The link between social and emotional isolation and dementia in older black and white Brazilians

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ABSTRACT

Objective: To examine the link between social and emotional isolation and likelihood of dementia among older black and white Brazilians.

Design: Cross-sectional clinical–pathological cohort study.

Setting: Medical center in Sao Paulo, Brazil.

Participants: As part of the Pathology, Alzheimer's and Related Dementias Study, we conducted uniform structured interviews with knowledgeable informants (72% children) of 1,493 older (age > 65) Brazilian decedents.

Measurements: The interview included measures of social isolation (number of family and friends in at least monthly contact with decedent), emotional isolation (short form of UCLA Loneliness Scale), and major depression plus the informant portion of the Clinical Dementia Rating Scale to diagnose dementia and its precursor, mild cognitive impairment (MCI).

Results: Decedents had a median social network size of 8.0 (interquartile range = 9.0) and a median loneliness score of 0.0 (interquartile range = 1.0). On the Clinical Dementia Rating Scale, 947 persons had no cognitive impairment, 122 had MCI, and 424 had dementia. In a logistic regression model adjusted for age, education, sex, and race, both smaller network size (odds ratio [OR] = 0.975; 95% confidence interval [CI]: 0.962, 0.989) and higher loneliness (OR = 1.145; 95% CI: 1.060, 1.237) were associated with higher likelihood of dementia. These associations persisted after controlling for depression (present in 10.4%) and did not vary by race. After controlling for depression, neither network size nor loneliness was related to MCI.

Conclusion: Social and emotional isolation are associated with higher likelihood of dementia in older black and white Brazilians.

Key words: social isolation, loneliness, dementia, mild cognitive impairment, Latinx, racial differences

Introduction

With the aging of much of the world's population, the prevalence of dementia is projected to sharply increase by mid-century (Hebert et al., 2013). The need to confront this growing public health challenge has stimulated research on potentially modifiable risk factors for dementia. Much of this research

has focused on social engagement (Hertzog et al., 2009). In old age, there is substantial evidence that smaller social network size (Fratiglioni et al., 2000; Crooks et al., 2008; Rafnsson et al., 2020) and higher level of emotional isolation (Rafnsson et al. 2020; Tilvis et al., 2004; Wilson et al., 2007; Shankar et al., 2013; Holwerda et al., 2014; Sutin et al., 2020; Sundstrom et al., 2020) are associated with increased risk of cognitive decline and dementia. However, with few exceptions (Sutin et al., 2020) this research has been based on predominantly white persons of non-Latin descent. It is uncertain, therefore, whether social engagement is related to dementia in racial and ethnic minorities.

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In this paper, we examine the correlation between levels of social and emotional isolation and likelihood of dementia. As part of the Pathology, Alzheimer's and Related Dementias Study (PARDoS), knowledgeable informants of 1,493 older Brazilian decedents underwent a uniform structured interview to assess social and emotional isolation, history of major depression, and dementia and mild cognitive impairment (MCI). In analyses, we tested whether social and emotional isolation were related to the likelihood of dementia and MCI.

Methods

Decedents and informants

PARDoS enrolls deceased older persons who died from natural non-violent causes (e.g. excluding accidents, suicide, homicide) in the state of Sao Paulo, Brazil, and includes cases originally enrolled in the Study of Ancestry and Neurodegenerative Diseases. After consent by a legal representative of the decedent, informants were invited to participate in a structured interview while waiting for completion of brain and other organ removal. The study was approved by the Brazilian national ethics committee Comissao Nacional de Etica em Pesquisa. Because participants are deceased, the study is exempt from human subjects review in the USA.

These analyses are based on 1,493 individuals aged 65 years or older at death who had a consent signed by a legal representative for brain removal and examination of the decedent plus an informant who consented to do the interview. They died at a mean age of 79.5 (SD = 8.9; range: 65–110) mostly of cardiovascular disease (62.9%), infectious diseases (21.7%), and cancer (2.5%). They had completed a mean of 4.9 years of formal education (SD = 3.9; range: 0–25); 52.4% were women. Proxy reported race was black or mixed in 34.1% and white in 65.9%.

The relationships of informants to decedents were as follows: child (71.6%), grandchild (8.5%), sibling (5.4%), spouse (4.5%), other relative or in-law (1.7%), and other (8.1%). They reported knowing the decedent for a median of 46 years (interquartile range: 39–83). In the last year of the decedent's life, 70.9% of informants reported daily contact with the decedent, 28.0% reported weekly contact, and 1.2% reported monthly contact.

Clinical interview

An informant of the decedent had a 60–90 minute structured interview with a study nurse. If more than one representative of the decedent was available, we primarily considered the responses of the person with the most frequent contact with the decedent. The interview assessed basic demographic information including age at death, sex, education, and race; social and emotional isolation; history of major depression; and clinical diagnoses of dementia and MCI.

Assessment of social and emotional isolation

Social isolation was assessed with standard social network questions about frequency of contact with children, other family members, and friends (Cornoni-Huntley *et al.*, 1986). Social network size was defined as the number of individuals from these three categories seen at least once per month (Barnes *et al.*, 2004; Bennett *et al.*, 2006).

Emotional isolation was assessed with the 3-item short form (Hughes *et al.*, 2004) of the Revised UCLA Loneliness Scale (Russell *et al.*, 1980). Informants were asked to rate on a 3-point scale how often the decedent felt: lack of companionship, left out, and isolated from others. Item scores (0–2) were summed to yield the total score (0–6). We are not aware of previous use of informant report to assess loneliness, but informants are commonly used to assess other subjective states such as depression (Gilley *et al.*, 1995) and personality traits (Costa and McCrae, 1992). The self-report version of this short form has been shown to have sound psychometric properties (Russell *et al.*, 1980). The informant version of the scale used in the present study had adequate internal consistency (Cronbach's coefficient alpha = 0.86 in full group, 0.84 in black participants, 0.87 in white participants) which is comparable to estimates for the self-report version of the scale (Tilvis *et al.*, 2004).

Assessment of major depression history

We adapted the depression section of the Structured Clinical Interview for DSM (Robins *et al.*, 1981) for informant report (Saldanha *et al.*, 2020). The informant was asked about past depressive symptoms. The diagnosis of major depression required persistent depressed mood or loss of interest accompanied by at least four additional depressive symptoms.

Assessment of dementia and MCI

We diagnosed dementia and MCI in the decedent with the informant portion of the Clinical Dementia Rating Scale (Morris *et al.*, 1992)]. The scale rates level of function in six domains: memory, orientation, judgment and problem solving, community affairs, home and hobbies, and personal care. An algorithm converts domain scores to an overall rating of no cognitive impairment (score = 0), MCI (score = 0.5), or dementia (score > 0.5).

Dementia diagnoses based on the informant portion of the Clinical Dementia Rating Scale have been shown to have good agreement with diagnoses based on in-person examination (Waite *et al.*, 1999; Ferretti *et al.*, 2010).

Statistical analysis

To test the hypotheses that smaller social network size and higher level of loneliness are associated with higher likelihood of dementia and MCI, we constructed a series of logistic regression models. The outcome of the first set of models was no cognitive impairment versus dementia. All models had terms for age at death, sex, education, and race. The core model also had terms for social network size and loneliness score. We subsequently repeated the core model with a term for depression and then in separate analyses added terms for the interaction of race with social network size and the interaction of race with loneliness. We conducted additional analyses with terms for friend network size plus demographic variables in one model and family network size plus demographic variables in a second model. We then repeated each of these models with terms for loneliness and depression.

The outcome for the second set of logistic regression models was no cognitive impairment versus MCI. All models included terms for the four demographic variables. The core model had terms for social network size and loneliness. We added a term for depression to the core model and then repeated the model, first with a term for race × social network size and then with a term for race × loneliness. We constructed two additional models, one with a term for friend network size and the other with a term for family network size.

Results

Social and emotional isolation

Decedents were reported to have at least monthly contact with a median of eight individuals (interquartile range = 9.0). Neither age (Spearman $r = -0.05$, $P = 0.063$) nor education (Spearman $r = -0.03$, $P = 0.208$) was related to social network size. Black race (χ^2 [1] = 10.8, $P = 0.001$) was associated with larger social network size, but sex (χ^2 [1] = 0.2, $P = 0.637$) was not. Loneliness scores ranged from 0 to 6 (median = 0.0, interquartile range = 1.0) with higher scores indicating more loneliness. Loneliness was not related to age (Spearman $r = 0.01$, $P = 0.587$) but was to education (Spearman $r = -0.05$, $P = 0.047$). Level of loneliness in black and white people did not differ (χ^2 [1] = 0.2, $P = 0.663$). Women were more lonely than men (χ^2 [1] = 13.3, $P < 0.001$). Smaller social network size was associated with higher loneliness score (Spearman $r = -0.18$, $P < 0.001$).

Clinical classification

On the Clinical Dementia Rating Scale, 947 individuals met criteria for no cognitive impairment, 122 had MCI, and 424 had dementia. Consistent with prior research, the diagnostic subgroups differed in age (F[2, 1490] = 74.8, $P < 0.001$) and education (F[2, 1490] = 4.2, $P = 0.015$).

Relation of isolation to dementia

To estimate the associations of social and emotional isolation with dementia, we constructed a logistic regression model. The outcome was persons with no cognitive impairment versus persons with dementia. The model included terms for social network size and loneliness score plus terms for the potentially confounding effects of age at death, sex, education, and race. As shown for model A in Table 1, both smaller network size and higher level of loneliness were associated with higher likelihood of dementia. The size of each effect was modest. Thus, a typical decedent with a small social network (size = 3, 10th percentile) was about 11.3% more likely to have dementia than a decedent with a large social network (size = 23, 90th percentile) which was equivalent to being 2.4 years older. A lonely decedent (score = 3, 90th percentile) was about 9.4% more likely to have dementia than a decedent who was not lonely (score = 0, 10th percentile) which was equivalent to being 2.0 years older.

Because depression is related to social isolation (Domenech-Abella *et al.*, 2017), emotional isolation (Cacioppo *et al.*, 2006), and dementia (Saczynski *et al.*, 2010), we repeated the initial analysis with a term added for a history of major depression (present in 10.4%). As shown for model B in Table 1, a history of depression was associated with a more than twofold increase in the likelihood of dementia, but after adjusting for depression the associations of social and emotional isolation with dementia persisted.

With few exceptions (Sutin *et al.*, 2020), knowledge about the relation of social and emotional isolation to dementia is based on studies of predominantly non-Latin white persons. Therefore, we repeated model B from Table 1, first with a term for the interaction of race (i.e. black + mixed versus white) with social network size and then again with a term for the interaction of race with loneliness. There were no interactions (each $P > 0.70$).

Prior research has suggested that engagement with friends is more strongly related to late life

Table 1. Relation of social and emotional isolation to likelihood of dementia*

MODEL TERM	MODEL A			MODEL B		
	OR	95% CI		OR	95% CI	
Social network size	0.975	0.962	0.989	0.976	0.962	0.989
Loneliness	1.145	1.060	1.237	1.092	1.007	1.184
Depression				2.256	1.573	3.363

OR, odds ratio; CI, confidence interval.

*From separate logistic regression models adjusted for age at death, sex, education, and race.

cognitive health than engagement with family (Zahodne *et al.*, 2019; Sharifian *et al.*, 2020). In separate analyses, larger networks of both friends (odds ratio [OR] = 0.947, 95% confidence interval [CI]: 0.923, 0.973) and family (OR = 0.976, 95% CI: 0.956, 0.996) were related to lower likelihood of dementia. When we added terms for loneliness and depression, the association of friend network size with dementia persisted (OR = 0.959, 95% CI: 0.928, 0.977), but the association of family network size with dementia was no longer significant (OR = 0.982, 95% CI: 0.962, 1.002).

Relation of isolation to MCI

To test the associations of social and emotional isolation with MCI, we constructed a logistic regression model contrasting the MCI subgroup with the no cognitive impairment subgroup. Model A in Table 2 shows that higher level of loneliness was related to higher likelihood of MCI, but social network size was not. When a term for depression was added to the model, neither social network size nor loneliness was related to MCI (model B in Table 2).

Discussion

We interviewed knowledgeable informants of nearly 1,500 older Brazilian decedents to test the hypotheses that social and emotional isolation are associated with higher likelihood of dementia. More than one-fourth of decedents met dementia criteria. Both smaller social network size and higher level of loneliness were associated with higher likelihood of dementia even after controlling for depression. The results support the idea that social and emotional isolation are associated with late life dementia.

Most prior research reporting an association of loneliness with dementia is based on groups of predominantly non-Latin white participants (Rafnsson *et al.*, 2020; Tilvis *et al.*, 2004; Wilson *et al.*, 2007; Shankar *et al.*, 2013; Holwerda *et al.*, 2014; Sundstrom *et al.*, 2020). In an exception to this pattern, analyses of data from the Health and Retirement Study did not suggest either ethnic or racial differences in the association of loneliness with dementia (Sutin *et al.*, 2020). That the association of loneliness with dementia was observed in older Brazilians and did not vary between black and white persons provides further evidence that the association of loneliness with dementia generalizes across racial and ethnic lines.

Smaller social network size has been associated with dementia in some studies (Fratiglioni *et al.*, 2000; Crooks *et al.*, 2008; Rafnsson *et al.*, 2020). However, other studies have not observed the association (Wilson *et al*, 2007; Holwerda *et al.*, 2014), and meta-analyses have reflected these inconsistent results (Kuiper *et al.*, 2015; Penninkilampi *et al.*, 2018). In the present study, smaller social network size was robustly associated with higher likelihood of dementia even after accounting for loneliness and depression. That this association was observed in individuals of Latin descent and did not differ between black and white persons suggests that the association of social network size with dementia generalizes across racial and ethnic lines.

Recent research has suggested that the size of friend networks is more strongly related to late life cognitive health than the size of family networks (Zahodne *et al.*, 2019; Sharifian *et al.*, 2020). In the present analyses, both friend and family network sizes were related to dementia in initial models, but only friend network size remained significant in the fully adjusted analyses.

Knowledge about social and emotional isolation in MCI is limited. In cross-sectional studies, higher level of loneliness has been associated with lower level of cognitive function (Boss *et al.*, 2015) and higher likelihood of MCI (Yu *et al.*, 2016). In the present analyses, we found that loneliness, but not social isolation, was associated with higher likelihood of MCI, consistent with prior research. However, this association was no longer significant after adjusting for depression, possibly because the smaller number of MCI cases ($n = 121$ compared to 424 with dementia) limited statistical power. Further

Table 2. Relation of social and emotional isolation to likelihood of mild cognitive impairment*

MODEL TERM	MODEL A			MODEL B		
	OR	95% CI		OR	95% CI	
Social network size	0.988	0.969	1.008	0.989	0.969	1.009
Loneliness	1.135	1.011	1.275	1.105	0.978	1.248
Depression				1.666	0.986	3.096

OR, odds ratio; CI, confidence interval.

*From separate logistic regression models adjusted for age at death, sex, education, and race.

research on social and emotional isolation in MCI is needed.

The bases of the correlation between social and emotional isolation on the one hand and dementia on the other hand are uncertain. One possibility is that social and emotional isolation are not risk factors for dementia but consequences of the neurodegenerative and cerebrovascular conditions that underlie dementia. In support of this reverse causality hypothesis, there is evidence that social network size tends to decrease in old age (Wrzus *et al.*, 2013; Sander *et al.*, 2017; Casey *et al.*, 2020) and that declining network size is associated with cognitive decline (Casey *et al.*, 2020; Rohr *et al.*, 2020). However, loneliness appears to be relatively stable in adulthood and old age (Mund *et al.*, 2020) and evidence that lower cognitive function predicts subsequent increase in loneliness has been inconsistent (Wilson *et al.*, 2007; Donovan *et al.*, 2017; Yin *et al.*, 2019). In addition, neither social network size (Bennett *et al.*, 2006) nor loneliness (Wilson *et al.*, 2007) appears to be related to postmortem neuropathological markers of dementia. At present, therefore, support for the reverse causality hypothesis is mixed. Other (not mutually exclusive) possibilities are that social engagement somehow enhances cognitive reserve by modifying the deleterious impact of neuropathologies on cognition (Bennett *et al.*, 2006) or by a positive association with cognition that is independent of dementia-related neuropathologies (Wilson *et al.*, 2007). Understanding the link between social engagement and late life cognitive function may suggest novel strategies for delaying dementia onset in old age.

This study has strengths and limitations. Results are based on a large racially diverse group of participants. The diagnoses of dementia and MCI were based on uniform implementation of previously validated clinical procedures. Social and emotional isolation were assessed with standard psychometrically sound measures. Caregiver burden which was not assessed may have influenced informant report. In addition, reliance on informant report may have increased measurement error and assessing isolation and dementia/MCI at the same point in time may also have biased our estimate of the association between them. An important limitation is that analyses are based on a selected group. In the future, we will be able to examine the associations of social and emotional isolation with dementia-related neuropathologies in PARDoS. Data collection is ongoing.

Conflict of interest

None.

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Description of author(s)' roles

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