puga, M. D., Rosero-Bixby, L., Glaser, K., & Castro Martín, T. (2007). Red social y salud del adulto mayor en perspectiva comparada: Costa Rica, España e Inglaterra.

Requena, M. (2017). La desigualdad ante la muerte: educación y esperanza de vida en España. *Perspectives Demogràfiques*, 6.

Rico-Urbe, L. A., Caballero, F. F., Olaya, B., Tobiasz-Adamczyk, B., Koskinen, S., Leonardi, M., et al. (2016). Loneliness, social networks, and health: a cross-sectional study in three countries. *PLoS one*, 11(1), e0145264

Rook, K. S. (2015). Social networks in later life: Weighing positive and negative effects on health and well-being. *Current directions in psychological science*, 24(1), 45-51.

Santini, Z. I., Koyanagi, A., Tyrovolas, S., Mason, C., & Haro, J. M. (2015). The association between social relationships and depression: A systematic review. *Journal of Affective Disorders*, 175, 53–65. <https://doi.org/10.1016/j.jad.2014.12.049>

Smith, K. P., & Christakis, N. A. (2008). Social networks and health. *Annual Review of Sociology*, 34, 405–429. <https://doi.org/10.1146/annurev.soc.34.040507.134601>

UNESCO United Nations Educational, Scientific and Cultural Organization. (2003). *International Standard Classification of Education, ISCED 1997* (pp. 195-220). Springer US.

United Nations (2015). Transforming our World: The 2030 Agenda for Sustainable Development.

United Nations (2019). World Population Prospects 2019. Department of Economic and Social Affairs, Population Division.

Wang, X., & Kanungo, R. N. (2004). Nationality, social network and psychological well-being: Expatriates in China. *International Journal of Human Resource Management*, 15(4–5), 775–793. <https://doi.org/10.1080/0958519042000192942>

Wenger, G. C. (1997). Social networks and the prediction of elderly people at risk. *Aging and Mental Health* 1(4), 310-320. <https://doi.org/10.1080/13607869757001>

Yousefi-Nooraie, R., Marin, A., Hanneman, R., Pullenayegum, E., Lohfeld, L., & Dobbins, M. (2019). The relationship between the position of name generator questions and responsiveness in multiple name generator surveys. *Sociological Methods & Research*, 48(2), 243-262.

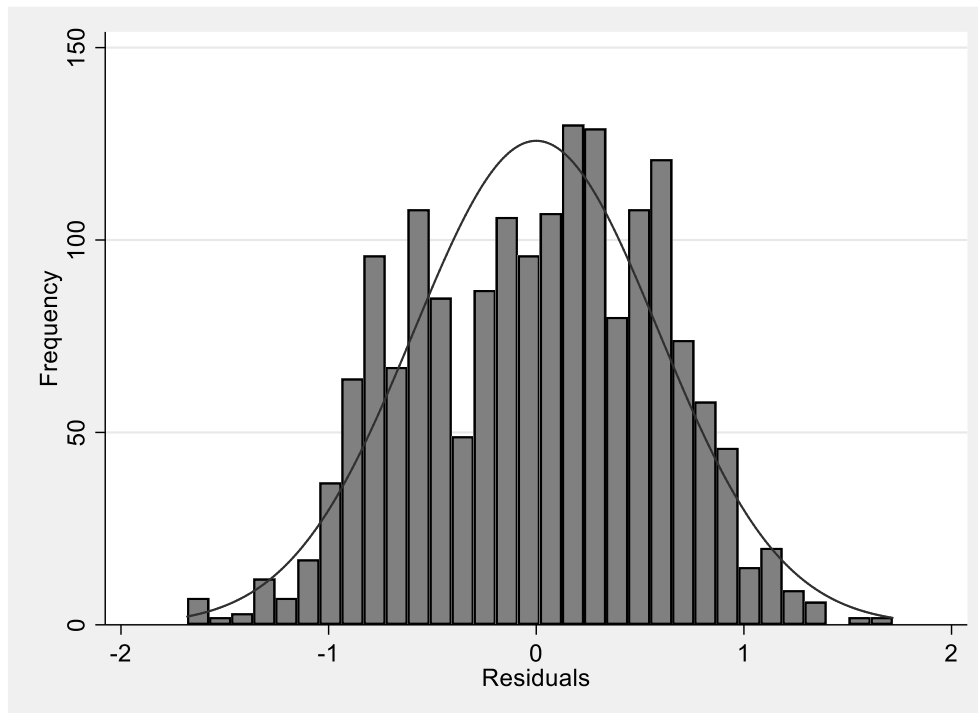
Zunzunegui, M. V., Alvarado, B. E., Del Ser, T., & Otero, A. (2003). Social networks, social integration, and social engagement determine cognitive decline in community-dwelling Spanish older adults. *Journals of Gerontology - Series B Psychological Sciences and Social Sciences*, 58(2), 93–100. <https://doi.org/10.1093/geronb/58.2.S93>

Appendix

Table 6. Results of Variance Inflation Estimator (VIF)

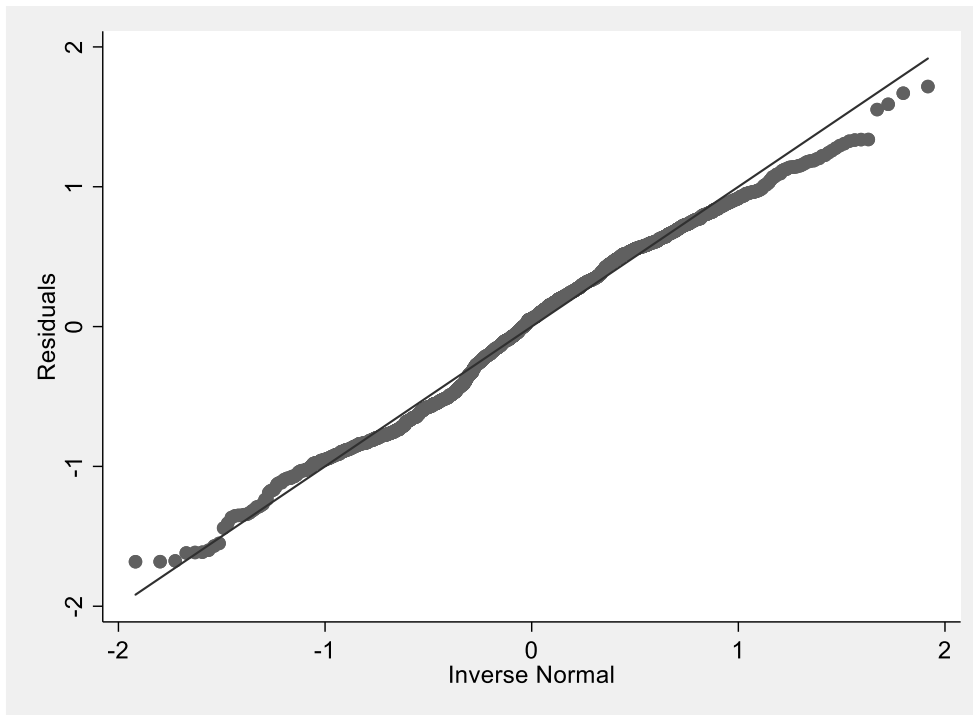
<i>Variable</i>	<i>VIF</i>	<i>1/VIF</i>
<i>Size</i>	1.19	0.842132
<i>Composition</i>	1.16	0.860068
<i>Frequency of contact</i>	1.51	0.662960
<i>Geographical proximity</i>	1.61	0.622307
<i>Emotional closeness</i>	1.22	0.819320
<i>Quality</i>	1.11	0.902932
<i>Age</i>	1.22	0.819065
<i>Sex</i>	1.08	0.928785
<i>Memory</i>	1.13	0.885901
<i>Self-perceived health</i>	1.15	0.869300
<i>Education</i>	1.22	0.819498
<i>Partner</i>	1.09	0.916690
<i>Mean VIF</i>	1.22	

Figure 6. Histogram of the residuals of Model 1.



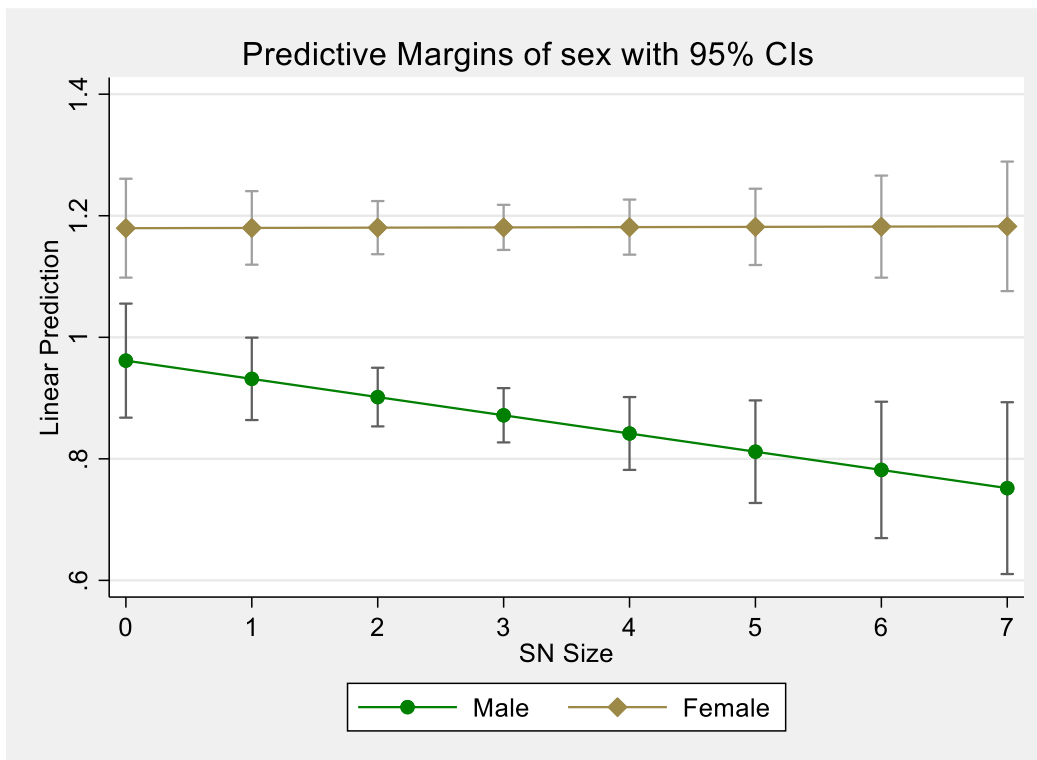
Source: Own elaboration from SHARE dataset.

Figure 7. Q-Q plot for Model 1.



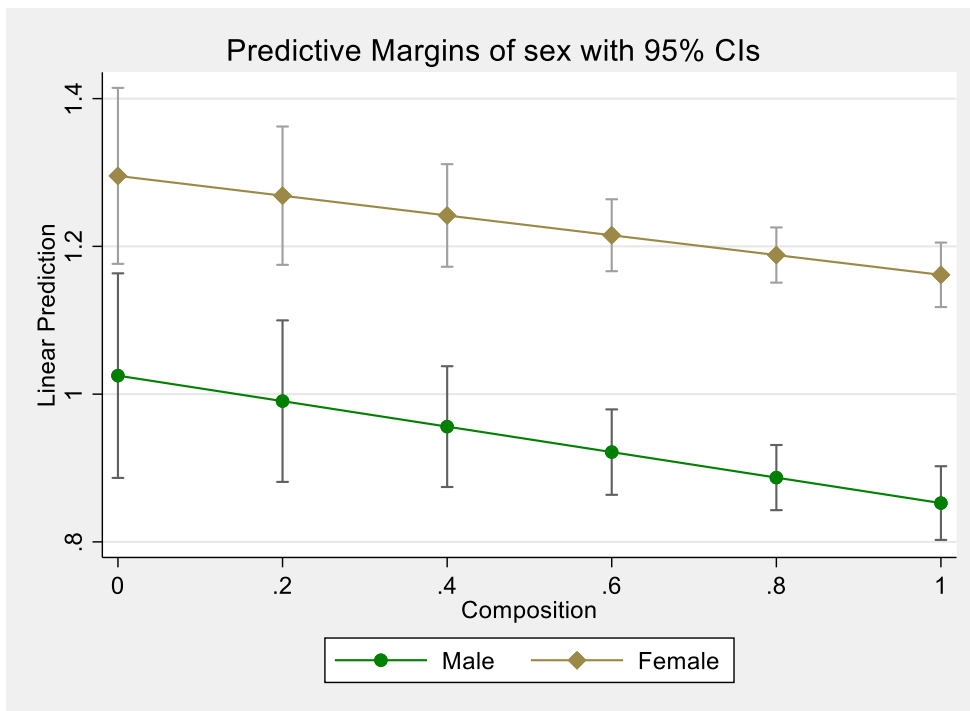
Source: Own elaboration from SHARE dataset.

Figure 8. Graphic visualization of the interaction between sex and size in Model 2.



Source: Own elaboration from SHARE dataset.

Figure 9. Graphic visualization of the interaction between sex and composition in Model 3.



Source: Own elaboration from SHARE dataset.