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**The role of socioeconomic status and neighborhood social capital on loneliness among older adults: evidence from the Sant Boi Aging Study**

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## **Abstract**

### **Purpose**

The aim of the present study is to analyze the role of age in the association between socioeconomic status (SES) and loneliness as well as the role of neighborhood social capital (NSC) in the association between individual social capital and loneliness.

### **Methods**

Data include a representative population-based sample from Sant Boi de Llobregat (a suburb of Barcelona) of 1,124 adults aged 50 and over. Logistic regression models were used to analyze the survey data. Interactions between SES and age, and NSC and individual social capital were explored.

### **Results**

Among the poorest older adults, older individuals showed a lower likelihood of loneliness (OR=0.09, 95% CI 0.02, 0.30,  $p<0.05$ ) compared with the youngest cohort after adjusting for covariates, while among the richest individuals there were no significant differences among age cohorts. Individuals living in an area with high NSC and high individual social capital showed a lower likelihood of loneliness (OR=0.36, 95% CI 0.17, 0.73,  $p<0.05$ ) compared with those with low individual social capital after adjusting for covariates. The effect of individual social capital was not significant among individuals living in an area with low NSC.

### **Conclusion**

Interventions focusing on low SES middle-aged (50-59 years old) individuals and those aiming to increase NSC could be effective strategies to reduce the prevalence of loneliness in older people.

## **Introduction**

Loneliness has been defined as a discrepancy between the actual and desired characteristics of an individual social network which causes an unpleasant feeling [1]. In a study in 25 European countries [2], the prevalence of loneliness was estimated to range from 3.2% in Denmark to 34% in Ukraine. Loneliness is thought to increase with age. Some relationships are lost as people get older (e.g., retirement, partner's death) [3–5]. In a cross-national European study, it was found that 7.4% of people aged 60 years or older in the UK, 11.4% in France and 11.5% in Spain reported feeling lonely in the previous week [2].

Perceived social isolation has traditionally been used as a proxy for loneliness [6]. However, the loneliness construct includes other factors, such as lack of a partner or affiliative environments [7]. Loneliness has also been considered as a consequence of a maladaptive social cognition. A meta-analysis of interventions to reduce loneliness [8] found that cognitive therapy aimed at redirecting distorted perceptions of social life was effective in alleviating loneliness, compared with interventions to increase social support and opportunities for social interaction. Conversely, the Framingham Heart Study showed that loneliness is spread through social networks, with the strongest effect seen at the periphery, highlighting the relevance of the real social network and showing that individuals with fewer social ties are at special risk of loneliness [9].

Being divorced or widowed [10], having a small social network or poor social relationships [11], a greater number of chronic medical conditions and lower quality of life [12] have been associated with loneliness. Cacioppo et al. also showed that loneliness and depressive symptomatology act in a synergistic way to diminish well-being in middle and older-aged adults [13].

The association between socio-economic status (SES) and loneliness is still unclear and a mixture of results have been obtained [14, 15]. However, the hypothesis that loneliness spreads through social networks [9] suggests that loneliness has a close relationship with social exclusion and, therefore, the most vulnerable people in society, such as the poorest and oldest individuals, could be those most affected by loneliness [16]. According to this hypothesis, the oldest adults would be at higher risk of loneliness. This is in line with previous studies [17], although this association could be modified by SES.

Furthermore, neighborhood social capital (NSC) could have an impact on loneliness. According to Coleman, social capital is a public good, benefiting all those who are part of a structure and is a potential asset for the underprivileged [18]. As reported by Nyqvist et al., there is an association between living in an area with high levels of NSC and lower levels of loneliness [19]. Previous studies distinguished between contextual social capital defined as part of a structure (i.e., NSC) and individual social capital defined as an individual characteristic measured through social capital indicators (i.e., reciprocity and trust in neighbors and civic participation). Lower levels of individual social capital have been associated with further deterioration in health, especially in areas with high levels of NSC [20] and it is not clear whether NSC, combined with high ISC, has the same effect on loneliness as it has on health.

The aim of the present study is to analyze the role of socioeconomic status (SES) in the association between age and loneliness as well as the role of NSC in the association between individual social capital and loneliness in a community-based sample of people aged 50 and over from Sant Boi de Llobregat, a suburban municipality of Barcelona with about eighty thousand inhabitants.

## **Methods**

### **Study Design**

The Sant Boi Aging Study is a cross-sectional household survey conducted in a representative sample of the non-institutionalized population aged 50 years and over in Sant Boi de Llobregat, a suburban population of Barcelona with 83,107 inhabitants. Simple random sampling was carried out in the population 50+ years from municipality census data, with an oversampling of those  $\geq 80$  years, which was 10% in the real population and 20% in the sample. The final sample included 1,124 individuals. The main reasons for survey non-response were decline to participate (57%) and inability to locate the household or individual respondent (26%). Overall response rate was 52.8%.

Interviewer-administered questionnaires were conducted through Computer-Assisted Personal Interviewing (CAPI) at respondents' homes between October, 2014 and October, 2015 using COURAGE-derived methodology [21]. The survey protocol was translated from English into Spanish according to WHO translation guidelines for assessment instruments [22]. Lay interviewers were trained on the survey before administration. Quality assurance strategies were implemented during fieldwork [23].

At the beginning of the interview, the Mini Mental State Examination (MMSE) questionnaire [24] was used to assess the global cognitive functioning of the selected individual. This test is primarily used to detect and assess the progression of cognitive impairment associated with neurodegenerative diseases such as Alzheimer's disease. CAPI included a computerized algorithm based on a cut-off point ( $\geq 15$  on a scale from 0 to 30) which was automatically calculated during the interview. This allowed the interviewer to determine whether the selected participant had cognitive problems which could compromise the validity of interview responses. To increase

the sensitivity of the study, we chose an intermediate cut-off point within the range previously recommended by other researchers [25] in order to detect possible mild or moderate cases of dementia. In the event that the cut-off point was reached, a proxy interview was conducted with the participant's relative. Proxy interviews were much shorter and included questions on sociodemographics and the general state of health of the selected individual but did not include self-reported information on issues such as loneliness or social networks. Therefore, these interviews ( $n=49$ ) were excluded from the present analysis. Data obtained from those who did not answer the questions about SES ( $n=104$ ) were also not included in the analyses. Thus, the final analytical sample consisted of 971 participants. Differences between included and excluded participants (i.e., proxy interviews or with missing values in the outcomes) were tested by Chi-squared tests. We found that respondents who underwent a proxy interview were more likely to be female and older than non-proxy respondents. Comparison between participants included in the analysis and those excluded due to missing values showed that there were no significant differences in terms of age, gender, educational level, chronic medical conditions, depression and loneliness status.

### **Ethics statement.**

Ethical approval was provided by Parc Sanitari Sant Joan de Déu, Barcelona, Spain. Written informed consent was obtained from the participants.

### **Measurements**

#### ***Socio-demographic variables***

Participants were asked for socio-demographic information: age (in years) which was categorized into three age groups (50-59 years, 60-69 years and more than 70 years), gender and marital status (married or cohabiting, never married and

previously married, with the final category including separated or divorced and widowed).

### ***Biomedical variables***

Chronic medical conditions were based on self-report diagnoses of chronic obstructive lung disease, asthma, cancer, hypertension, arthritis, stroke, angina pectoris and diabetes in the previous 12 months. Additionally, symptom algorithms were used to detect non-diagnosed cases of arthritis, stroke, angina, chronic lung disease, and asthma [26]. The presence of hypertension was based on self-report diagnosis or presence of systolic blood pressure  $\geq 140$  mmHg or diastolic blood pressure  $\geq 90$  mmHg measured at the time of the interview [27, 28]. Participants were considered to have a chronic medical condition if there was presence of either a diagnosed or non-diagnosed condition. Chronic medical conditions were categorized according to number of chronic conditions: none, one, two, or more than two.

An adapted version of the Composite International Diagnostic Interview (CIDI 3.0) was used to assess the presence of depression in the previous 12 months [29]. An algorithm based on the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders was used [30].

### ***Loneliness***

Loneliness was assessed by means of the 3-item UCLA Loneliness Scale [31], which consists of the following items: “*How often do you feel that you lack companionship?*”; “*How often do you feel left out?*”; and “*How often do you feel isolated from others?*”. Each item was answered on a 3-point scale (1=hardly ever; 2=some of the time; 3=often). The scores for each item were added up to produce a loneliness scale from 3 to 9, with higher scores indicating a higher degree of loneliness. Previous research indicates that this scale has a satisfactory degree of

reliability and has both concurrent and discriminant validity [31]. A cutoff of  $\geq 6$  was established in accordance with other studies [32].

### ***Social isolation***

Following a previous study [32], a social isolation index was created, ranging from 0 to 4. Respondents were given a point if they had less than monthly contact with children, other immediate family and friends (each scored as 1) and if they did not participate in any organizations, religious groups, or committees more than twice per year (scored as 1). Being unmarried was not considered, as this was directly related to one of the covariates (marital status). The social isolation index was categorized as: Low (0), Medium (1) or high (2-4).

### ***Socio-economic variables***

SES was computed by using the total number of years of education (0–22) and the quintiles of household income level (1–5) [33]. The inclusion of education and income simultaneously in the same model may lead to collinearity. Therefore, a composite score was generated. The two variables were multiplied to create scores from 0 to 55 and summed to obtain combined scores ranging from 0 to 110, which were categorized as low, medium and high SES using tertiles as cut-off points. Occupation-based measures were not used to calculate SES levels because they might not be applicable to people who are currently unemployed and may have different meanings for different birth cohorts [34].

We assessed individual social capital through three indicators: residents' perceptions of reciprocity, trust and civic participation [35]. Perceptions of reciprocity were defined as finding “easy/very easy” to “get practical help from neighbors”. People were asked whether “people in this neighborhood can be trusted?”. Those responding “to a very great extent” /“to a great extent” to this question were



considered to have a positive perception of trust. Civic participation was defined as participating in meetings with community leaders or in activities to improve the neighborhood more than twice per year.

For the present analyses, Sant Boi de Llobregat was divided into two areas with high and low NSC. The area with low NSC, which included the historical center and the area around the center, was built before 1965. In contrast, the area with high NSC was built after 1965, when mass migration from rural regions of Spain to the industrial zones of Barcelona made it necessary to increase the housing supply in the metropolitan area [36]. This area has more active neighborhood associations and part of the social life is also managed by recreational organizations and cultural associations set up by internal migrants [37]. We verified that the high social capital area showed significantly higher percentages of the population fulfilling all social capital indicators (data not shown but available upon request).

### **Statistical analysis**

Data were weighted taking into account post-stratification corrections to adjust for the population distribution obtained from the 2014 Sant Boi de Llobregat census to compensate for survey non-response and ensure the representativeness of the sample. Descriptive analyses included weighted proportions and unweighted frequencies. The proportion of loneliness was compared in several socio-demographic variables using the Rao-Scott Chi-squared tests.

Univariate logistic regression models were fitted to evaluate the socioeconomic and socio-demographic factors related to loneliness (dependent variable). Those factors which were significantly associated with loneliness in the unadjusted models were added to the adjusted model. To verify whether SES had an impact on the relationship between age and loneliness, and whether NSC had an

impact on the association between individual social capital and loneliness, the following interactions were tested in separate models: SES x Age, NSC x Reciprocity, NSC x Trust and NSC x participation. Only SES x Age ( $p=0.023$ ), and NSC x Reciprocity were significant ( $p=0.041$ ), and thus were included in the final adjusted model. Results from regression models were presented as Beta coefficient and 95% Confidence Intervals (95%CI).

To clarify the interaction effect, estimated probabilities of loneliness were calculated based on the adjusted regression model. To estimate these probabilities, adjusted variables were centered, taking the real proportion in the sample into account. The probabilities of loneliness associated with NSC x Reciprocity and those associated with SES x Age are shown in Figure 2 and Figure 1, respectively. Adjusted logistic regression models were also run stratified by SES and by NSC, obtaining odds ratios for loneliness with 95% CI which are shown as footnotes to Figure 1 and Figure 2, respectively.

All reported  $p$ -values were based on two-sided test, where the level of statistical significance was set at  $p<0.05$ . Stata (version SE 12) was used to analyze the survey data.

## **Results**

The socio-demographic characteristics of the study sample are presented in Table 1. Mean age was 66.1 years ( $SD=9.9$ ) and 53.7% of the sample was female. About one in ten participants reported feelings of loneliness. Statistically significant differences in loneliness according to individuals' characteristics were detected. Lonely individuals were more frequently women, previously married, did not fulfil the reciprocity with neighbors indicator, had higher levels of social isolation, suffered

from two or more chronic conditions and had had a episode of major depression in the previous twelve months.

Table 2 shows the unadjusted models and the final adjusted model including the two significant interactions (SES x Age and NCS x Reciprocity). In the univariate regression models, being female, previously married, having more than two chronic conditions, depression, and presenting social isolation were significantly related to loneliness, whereas medium and high, compared with low SES, and presenting reciprocity were associated with low loneliness.

The estimated probabilities of loneliness by age cohort (i.e., 50-59 years, 60-69 years, and more than 69 years) stratified by low, medium and high SES are shown in Figure 1. The graph shows that the youngest cohort (i.e., 50-59 years old) differed markedly from the other two; people with low SES have the highest probability of reporting loneliness (0.37) compared with people with medium (0.15) and high SES (0.05). These differences seem to disappear as people get older. These results are also supported by the ORs. According to our results and in contrast to our expectations, getting older buffers the negative effect of SES on loneliness. Having low SES is significantly associated with a higher risk of loneliness, although only among the youngest cohort (i.e., 50-59).

Figure 2 shows the estimated probabilities of loneliness, according to whether the reciprocity with neighbors indicator was met or not, stratified by high and low NCS. The effect of low NCS on the probability of loneliness does not seem to be affected by the level of reciprocity from neighbors. However, participants living in a high NCS neighborhood are significantly less likely to report loneliness if they also report reciprocity from neighbors (OR=0.36, 95% CI 0.17, 0.73,  $p<0.05$ ).

## **Discussion**

To the best of our knowledge, this is the first study to analyze the relationship between age and loneliness taking the role of SES into account as well as the relationship between individual social capital and loneliness when NSC is considered. We found that there is a detrimental effect of low SES on loneliness which is only relevant among those individuals aged from 50 to 59 years. Furthermore, individual social capital in terms of reciprocity from neighbors only had a significant buffering effect on loneliness in the area with high NSC.

The prevalence of loneliness among older adults of Sant Boi de Llobregat was 10.2%, which is relatively consistent with another study of the Spanish population aged 50 and over that showed a prevalence of 13.1% [38]. These figures represent an intermediate level of loneliness compared with other European countries [2]. Those European regions with a higher percentage of people at risk of poverty after social transfer [39] seem to have the highest levels of loneliness [2]. To test this hypothesis, we conducted a bivariate regression model with the percentage of older adults with frequent loneliness and the percentage of people at risk of poverty after social transfer [39] in 23 European Union countries [2], obtaining  $\beta=0.59$  (CI 95% 0.02, 1.15,  $p<0.05$ ) (data not shown). Therefore, it seems plausible that the differences observed between countries in terms of loneliness are explained by distinct economic scenarios, among other factors. This hypothesis should be tested in future research.

Following consideration of several studies, we hypothesized that loneliness would be higher among the oldest adults [17]. In the univariate logistic regression models, we found that age was not significantly related to loneliness, contrary to what other cross-sectional studies suggested [40]. It has been speculated that being older is associated with some of the leading risk factors for loneliness, for instance being

widowed, and with risk factors for low life satisfaction, such as poor physical condition. However, aging is also related to other factors associated with wellbeing such as a greater degree of self-acceptance [41], which might explain why the oldest people do not report high levels of loneliness, compared with middle-age people. Most importantly, in the multivariate logistic regression model for loneliness, the interaction between age and SES was significant. This would indicate that the relationship between aging and loneliness depends on SES. Low SES levels were significantly associated with loneliness only among middle-aged adults (50-59 years old), whereas being older (60-69 and 70+) was protective against the deleterious effect of low SES on loneliness. These age cohort differences for the effect of SES on loneliness could also be explained by survival bias. Those with low SES and high loneliness might be more likely to die [42] or present severe health problems such as dementia [43] and therefore not be included in the oldest cohorts.

According to our results, the common origin of most inhabitants in the areas with high NSC, established in 1965 and occupied by migrants from rural areas of Spain employed mainly as industrial workers, could have facilitated social organization and identification within the neighborhoods. Having neighbors with similar SES and common origin, social engagement and sense of community are factors related to higher NSC [44]. Furthermore, when networks of social capital have been built, newcomers have a need to become part of them, which could explain the permanence of social capital over years [45]. However, it is possible that social cohesion within neighborhoods weakens among younger participants. This might explain the differences found between the youngest and the oldest cohorts in the effect of SES on loneliness. The mass migration from Spanish rural areas to industrialized regions like Sant Boi de Llobregat mainly occurred during the 60's and 70's. Thus,

individuals aged 60 and older are the majority in that collective, whereas people in the youngest cohort (i.e., 50-59) could have different origins. Therefore, the reason why getting older seems to buffer the negative effect of SES on loneliness is unclear, although it could be related to higher levels of self-acceptance among older people, as indicated by previous literature [41]. Cohort or survival bias could also explain these results although longitudinal studies would be needed to test these hypotheses and future research should analyse whether differences in loneliness according to SES are maintained over time in the youngest cohort.

Our findings on the effects on loneliness of living in an area with higher or lower NSC are consistent with the view of social capital as an attribute of groups and communities according to which “features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit” [46] since only those living in the high NSC area benefit from their predisposition to establish networks of reciprocity with their neighbors. According to the results of the present study, in areas with high NSC, individuals outside the reciprocity network have far greater difficulty building alternative relationships and, therefore, show a greater probability of loneliness, which is relatively consistent with the results of other studies on social capital and health [20]. On the other hand, in areas with low NSC, there may no significant difference between being in or out of these networks, as social life may not depend on relationships with neighbors. These results may help to explain how the beneficial effects of individual social capital on health are stronger in vulnerable neighborhoods [47], the inhabitants of which would be more likely to establish reciprocity networks with neighbors due to the absence of other resources.

Although interventions for promoting social capital to reduce loneliness had previously been tested in Spain with significant results [48], there are doubts among the architects of the social capital concept regarding the possibility of building social capital in places where it is lacking. According to Putnam, “where institution building (and not mere constitution writing) is concerned, time is measured in decades” [49]. Therefore, a feasible measure could be to preserve social capital by respecting the autonomy of the community and facilitating its development.

### **Strengths and limitations of the study**

The strengths of our study include the use of community-representative data, with a sample of older adults from a variety of socio-economic backgrounds, and the ability to control for confounding factors. However, several limitations should be kept in mind. First, the cross-sectional design limited the possibility of examining causal relationships. Second, as previously mentioned, possible cohort or survival biases could explain the significantly higher prevalence of loneliness among younger and poorer individuals. Future longitudinal studies should further clarify these findings. Third, SES information was missing in about one tenth of participants. Results may have been different if these people had been included in the analysis. However, we did not find significant differences between those included or excluded, as has been previously noted. Fourth, Sant Boi de Llobregat is a large town and reducing it to two large areas can lead to bias due to the socio-demographic and socio-economic differences that exist within each of the areas. Nevertheless, the division used has been justified and the attributes associated with each area have been contrasted with data. Finally, some of the variables were collected retrospectively through self-report, which may result in recall or reporting bias. However, recall biases are usually relatively minor in epidemiological studies [50].

## **Conclusions**

The results of this study suggest that the level of loneliness among older adults depends on age and socio-economic status, with the middle-aged and economically disadvantaged the most vulnerable. However, these differences could be due to cohort differences in social cohesion. Our findings also show that individuals living in a neighborhood with high social capital who are outside this social capital are at higher risk of suffering from loneliness. Global interventions which are focused on improving the social conditions of the poorest middle-aged individuals as well as facilitating the increase of both NSC and individual social capital could be an effective strategy to reduce the prevalence of loneliness, while helping to promote healthy aging. There is a need for policies designed to create or preserve NSC, especially in low socioeconomic areas.

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## **Declaration of Conflicting Interests**

The authors declare that they have no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Table 1. Characteristics of the overall study sample and of individuals presenting loneliness.

Characteristics	Overall n=971	Loneliness n=100 (10.3)	<i>p</i> -value <sup>a</sup>
<b>Sex</b>			
Male, <i>n</i> (%)	457 (46.3)	33 (7.2)	0.003
Female, <i>n</i> (%)	514 (53.7)	67 (12.8)	
<b>Age, mean (SD)=66.1 (9.9)</b>			
50-59 years, <i>n</i> (%)	279 (30.8)	32 (12.0)	0.460
60-69 years, <i>n</i> (%)	325 (35.8)	28 (8.4)	
70 + years, <i>n</i> (%)	367 (33.4)	40 (10.4)	
<b>Marital Status</b>			
Married or cohabiting, <i>n</i> (%)	680 (71.0)	43 (6.5)	<0.001
Never married, <i>n</i> (%)	61 (6.4)	5 (8.1)	
Previously married, <i>n</i> (%)	230 (22.6)	52 (22.4)	
<b>Chronic conditions</b>			
None, <i>n</i> (%)	134 (14.1)	8 (5.7)	<0.001
One, <i>n</i> (%)	292 (30.9)	23 (7.6)	
Two, <i>n</i> (%)	267 (27.8)	22 (7.4)	
More than two, <i>n</i> (%)	275 (27.2)	46 (18.0)	
<b>Social isolation</b>			
Low, <i>n</i> (%)	445 (45.5)	31 (7.0)	0.003
Medium, <i>n</i> (%)	436 (45.1)	54 (11.7)	
High, <i>n</i> (%)	90 (9.4)	15 (18.3)	
<b>Depression</b>			
No, <i>n</i> (%)	934 (96.1)	89 (9.4)	<0.001
Yes, <i>n</i> (%)	37 (3.9)	11 (30.1)	
<b>Socioeconomic status</b>			
Low, <i>n</i> (%)	298 (30.0)	44 (15.0)	0.003
Medium, <i>n</i> (%)	352 (35.8)	35 (9.6)	
High, <i>n</i> (%)	321 (34.2)	21 (6.6)	
<b>Neighborhood social capital <sup>b</sup></b>			
High, <i>n</i> (%)	554 (61.1)	55 (9.8)	0.661
Low, <i>n</i> (%)	417 (38.9)	45 (10.7)	
<b>Social Capital indicators <sup>b</sup></b>			
<b>Reciprocity</b>			
No, <i>n</i> (%)	288 (29.0)	43 (15.6)	0.002
Yes, <i>n</i> (%)	683 (71.0)	57 (8.0)	
<b>Trust</b>			
No, <i>n</i> (%)	895 (92.3)	94 (10.4)	0.473
Yes ( <i>n</i> (%)	76 (7.7)	6 (8.0)	
<b>Civic participation</b>			
No, <i>n</i> (%)	917 (93.8)	98 (10.6)	0.101
Yes, <i>n</i> (%)	54 (6.2)	2 (3.5)	

Abbreviations: n=frequency; SD=Standard deviation.

Unweighted frequencies (n), and weighted proportions or weighted means and SD are displayed.

<sup>a</sup> The difference in proportions among categories was tested by Chi-squared tests.

<sup>b</sup> Neighborhood social capital refers to living in an area with low or high social capital, whereas social capital indicators refer to individual characteristics.

Table 2. Logistic regression analysis of factors associated with loneliness.

Characteristics	Unadjusted	Adjusted
<b>Sex</b>		
Male	Ref.	Ref.
Female	0.64 (1.18, 1.09)**	0.30 (-0.25, 0.84)
<b>Age</b>		
50-59 years	Ref.	Ref.
60-69 years	-0.40 (-0.95, 0.14)	-1.66 (-2.94, -0.39)*
70 + years	-0.17 (-0.68, 0.35)	-2.20 (-3.41, -0.99)***
<b>Marital Status</b>		
Married or cohabiting	Ref.	Ref.
Never married	0.23 (-0.74, 1.21)	0.10 (-1.09, 1.29)
Previously married	1.43 (0.97, 1.88)***	1.52 (0.96, 2.08)***
<b>Chronic conditions</b>		
None	Ref.	Ref.
One	0.31 (-0.54, 1.15)	0.25 (-0.68, 1.19)
Two	0.28 (-0.58, 1.14)	0.13 (-0.82, 1.07)
More than two	1.29 (0.49, 2.09)**	1.09 (0.17, 2.01)*
<b>Social isolation</b>		
High	Ref.	Ref.
Medium	0.57 (0.10, 1.05)*	0.40 (-0.12, 0.92)
Low	1.10 (0.41, 1.78)**	0.80 (0.03, 1.58)*
<b>Depression</b>		
No	Ref.	Ref.
Yes	1.43 (0.66, 2.20)***	0.96 (0.01, 1.91)*
<b>Socioeconomic status (SES)</b>		
Low	Ref.	Ref.
Medium	-0.51 (-1.01, -0.01)*	-1.19 (-2.47, 0.09)
High	-0.91 (-1.48, -0.35)**	-2.47 (3.76, -1.19)***
<b>Neighborhood social capital (NSC) <sup>a</sup></b>		
High	Ref.	Ref.
Low	0.10 (-0.33, 0.53)	-0.42 (-1.23, 0.40)
<b>Social Capital indicators <sup>a</sup></b>		
<b>Civic participation</b>		
No	Ref.	-
Yes	-0.20 (-1.17, 0.77)	-
<b>Trust</b>		
No	Ref.	-
Yes	0.32 (-0.43, 1.06)	-
<b>Reciprocity</b>		
No	Ref.	Ref.
Yes	-0.76 (-1.20, -0.32)**	-0.97 (-1.63, -0.30)**
<b>Interaction: age group x SES</b>		
50-59 years x Low SES	-	Ref.
60-69 years x Medium SES	-	0.09 (-1.57, 1.75)
60-69 years x High SES	-	2.04 (0.34, 3.73)*
70 + years x Medium SES	-	1.17 (-0.36, 2.70)
70 + years x High SES	-	1.95 (-0.08, 3.97)
<b>Interaction: Reciprocity x NSC</b>		
No x High NSC	-	Ref.
Yes x Low NSC	-	1.06 (0.04, 2.07)*

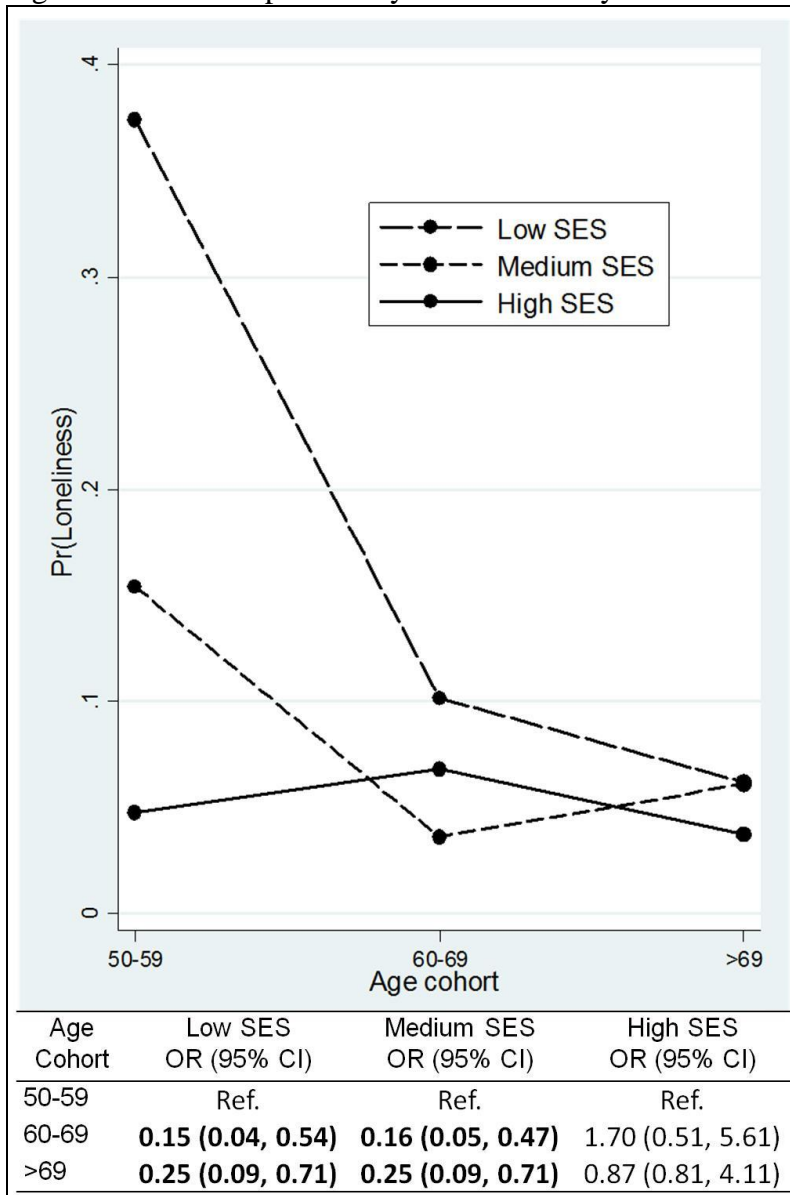
Beta coefficient and 95% confidence interval are displayed.

<sup>a</sup> Neighborhood social capital refers to living in an area with low or high social capital, whereas social capital indicators refer to individual characteristics.

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001. Abbreviations: Ref=Category of reference.



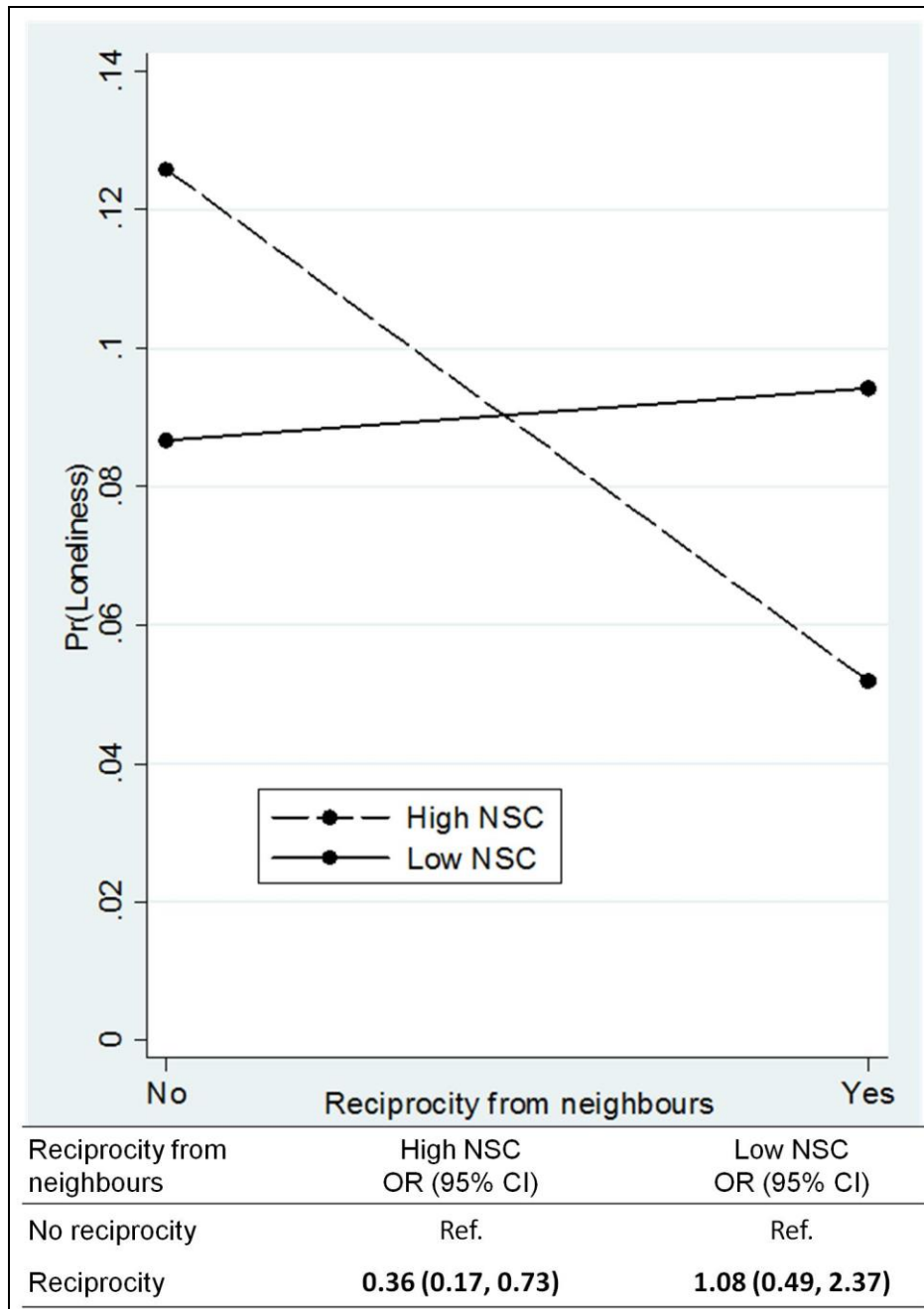
Figure 1. Estimated probability of loneliness by SES status and age cohorts.



Note: Estimated probabilities were calculated adjusted for covariates and interactions at mean from Table 2 model. Adjusted logistic regression models were also carried out by SES obtaining odds ratios (OR) for loneliness with 95% Confidence Interval (95% CI). In bold, significant odds ratio.

Abbreviations: SES= Socioeconomic status; Ref=Category of reference.

Figure 2. Estimated probability of loneliness according to neighborhood social capital and reciprocity from neighbors.



Note: Estimated probabilities were calculated adjusted for covariates and interactions at mean from Table 2 model. Adjusted logistic regression models were also run for NSC, obtaining odds ratios (OR) for loneliness with 95% Confidence Interval (95% CI). In bold, significant odds ratio. Abbreviations: NSC= Neighborhood social capital; Ref=Category of reference.