Jade Benson

Social Networks and Loneliness

**Introduction**

Social networks and their integration are very meaningful for older adult’s health, and better understanding these factors is especially important as the population ages in the United States.1-3 Loneliness also has consistently been found to affect older adult’s morbidity and mortality.4-6 Social isolation and loneliness are theoretically distinct but related concepts and, typically, their measures are lowly correlated with each other.7-9 Social isolation describes a lack of contact with other people and is captured through observable social network characteristics and participation.10 Whereas, loneliness is the distressing psychological feeling that desired social needs are not being met.11 Older adults that surround themselves with many and frequent social interactions may still feel lonely (“lonely in crowd”), and some that have few connections may feel socially satisfied (“lone farmer”).12

Most research has separately examined the effects of loneliness and social isolation on various health outcomes or placed them in competitive models to determine which one is more important.3,5,13 However, Newall & Menec argue that it is important to consider them together to better understand their mechanisms and develop effective interventions.13 Many interventions primarily focus on increasing network size and frequency of contact, as these network characteristics have been shown to be associated with feelings of loneliness.14-16 However, these interventions may not be effective for those who are “lonely in crowd,” who already have large and active networks but still feel lonely.12 Lee & Ko found that those who are lonely in crowd tend to have less frequent contact with their strongest ties, perhaps demonstrating the negative consequences of prioritizing quantity of relationships over quality.17 Better understanding which network characteristics are associated with feelings of loneliness can help us design targeted interventions.

In this study, we aim to explore how various characteristics of older adults’ social networks are associated with feelings of loneliness. We use the second round of the National Social Health, Life, and Aging Project (NSHAP), which is a nationally representative survey of community-dwelling older adults born 1920 – 1947 (N = 3,377). Loneliness is constructed using the shortened version of the widely used UCLA loneliness score. Various network characteristics were created using NSHAP’s egocentric network data including degree, density, diversity, interaction frequency (node strength), and proportion of emotionally close ties. We propose five hypotheses related to the relationship between these network characteristics and feelings of loneliness along with possible alternative hypotheses, summarized in Table 1. Overall, we hypothesize that more connected, close, and active networks will be associated with less loneliness, as older adults will be more supported by people they trust. An overarching alternative hypothesis may be that social networks and feelings of loneliness operate through different mechanisms and do not influence each other in these direct ways. Social needs and their satisfaction may be more complex or different from what is captured by these network measures.

*Table 1. Summary of study hypotheses about the directionality of association between various network measures and loneliness. Alternative hypotheses also presented.*

|  |  |  |
| --- | --- | --- |
| **Network Measure** | **Hypothesis** | **Alternative Hypothesis** |
| Degree | Larger networks provide more support, reducing loneliness. | “Lonely in crowd” or “lone farmer” dynamics. |
| Density | More ties between an ego’s alters captures a more tight-knit support group, reducing loneliness. | Ego might feel left out if they perceive their tight-knit group as being closer to each other than to themselves. |
| Diversity | More diversity in the types of relationships that an ego has may mean many different emotional needs are met (less loneliness). | Different types of relationships may be difficult/stressful to maintain or lead to less tight knit support groups. |
| Interaction Frequency  (Node Strength) | More opportunities for socialization allow for greater intimacy, reducing loneliness. | Frequent but low-quality interaction may make the ego feel even lonelier. |
| Closeness | More “high quality” and close relationships reduce loneliness. | “Emotional closeness” may have different meanings for participants and not fully capture particular social needs/desires. |

**Methods**

***Network Characteristics***

The NSHAP is a nationally representative longitudinal survey of older adults in the U.S. (born 1920 – 1947). There have been three rounds of data collection and the fourth is currently underway: 2005/6 (Round 1), 2010/11 (Round 2), and 2015/16 (Round 3). Every round includes biometric collection, surveys about mental and physical health, and an extensive social network questionnaire.1,18 Round 2 invited previous respondents’ spouses to join, those that fell outside the original sample age range were dropped so only older adults aged 63 – 91 were included. All respondents in NSHAP gave written informed consent and the study was approved by the institutional review boards at the University of Chicago and at NORC, who collected the data and prepared it for public use.

The full details of the network methodology can be found in Cornwell, et al.1 Briefly, egocentric networks were constructed for each participant by using a name generator that allows them to list a maximum of 5 people with whom they discuss important matters with (the alters).1 An indicator was created to identify if a participant attempted to list more than five, but extensive network data were not collected for them. If participants did not list their spouses/partners or other household members as a part of their egocentric networks, these people were placed onto additional rosters. Only information from those alters that were listed in the first five iterations (Roster 1) were included in this study. Participants (egos) then underwent a name interpreter where they were asked each alters’ gender, relationship type (i.e., spouse, family, friend), frequency of contact, likelihood of discussing health matters, emotional closeness, and how often they interacted with all other alters listed.

Five network metrics were then constructed using these data: degree, diversity, density, interaction frequency (node strength), and proportion close ties.19 Degree is the number of alters that the ego listed (range: 1 – 5). Diversity is the number of different types of relationships that an alter has (19 possible relationship types). It ranges from 1 where all the alters are the same relationship type to 5 where each alter has a different relationship to the ego. This was not scaled to account for network size, as respondents with only one alter would have the same score as those who listed 5 unique relationship types for all their alters. Density captures how often the ego interacts with all their alters and how often each of the ego’s alters communicate with each other, out of the possible maximum interactions. The alter-alter tie communication frequency is from the ego’s perspective and may not reflect their actual level of interaction. The ties can be weighted based on a 9-level communication frequency variable: 0 represents that the alters have never spoken to each other, 0.125 represents less than one interaction a year, and 1 represents communicating every day. This is then scaled by the total number of possible connections with the maximum level of communication in the network. Interaction frequency (node strength) represents only how often the ego communicates with their alters and does not include alter-alter ties. This metric is the sum of the communication weights the ego has with their alters (range: 0.125, less than once a year communication with only one alter listed to 5, everyday communication with all alters). Egos were also asked “how close do you feel” to each of their alters with four possible answers: “not very,” “somewhat,” “very close,” and “extremely close.” These closeness weights were summed, then divided by degree resulting in a proportion of emotional closeness score that ranged from 0.25 (not very close to all ties) to 1 (extremely close to all ties).

***Loneliness***

Loneliness was measured using the shortened version of the UCLA loneliness score.20 This scale ranges from 0 – 6, where higher values represent more frequent feelings of loneliness from responses to the three questions (posed separately): how often do you feel left out, isolated from others, or lacking companionship? Those that were missing loneliness scores were dropped from the analysis, resulting in an analytic sample of N = 2537.

***Statistical Analysis***

Previous research has found that both networks and feelings of loneliness differ by sociodemographic characteristics.1,12 Therefore, we control for sex, age, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, other), and educational attainment (less than high school, high school, some college, college or more) as potential confounders.

Each network characteristic was modeled as a predictor in separate ordinal logistic regression model with the loneliness score as the outcome. The beta coefficients were exponentiated to yield odds ratios which are interpreted as the odds change in the loneliness score for a unit change in each of the network scores. As is recommended for all NSHAP analysis, we use the ultimate cluster method for variance estimation to account for the multistage sampling and co-residing couples.21 R’s suite of commands for complex surveys was used to prepare the data and conduct all regressions (R Version 4.0.3, R Foundation for Statistical Computing, Vienna, Austria).22,23

**Results**

***Descriptive Statistics***

Descriptive statistics for all network, loneliness, and sociodemographic characteristics can be found in Table 2 below. Almost 46% of respondents answered the maximum number of alters possible in their networks and less than 1% listed only one alter. Their networks were relatively dense and active, with most older adults having some form of daily contact with at least one alter. Overall, the majority were not lonely (51.7% had a UCLA score of 0) and only 3% were very lonely (scores of 5 or 6).

*Table 2. Descriptive statistics for the analytic sample of Round 2 NSHAP participants (N =* *2537).*

|  |  |
| --- | --- |
|  | Mean (IQR) or Percent |
| **Network Characteristics** |  |
| Degree | 3.84 (3, 5) |
| Diversity | 2.58 (2, 3) |
| Density | 0.67 (0.53, 0.83) |
| Interaction Frequency | 3.21 (2.50, 4.13) |
| Closeness | 0.77 (0.70, 0.85) |
|  |  |
| **Loneliness** |  |
| UCLA Loneliness Score | 1.11 (0, 2) |
|  |  |
| **Sociodemographic Characteristics** |  |
| Female | 53.0% |
| Age | 73 (67, 79) |
| Race/Ethnicity |  |
| Non-Hispanic white | 76.2% |
| Non-Hispanic black | 11.7% |
| Hispanic | 9.4% |
| Other | 2.7% |
| Educational Attainment |  |
| Less than high school | 31.7% |
| High school | 26.0% |
| Some college | 25.6% |
| College or more | 16.7% |

***Regression Results***

The results from the 5 ordinal logistic regression models are presented in Table 3 below. The network characteristics associated with reduced frequency of feelings of loneliness were density and closeness. Network degree, diversity, and interaction frequency all had negligible effects (odds ratios close to 1, small t-values). Older adults that had more dense networks had 0.32 times the odds of being one point lonelier. Those who had networks composed of all extremely close ties had 0.05 times the odds of being lonelier.

*Table 3. Regression results from 5 ordinal logistic regression models. Network characteristics as predictors, loneliness as outcome, controlled for sociodemographic characteristics.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Network Characteristics**  **(Predictors)** | **Odds Ratio** | **Standard Error** | **t-value** |
| Degree | 0.99 | 1.04 | -0.22 |
| Diversity | 0.91 | 1.05 | -2.07 |
| Density | 0.32 | 1.30 | -4.31 |
| Interaction Frequency | 0.93 | 1.04 | -1.70 |
| Closeness | 0.05 | 0.37 | -7.89 |

**Discussion**

We found that two network characteristics were associated with reduced feelings of loneliness – density and closeness. Network density represents how often each of the network members communicate with all the others, out of the possible maximum communication (everyone communicates every day). This measure tries to capture how tight knit an older adult’s community is, which may mean they are able to have an integrated social support system to help them meet their social and other needs. Being surrounded by a community that is perceived as highly connected to each other is important for reducing feelings of loneliness in our sample of older adults. Another network characteristic related to perceptions of connectedness is the closeness score, which captures how emotionally close an older adult feels to all their alters. Having a closer network is very meaningful for reducing feelings of loneliness. Network degree, diversity, and interaction frequency were all not associated with loneliness. Together, these findings suggest that network quality is very meaningful for reducing older adult’s loneliness.

However, there are some important limitations to consider when interpreting our findings. The network characteristics might not be well suited for ordinal logistic regression models due to their scales. A unit change for network degree is listing one other alter, where a unit change in closeness captures the entire range of the variable. Additionally, there may not be a meaningful difference between each unit of the loneliness score and it may be better categorized (i.e., “not lonely,” “sometimes lonely,” or “very lonely”). Future work may experiment with different sensitivity analyses to better adjust these measures or their models. There may also be difficulties in how these variables are conceptually operationalized, as both are reported from an ego’s subjective perspective. Older adults who are already feeling lonely may perceive their social networks as being less robust, or they may further isolate themselves from their social communities due to their loneliness. Therefore, there may be the opposite directionality to these associations where loneliness drives the changes in network characteristics. Causality cannot be inferred from this cross-sectional study, but better insight into the temporality of these associations could be gained by joining multiple rounds of the NSHAP together.

Despite these challenges, this study presents a detailed examination of multiple network characteristics and how they are associated with feelings of loneliness in a nationally representative study of older adults. We contribute to a growing body of literature exploring network characteristics and loneliness together to help better understand their relationship, which has become increasingly important during the COVID-19 pandemic.24 We find that prioritizing tight knit and emotionally close networks are important for reducing feelings of loneliness for older adults.

**References**

1. Cornwell B, Schumm LP, Laumann EO, Graber J. Social Networks in the NSHAP Study: rationale, measurement, and preliminary findings. *J Gerontol B Psychol Sci Soc Sci*. Nov 2009;64 Suppl 1:i47-55. doi:10.1093/geronb/gbp042

2. Shankar A, McMunn A, Demakakos P, Hamer M, Steptoe A. Social isolation and loneliness: Prospective associations with functional status in older adults. *Health Psychol*. Feb 2017;36(2):179-187. doi:10.1037/hea0000437

3. Courtin E, Knapp M. Social isolation, loneliness and health in old age: a scoping review. *Health Soc Care Community*. 05 2017;25(3):799-812. doi:10.1111/hsc.12311

4. Hawkley LC, Masi CM, Berry JD, Cacioppo JT. Loneliness is a unique predictor of age-related differences in systolic blood pressure. *Psychol Aging*. Mar 2006;21(1):152-64. doi:10.1037/0882-7974.21.1.152

5. Holt-Lunstad J, Smith TB, Baker M, Harris T, Stephenson D. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspect Psychol Sci*. Mar 2015;10(2):227-37. doi:10.1177/1745691614568352

6. Steptoe A, Shankar A, Demakakos P, Wardle J. Social isolation, loneliness, and all-cause mortality in older men and women. *Proc Natl Acad Sci U S A*. Apr 2013;110(15):5797-801. doi:10.1073/pnas.1219686110

7. Coyle CE, Dugan E. Social isolation, loneliness and health among older adults. *J Aging Health*. Dec 2012;24(8):1346-63. doi:10.1177/0898264312460275

8. Perissinotto CM, Covinsky KE. Living alone, socially isolated or lonely--what are we measuring? *J Gen Intern Med*. Nov 2014;29(11):1429-31. doi:10.1007/s11606-014-2977-8

9. Benson JA, McSorley VE, Hawkley LC, Lauderdale DS. Associations of loneliness and social isolation with actigraph and self-reported sleep quality in a national sample of older adults. *Sleep*. 01 21 2021;44(1)doi:10.1093/sleep/zsaa140

10. Cornwell EY, Waite LJ. Social disconnectedness, perceived isolation, and health among older adults. *J Health Soc Behav*. Mar 2009;50(1):31-48. doi:10.1177/002214650905000103

11. Hawkley LC, Cacioppo JT. Loneliness matters: a theoretical and empirical review of consequences and mechanisms. *Ann Behav Med*. Oct 2010;40(2):218-27. doi:10.1007/s12160-010-9210-8

12. Menec VH, Newall NE, Mackenzie CS, Shooshtari S, Nowicki S. Examining individual and geographic factors associated with social isolation and loneliness using Canadian Longitudinal Study on Aging (CLSA) data. *PLoS One*. 2019;14(2):e0211143. doi:10.1371/journal.pone.0211143

13. Newall NEG, Menec VH. Loneliness and social isolation of older adults: Why it is important to examine these social aspects together. *Journal of Social and Personal Relationships*. December 27, 2017;36(3):925-939. doi:<https://doi.org/10.1177/0265407517749045>

14. Capitanio JP, Hawkley LC, Cole SW, Cacioppo JT. A behavioral taxonomy of loneliness in humans and rhesus monkeys (Macaca mulatta). *PLoS One*. 2014;9(10):e110307. doi:10.1371/journal.pone.0110307

15. Burholt V, Scharf T. Poor health and loneliness in later life: the role of depressive symptoms, social resources, and rural environments. *J Gerontol B Psychol Sci Soc Sci*. Mar 2014;69(2):311-24. doi:10.1093/geronb/gbt121

16. Poscia A, Stojanovic J, La Milia DI, et al. Interventions targeting loneliness and social isolation among the older people: An update systematic review. *Exp Gerontol*. 02 2018;102:133-144. doi:10.1016/j.exger.2017.11.017

17. Lee Y, Ko Y-g. Feeling lonely when not socially isolated: Social isolation moderates

the association between loneliness and daily social interaction. *Journal of Social and Personal Relationships*. 2017;35(10):1340-1355. doi:<https://doi.org/10.1177/0265407517712902>

18. Jaszczak A, O'Doherty K, Colicchia M, et al. Continuity and innovation in the data collection protocols of the second Wave of the National Social Life, Health, and Aging Project. *J Gerontol B Psychol Sci Soc Sci*. Nov 2014;69 Suppl 2:S4-14. doi:10.1093/geronb/gbu031

19. Wasserman S, Faust K. *Social network analysis : methods and applications*. Structural analysis in the social sciences. Cambridge University Press; 1994.

20. Hughes ME, Waite LJ, Hawkley LC, Cacioppo JT. A Short Scale for Measuring Loneliness in Large Surveys: Results From Two Population-Based Studies. *Res Aging*. 2004;26(6):655-672. doi:10.1177/0164027504268574

21. O'Muircheartaigh C, English N, Pedlow S, Kwok PK. Sample design, sample augmentation, and estimation for Wave 2 of the NSHAP. *J Gerontol B Psychol Sci Soc Sci*. Nov 2014;69 Suppl 2:S15-26. doi:10.1093/geronb/gbu053

22. *survey: analysis of complex survey samples*. Version 4.1.1. 2020.

23. *R: A language and environment for statistical  computing*Version 4.0.3. R Foundation for Statistical Computing; 2020. <https://www.R-project.org/>

24. Wu B. Social isolation and loneliness among older adults in the context of COVID-19: a global challenge. *Glob Health Res Policy*. 2020;5:27. doi:10.1186/s41256-020-00154-3