



ORIGINAL RESEARCH

Neighborhood Predictors of Mental Health of Older Americans: Evidence from a 5-year Longitudinal Study

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Abstract

Background: With increasing dependence on other people in old age, environmental resources become an important asset for older adults to experience healthy aging. Neighborhood conditions, therefore, are some of the multiple factors that contribute to the mental wellbeing of older adults. This study investigated whether and which neighborhood factors predicted depression and anxiety among American older adults followed up for over five years within the same neighborhood.

Methods: Two waves of publicly available longitudinal data from the National Social Life, Health, and Aging Project (NSHAP) were utilized. A hierarchical multiple regression model analysis was employed to explore the association between neighborhood factors and mental health. The secondary data contained a cohort of 1,731 older adults. Outcome measures were depression using the 11-item CES-Depression Scale and anxiety using the 7-item HADS Anxiety Scale. The predictors were four neighborhood factors: Social cohesion, social ties, neighborhood problems, and perceived neighborhood danger. We also adjusted for demographic and physical health characteristics.

Results: The mean age of the respondents was 71.4 ± 6.5 years and were mostly females (55.5%) and Whites (74.4%). Lower Neighborhood Social Cohesion and a higher Perceived

Neighborhood Danger significantly predicted depression. However, the model only explained 2.8% of the variance in Depression. None of the neighborhood factors predicted depression following 5 years after adjusting for demographic and physical health characteristics and baseline depression, but the model significantly improved to 32.5%. Neighborhood problem was the only significant predictor of anxiety after adjusting for other covariates and explained 27.8% of the variance in anxiety.

Conclusion: The study sheds some light on the complexity of the relationship between neighborhood and mental health in older adults. Moreover, our findings suggest that city planners and policymakers can influence healthy aging through the proper mapping of a city and the reduction in disorderliness within communities for older adults. Therefore, future policy development and interventions should target improving both physical and social environments to enhancing the mental wellbeing of older adults.

Keywords

Environmental correlates, Depression, Anxiety, Neighborhood problems, Older adults

Introduction

The aging population faces physical and mental health problems in addition to social challenges. Even though most degenerative and inflammatory conditions are expected age-related continuum of diseases associated with the normal aging process [1], mental disorders, unlike these conditions, are not part of the normal aging process [2]. Older adults when compared to their younger counterparts experience lower, but substantial rates of mental health [3]. Despite the lower rate of mental illness, their risk of suicide from a mental illness is higher than the general population [4,5]. Fiske, et al. found that up to 80% of suicides in old age are linked to late-life depression [6].

Because of the high prevalence of mental health disorders, extensive research has investigated the several complex and interrelated factors that contribute to mental health disorders. Neighborhood conditions are some of these factors that contribute to the mental wellbeing of older adults [7,8]. Older adults are particularly at risk of developing poor interaction with their environment due to a decline in mobility and increased dependence [9]. Limitations in mobility in combination with higher cognitive and physical decline were associated with increased dependence on the neighborhood and its resources [10,11]. Since older adults spend a significant amount (about 75%) of their time relating with the neighborhood [12], they are more appreciative to the benefits and vulnerable to the harm of their immediate neighborhood [13].

Undoubtedly, the growing shift in the patterns of family dynamics results in non-readily available kinship ties and support [14]. Consequently, non-familial neighborhood social ties (NST), defined as “the presence of trusting relationships with individuals in one’s community,” are becoming an increasingly necessary source of social support in old age [15]. NST is a strong positive predictor of good mental health [16,17] and protective against depression and anxiety [18,19]. Importantly, the level of social ties determines the amount of social support received [20]. Therefore, older adults residing in neighborhoods with greater ties among residents may receive greater support than those in neighborhoods with lower social ties. While cross-sectional studies strongly associate lower neighborhood social cohesion (NSC) with higher depression and anxiety severity [21,22], the results of the longitudinal relationship between NSC and mental health factors remain inconclusive [23-26].

In addition to the quality of interpersonal relationships within one’s neighborhood, neighborhood problems and perceived danger are also negatively correlated with mental health [27,28]. Neighborhood problems are the physical problems encountered within the neighborhood such as pollution, heavy traffic, noise, and overcrowding [29]. These problems in addition to

perceived danger trigger fear and anxiety that may precipitate mental health problems [30]. Older adults living in neighborhoods with greater problems and perceived danger are not able to access necessary social resources which can lead to a decline in their reported well-being [31]. However, an improvement in the perception of the neighborhood in terms of safety may result in improvement in wellbeing.

Despite the culminating evidence on the association between neighborhood factors and mental health, most studies were conducted among adults and not the older adult population. With an increasing emphasis on the significance of aging-in-place among older adults, there is a need for studies that explore the impact that neighborhood social environment have on their mental health. Moreover, there is a need for a current national study to show the longitudinal association between neighborhood correlates and mental health in the literature of the aging population. As a result, implementing a longitudinal study design to examine the impact of neighborhood environment and mental health will give better insight into their relationships and add to the body of literature on the subject matter. This quantitative study was designed to investigate whether and which neighborhood factors predicted depression and anxiety among American older adults followed up for over five years within the same neighborhood.

Methodology

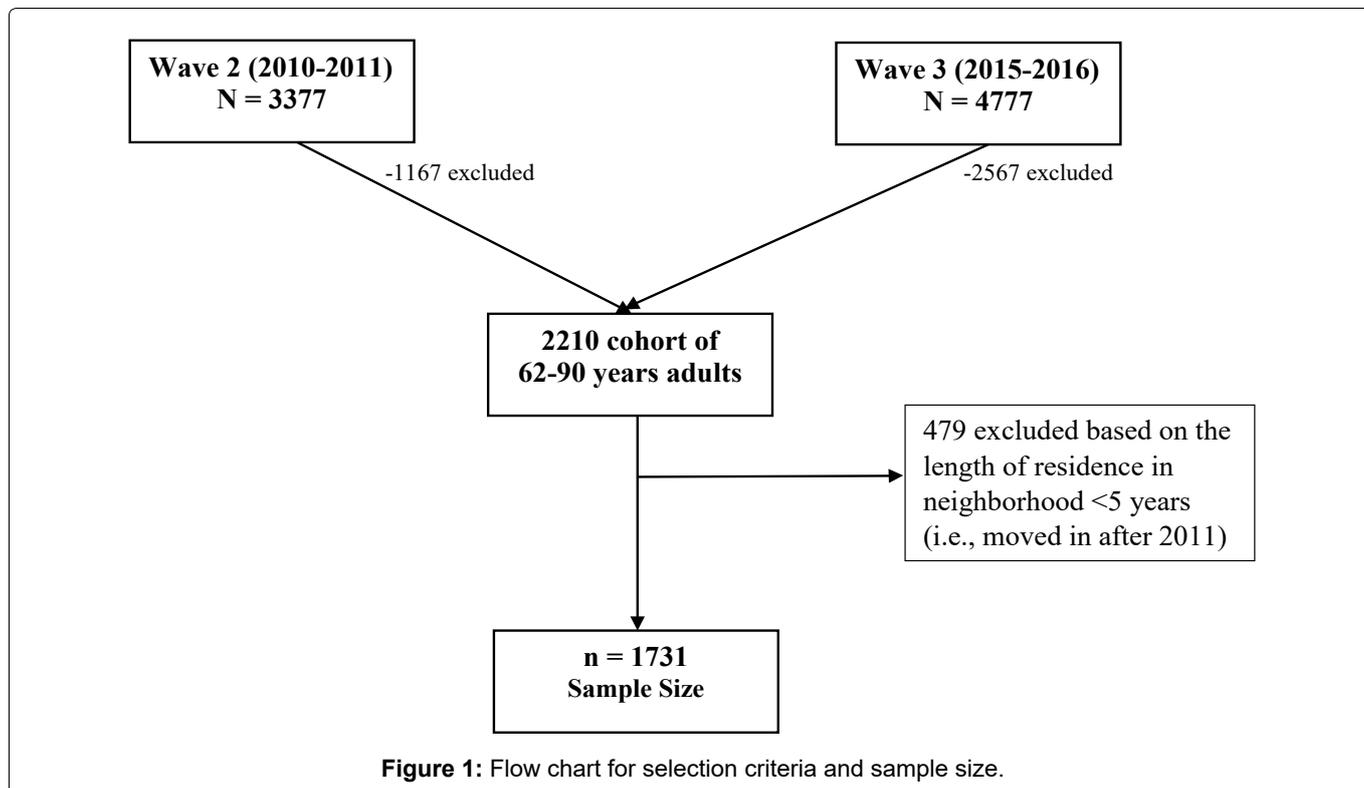
Study design

Two waves of publicly available longitudinal data from the National Social Life, Health and Aging Project (NSHAP) which was accessed online from the Interuniversity Consortium for Political and Social Research [32] were utilized. The NSHAP is a nationwide survey that covers aspects of health and social connectedness of older adults across all ethnicities and gender in the United States. The first (Wave 1) interview period was between 2005 and 2006 while subsequent Waves were conducted five years apart. Face-to-face interviews using structured questionnaires were conducted, and bio-measures were taken at the respondent’s home.

Sampling method

A national area probability sampling method was used to select community-residing adults based on the Health and Retirement Study’s (HRS) national household screening method.

The HRS used a multi-stage area probability sample method with four selection stages. The HRS includes the selection of U.S. Metropolitan Statistical Areas (MSAs) and non-MSA Counties, i.e., include both urban and rural areas. A more detailed sampling method was described elsewhere [32,33]. A total of 3005 respondents were interviewed during the Wave 1 period. During the



Wave 2 period, about 3400 interviews were completed where as a total of 4,777 respondents were interviewed for Wave 3. The Wave 1 interviews did not include the neighborhood correlates of interest to this study. Therefore, only the core datasets from both Waves 2 and 3 were used and only respondents that participated in both waves were used for this analysis. Wave 2 (Time 1 or T1) and Wave 3 (Time 2 or T2) data were merged after data cleaning into a horizontal format using the participant's assigned identification numbers. Following merging, we obtained a cohort of 2210 older adults from both Waves 2 and 3. However, we excluded all the participants who have lived within their neighborhood for less than 5 years at T2 using a variable assessing the length of residence within the neighborhood. This exclusion was done to ensure that people were already living within their neighborhood at T1, thus accounting for neighborhood factors at T1. Our final sample size was 1731 cohort of older adults as depicted in Figure 1.

Measures

Outcome variables were two mental health constructs, depression and anxiety at T2 (Wave 3). Previously validated 11-item Center for Epidemiologic Studies Depression Scale (CES-D) and the 7-item Hospital Anxiety and Depression Scale (HADS) were used for depression and anxiety, respectively. These constructs' items were discussed extensively by Payne, et al. who reported internal consistencies of 0.78 and 0.73 for the CES-D and HADS scales, respectively [34]. The reliability scores for these scales for both Waves of data are reported in Table 1.

Predictors of mental health used in this study were

four previously validated multi-item psychometric scales of neighborhood factors: Neighborhood social cohesion, social ties, and neighborhood problems, rated from 1 to 5 as described in Table 1. Other covariates were demographic factors, self-rated physical health, and comorbidity index (CCI) described in Table 1 and below. The modified CCI [36] was used to calculate the comorbidity index (CCI) to control for other mortality risk factors and medical conditions that may affect health and cognition.

Data Analysis

IBM SPSS statistical software v27.0 was used for all the data analytic procedures. Frequencies and percentages were used to describe categorical variables while means and standard deviations were used to describe continuous variables at both times. Next, chi-square and independent T-tests were used to compare differences between dichotomous and continuous variables at T1 and T2, respectively. We used a Hierarchical Multiple Regression to examine the relationship between neighborhood factors at T1 and depression as well as anxiety at T2. We had three models in total for each of the outcome variables. Model 1 contained the interaction between the neighborhood factors at T1 and outcome variables. Since depression and anxiety at T1 may act as a confounding factor, we controlled for depression and anxiety at T1 in model 2, for the depression and anxiety outcome variables, respectively. We finally introduced the demographic factors, physical health, and CCI as covariates in the third model.

Additionally, assumptions of normality of residuals

Table 1: Summary of variables.

Constructs	Definition
Depression	11-item CES-D scale (α at T1 = 0.78, α at T2 = 0.78).
Anxiety	7-item short-form HADS scale (α at T1 = 0.73, α at T2 = 0.69).
Predictors	
Neighborhood Social Cohesion	Previously validated 5-item psychometric scale (α at T1= 0.69, α at T2 = 0.70). Responses were rated 1-5 from strongly disagree to strongly agree. Items “were close-knit area”, “people willing to help”, “people don’t share the same values”, “people can be trusted”, and “people don’t get along with each other”, respectively. The third and fifth items were reverse coded to ensure same directionality.
Neighborhood Problems	Previously validated 5-item psychometric scale (α at T1= 0.79, α at T2 = 0.78) based on cleanliness, noise, traffic, overcrowding, and smell/pollution. Responses were rated 1-5 with increasing disorderliness. Item four, overcrowding, was deleted to improve the reliability of both scales. Higher scores represent greater problems in the neighborhood.
Neighborhood Social Ties	Previously validated 3-item psychometric scale (α at T1= 0.75, α at T2 = 0.76). Likert-like scale based on the frequency of visits from neighbors, frequency of people doing favors, and frequency of people asking for advice. Responses were rate 0-3 from ‘never’ to ‘often’. Higher scores represented better social ties.
Perceived Neighborhood Danger	Previously validated 3-item psychometric scale (α at T1= 0.83, α at T2 = 0.81) based on fear of going out at night, expectations of trouble in the area, and big chance at going out after dark. Responses were rated 1-5 from ‘strongly disagree’ to ‘strongly agree’. Higher scores represented higher perceived danger in the neighborhood.
Self-rated physical Health	Rated on a Likert scale of 1 to 5 from Poor to Excellent. Respondents were asked: Would you say your health is excellent, very good, good, fair, or poor?

Note: CES-D: Center for Epidemiological Studies Depression; HADS: Hospital Anxiety and Depression Scale; T1: Time 1 for Wave 2; T2: Time 2 for Wave 3.

and assumptions of no multicollinearity were checked before progressing with the multiple regressions. The assumption of normally distributed residuals was tested with QQ-plots and descriptive statistics while the assumption of multicollinearity was tested by calculating the variance inflation factor [37]. The quality of the multiple regressions was interpreted using the overall model effect size, R^2 the statistical significance of the overall model, and the statistical significance of the individual regression coefficients. R^2 is the variance explained effect sizes. We observed the changes in regression statistics in the relationship between neighborhood factors and depression as well as anxiety in the second and third models. All tests were two-sided and p-values less than 0.05 were considered to be statistically significant.

Results

Characteristics of the participants

This nationally representative sample consists of older adults with a mean of 71.6 ± 6.6 years, who are mostly females (55.5%) and also in a marital relationship (71.9%). About 59% of them had at least some college education. The majority of the respondents were White non-Hispanic older adults. About a quarter of them earn above \$50,000 but less than \$100,000 annually at T1 and there was a statistically significant increase in income at T2. When asked about their physical health at T1, only 19.2% reported fair or poor health status and there was a significant report of poorer health at T2. The mean comorbidity index decreased significantly from 1.76

Table 2: Selected descriptive statistics for residuals and VIF of outcome variables.

	CES-D (T1)	CES-D (T2)	HADS (T1)	HADS (T2)
Skew	1.43	1.24	0.83	0.77
VIF	1.40	1.060	1.41	1.08

Note: VIF: Variance inflation factor; CES-D: Center for Epidemiological Studies Depression; HADS: Hospital Anxiety and Depression Scale; T1: Time 1 for Wave 2; T2: Time 2 for Wave 3.

to 1.60 within the five years. Contrastingly depression increased significantly whereas anxiety scores remained the same after five years of living in the neighborhood. There was no statistically significant difference in the participants’ reports of social cohesion and perceived danger within their neighborhood. However, problems within the neighborhood, as well as social ties, decreased significantly within the five-year period.

Hierarchical Multiple Regression

Assumption testing

A normally distributed sample has a skewness of zero and deviation from normality occurs when skewness is > 1.98 (West, Finch, & Curran, 1996). Table 2 showed that the skewness of our outcome variable is within the normal range. Similarly, the VIF indicate no severe multicollinearity for any of the outcome variables.

Depression

All three models were statistically significant. The first model examining the relationships between

Table 3: Hierarchical multiple regression for the neighborhood predictors of depression.

Predictors	Model 1			Model 2			Model 3		
	B	SE B	β	B	SE B	β	B	SE B	β
NSC	-0.018	-0.009	-0.06*	-0.002	0.008	-0.006	-0.005	0.007	-0.016
PND	0.027	0.005	0.139**	0.011	0.004	0.055*	0.002	0.005	0.010
NP	-0.006	0.007	-0.021	-0.008	0.006	-0.031	-0.007	0.006	-0.028
NST	-0.006	0.007	-0.025	0.000	0.006	-0.001	0.000	0.005	0.001
CESD1				0.216	0.009	0.521**	0.190	0.009	0.459**
Age (years)							0.002	0.001	0.065**
Gender							0.032	0.007	0.094**
Education							0.002	0.004	0.013
Ethnicity							-0.011	0.005	-0.049**
Marital							-0.005	0.002	-0.049*
Income							-0.009	0.005	-0.050
PH							-0.022	0.004	-0.129**
CCI							0.008	0.002	0.073**

Note: NSC: Neighborhood Social Cohesion; PND: Perceived Neighborhood Danger; NP: Neighborhood Problems; NST: Neighborhood Social Ties; CESD1: CESD at T1; PH: Physical Health; CCI: Comorbidity Index; * $p < 0.05$; ** $p < 0.01$; B: Unstandardized regression coefficient; SE: Standard Error; β : Standardized regression coefficient; Model 1: $F(4, 1719) = 12.59$, $p < 0.05$, $R^2 = 0.028$; Model 2: $F(5, 1718) = 136.49$, $p < 0.05$, $R^2 = 0.284$; Model 3: $F(13, 1710) = 63.27$, $p < 0.05$, $R^2 = 0.325$.

the neighborhood factors and depression had a low variance explained, $R^2 = 2.8\%$. The variance explained by the predictors increased significantly by 25.6% after controlling for depression at T1 (Model 2). In model 3, adjusting for socio-demographic factors made the model better as R^2 increased further by 4% (overall model = 32.5% of variance explained). In the first model in Table 3, PND was the strongest predictor of depression with β coefficient of 13.9%. That is, higher perceived danger within the neighborhood predicts a higher rate of depression. Conversely, NSC was significantly related to depression in the negative direction while the two remaining neighborhood factors did not predict depression after five years in this model. After controlling for depression at T2 in the second model, PND was the only significant predictor of depression, $\beta = 0.055$, $p < 0.05$. In this model, depression at T1 was the strongest predictor of depression at T2, $\beta = 0.216$, $p < 0.001$. In the third step, with the entry of demographic factors, CCI, and physical health in the equation, none of the neighborhood factors emerged as a significant predictor of depression. In this model, age, gender, ethnicity, marital status, physical health, and CCI significantly predicted depression, but depression at T1 remained the strongest predictor. A better self-report of physical health is associated with a lower risk of depression, $\beta = -0.129$, $p < 0.05$. In contrast, a unit increase in CCI score potentially increases the risk of depressive symptomology by 7.3%.

Anxiety

In the hierarchical regression analysis for the neighborhood predictors of anxiety, all of the three models were statistically significant (Table 4). The first

model explained only 3.7% of the variability in the outcome, anxiety at T2. Two neighborhood factors, NSC and neighborhood problems were significant negative predictors of anxiety. PND, on the other hand, was the strongest and positive predictor of anxiety, $\beta = 0.154$, $p < 0.01$. This indicates that a higher perception of danger within the neighborhood increases the risk of depression. With the addition of anxiety at T1, model 2, only PND and neighborhood problems emerged as significant neighborhood predictors of anxiety. Both predictors had equal β weights (0.048) but in opposite direction, such that a higher PND and lower NP predicts higher levels of anxiety among older adults. Additionally, anxiety at T1 strongly predicted anxiety at T2, indicating that the presence of anxiety at any point in time is the strongest risk factor for future anxiety symptomology. In this second model, we observed a significant rise in the variance explained by 23% ($R^2 = 0.267$). Finally, adjusting for demographic factors, CCI, and physical health resulted in a significant and better model fit, $F(13, 1710) = 50.76$, $p < 0.05$, $R^2 = 0.278$. However, NP was the only significant neighborhood predictor of anxiety, in the negative direction, $\beta = -0.050$, $p < 0.05$. As expected, anxiety symptoms at T1 also strongly predict anxiety at T2. Among the covariates adjusted for, only gender, ethnicity, and physical health were statistically significantly related to anxiety.

Discussion

This study sought to investigate whether and which neighborhood factors predicted the mental health of older adults in America residence for five years within their community. Understanding the different neighborhood factors the mental health of older adults is crucial for healthy aging. Several measures of

Table 4: Hierarchical multiple regression for the neighborhood predictors of anxiety.

Predictors	Model 1			Model 2			Model 3		
	B	SE B	β	B	SE B	β	B	SE B	β
NSC	-0.025	0.009	-0.075**	-0.011	0.008	-0.035	-0.012	0.008	-0.038
PND	0.032	0.005	0.154**	0.010	0.005	0.048*	0.005	0.005	0.026
NP	-0.026	0.007	-0.094**	-0.013	0.006	-0.048*	-0.014	0.006	-0.050*
NST	-0.006	0.007	-0.022	-0.007	0.006	-0.029	-0.006	0.006	-0.025
HADS1				0.183	0.008	0.494**	0.177	0.008	0.478**
Age (years)							0.000	0.001	0.005
Gender							0.016	0.008	0.045*
Education							-0.007	0.004	-0.041
Ethnicity							-0.013	0.005	-0.055*
Marital							-0.001	0.002	-0.007
Income							-0.002	0.005	-0.013
PH							-0.014	0.004	-0.079**
CCI							-0.004	0.003	-0.031

Note: NSC: Neighborhood Social Cohesion; PND: Perceived Neighborhood Danger; NP: Neighborhood Problems; NST: Neighborhood Social Ties; HADS1: HADS at T1; PH: Physical Health; CCI: Comorbidity Index; * $p < 0.05$; ** $p < 0.01$; B: Unstandardized regression coefficient; SE: Standard Error; β : Standardized regression coefficient; Model 1: $F(4, 1719) = 16.55$, $p < 0.05$, $R^2 = 0.037$; Model 2: $F(5, 1718) = 125.11$, $p < 0.05$, $R^2 = 0.267$; Model 3: $F(13, 1710) = 50.76$, $p < 0.05$, $R^2 = 0.278$.

assessing the neighborhood context and the mental health status of older adults were included in the NSHAP study. According to previous research with the same NSHAP study data [35], four neighborhood correlates were conceptualized with high internal consistencies. The four correlates were NSC, social ties, neighborhood problems, and PND. Cross-sectional studies have highlighted how these neighborhood factors impact anxiety and depression, but only a few longitudinal studies have examined this relationship.

Based on previous studies, we expected that older adults with better social cohesion or social ties will be less anxious and depressed [38]. Conversely, those with more problems or perceived danger within their neighborhood will have poorer mental health outcomes [27]. Our results, however, suggest that PND and social cohesion were the only predictors of depression in the direction also indicated by previous studies [27,38]. Due to the longitudinal nature of this study, adjusting for baseline depression resulted in PND being the only significant predictor of depression, while social cohesion no longer predicted depression. Previous cross-sectional research also reported a significant relationship between social cohesion and depression [21]. Whereas longitudinal studies have mixed reports. For example, Fujiwara and Kawachi in their three-year longitudinal study reported a higher level of depression with lower levels of social cohesion after adjusting for baseline depression [24]. On the other hand, Mair, et al. found no association between social cohesion and depression in their 4-5 years follow-up study [26].

According to Lorenc, et al. and Doran and Burgess, the perception of danger within one's immediate community fosters fear and mistrust that produces

increased levels of psychological distress such as depression and anxiety [37,39]. It is noteworthy that despite the statistically significant relationship between depression and PND, as well as NSC, before adjusting for baseline depression, the predictors explained only 2.8% of the variance in depression. That is, other factors beyond the neighborhood social environment may have a stronger influence on depression. In our study, some of these factors included age, gender, ethnicity, marital status, comorbidities, and physical health status.

The addition of baseline depression and other sociodemographic and physical health characteristics and the subsequent increase in the R^2 to 32.6% supported this observation. In fact, none of the neighborhood factors were significant predictors of depression after adjusting for these covariates. In contrast to cross-sectional study findings, some longitudinal study designs also did not report a significant relationship between neighborhood factors and depression after three to five years of follow-up [26,40,41]. The findings in these longitudinal studies were similar to those observed in this study. However, a longitudinal study examined this relationship and reported that social cohesion reduced the negative change in mental health caused by living in a deprived neighborhood after seven years [25]. Interestingly, another ten-year follow-up study also observed a significant increase in common mental disorders such as depression in adults living in more deprived neighborhoods [22]. Clearly, the studies with longer follow-up periods reported a significant relationship between neighborhood factors and mental health, whereas those with follow-up within five years or less reported no significant relationship. We can, therefore, assume that a significant change in mental

health may only occur after prolonged interaction with one's neighborhood.

In our study, baseline depression was the strongest determinant of depression following five-year, followed by self-rated physical health. Previous research findings support an age-associated rise in negative affect or increased depression in older adults [42], which may explain why baseline depressive symptoms strongly influence depression in later years. Furthermore, the effect of physical health on the relationship between neighborhood factors and depression cannot be overemphasized because older adults rely on the relationships in their neighborhood which may be adversely affected by poor physical health which may subsequently result in higher mental disorders. Previous research also indicates that physical health has a strong impact on mental health and vice versa and this effect are especially more prominent with advanced age [43]. Besides, an older adult's physical health determines their ability to interact with their neighborhood. Therefore, older adults who rely on their neighborhood for various resources may report higher mental disorders particularly when they have poor physical functioning.

Consistent with other studies, lower NSC and a higher PND were associated with higher anxiety symptoms

among older adults [21,22]. Surprisingly, however, higher neighborhood problems predicted lower anxiety levels in our study. We expected that physical problems encountered within the neighborhood such as pollution, heavy traffic, noise, or overcrowding to cause a higher level of anxiety within the neighborhood [29,30]. The contrasting relationship observed in our study could be due to the significant decrease in the neighborhood problem scores from baseline to T2 (Table 5). Since the older adults reported the neighborhood that they live in to have fewer problems after five years, it is understandable why their levels of anxiety may decrease as well. After controlling for baseline anxiety levels, only PND and NP were significantly associated with anxiety. In this case, a higher PND and lower NP predicts higher anxiety symptomology.

In our third model, we controlled for demographic and physical characteristics and baseline anxiety levels (Table 3). In this model, only NP emerged as the only significant predictor of anxiety, however, still in the negative direction. This finding still contradicts evidence from previous research that established how built environment or the amount of physical disorder in a neighborhood negatively impacts people's ability to focus or sleep thereby causing substantial anxiety. Despite the negative impact of neighborhood problems on the development

Table 5: Characteristics of the participants.

Characteristics	Time 1	Time 2	t or C	P
Age (years): Mean (\pm SD)	71.4 (\pm 6.5)	76.4 (\pm 6.5)	-496.4	0.000
Gender				
Male (%)	770 (44.5)	770 (44.5)		
Female (%)	961 (55.5)	961 (55.5)		
Others				
Marital Status				
Married	1245 (71.9)	1245 (71.9)		
Living with a partner	34 (2.0)	34 (2.0)		
Separated	16 (0.9)	16 (0.9)		
Divorced	126 (7.3)	126 (7.3)		
Widowed	278 (16.1)	278 (16.1)		
Never married	32 (1.8)	32 (1.8)		
Education				
< High school	284 (16.4)	284 (16.4)		
High school/equivalence	430 (24.8)	430 (24.8)		
Some college	544 (31.4)	544 (31.4)		
Bachelors or greater	473 (27.3)	473 (27.3)		
Ethnicity				
White	1287 (74.4)	1287 (74.4)		
Black	222 (12.8)	222 (12.8)		
Hispanic	182 (10.5)	182 (10.5)		
Other	33 (1.9)	33 (1.9)		

Household Income (USD)				
0-24,999	288 (16.6)	299 (17.3)	1175.2	0.000
25,000-49,999	371 (21.4)	366 (21.1)		
50,000-99,999	433 (25.0)	450 (26.0)		
100,000 or higher	192 (11.1)	201 (11.6)		
Comorbidity Index	1.76 (\pm 1.55)	1.60 (\pm 1.60)	5.49	0.000
Physical Health				
Poor	46 (2.7)	85 (4.9)	1046.77	0.000
Fair	285 (16.5)	306 (17.7)		
Good	561 (32.4)	590 (34.1)		
Very good	599 (34.6)	569 (32.9)		
Excellent	239 (13.8)	177 (10.2)		
CES-D scale	1.40 (\pm 0.41)	1.47 (\pm 0.43)	-6.95	0.000
HADS scale	1.66 (\pm 0.48)	1.65 (\pm 0.47)	0.97	0.333
Neighborhood: Mean (\pm SD)				
NSC	3.50 (\pm 0.55)	3.51 (\pm 0.56)	-0.71	0.477
PND	2.37 (\pm 0.87)	2.36 (\pm 0.88)	0.88	0.379
NP	1.56 (\pm 0.64)	1.51 (\pm 0.59)	2.71	0.007
NST	1.55 (\pm 0.69)	1.40 (\pm 0.70)	9.55	0.000

Note: * $p < 0.05$, ** $p < 0.01$, SD: Standard Deviation; USD: U.S. Dollars; CES-D: Center for Epidemiological Studies Depression; HADS: Hospital Anxiety and Depression Scale; NSC: Neighborhood Social Cohesion; PND: Perceived Neighborhood Danger; NP: Neighborhood Problems; NST: Neighborhood Social Ties.

of stress and anxiety, Pudrovska, et al. highlighted how mastery of the said problems within the neighborhood may moderate these relationships [44]. The extent to which the respondents perceived the events or problems within their neighborhood that is their control, also called mastery, could also explain why their rating of neighborhood problems was lower after five years.

Similar to depression, baseline anxiety level was the strongest predictor of anxiety levels after five years after controlling for other factors as seen in Table 4. This is despite the non-significant change in anxiety levels within five years (Table 5). Sami and Nilforooshan also reported baseline anxiety to be a considerable prognostic factor for future anxiety in a six-year follow-up study [45]. Additionally, we found that physical health influenced anxiety levels, such that a unit increase in physical health rating in the positive direction lowers the risk of anxiety symptoms by 7.9%. Older adults without functional limitations can explore the resources within their immediate community leading to lower rates of psychosocial problems.

Limitations

This study has some limitations. First, secondary data was used which constrained the variables of interest. For instance, we were unable to account for the social and regional characteristics of the respondents which may contribute to the covariates explaining most of the variance in anxiety and depression in our study. Second, longitudinal studies require more than two data points

for best practices to assert causality. However, this study utilized only two waves of data with two-time points. Therefore, despite the associations claimed in this study, causal inference cannot be established. Third, considering the significant association between baseline depression/anxiety and anxiety and depression at T2, we were unable to ascertain if the participants have received a clinical diagnosis of these mental disorders or on medical treatment for them.

Conclusion

From this study, we conclude that after adjusting for other covariates, neighborhood factors do not predict the development of depression among older adults in America who have lived in their present communities for at least five years. However, neighborhood problems significantly influence anxiety among this population even after adjusting for other covariates. We also established the significant impact of physical health on mental health among community-dwelling older adults. Our findings suggest that city planners and policymakers can influence healthy aging through the proper mapping of a city and the reduction in disorderliness within communities for older adults. Therefore, future policy development and interventions should target improving both physical and social environments to enhancing the mental wellbeing of older adults.

Conflict of Interest

The authors declare that they have no competing interests.

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Equal Author's Contribution Statement

All the authors contributed equally in the preparation of this study.

References

- Franceschi C, Garagnani P, Parini P, Giuliani C, Santoro A (2018) Inflammaging: A new immune-metabolic viewpoint for age-related diseases *Nat Rev Endocrinol* 14: 576-590.
- Centers for Disease Control and Prevention and National Association of Chronic Disease Directors (2008) The State of Mental Health and Aging in America Issue Brief 1: What Do the Data Tell Us? Atlanta, GA: National Association of Chronic Disease Directors.
- Kessler RC, Angermeyer M, Anthony JC, Graaf RD, Demyttenaere K, et al. (2007) Lifetime prevalence and age-of-onset distributions of mental disorders in the World Health Organization's World Mental Health Survey Initiative *World Psychiatry* 6: 168-176.
- Conejero I, Olié E, Courtet P, Calati R (2018) Suicide in older adults: Current perspectives. *Clin Interv Aging* 13: 691-699.
- Shah A, Bhat R, Zarate-Escudero S, DeLeo D, Erlangsen A (2016) Suicide rates in five-year age-bands after the age of 60 years: The international landscape. *Aging Ment Health* 20: 131-138.
- Fiske A, Wetherell JL, Gatz M (2009) Depression in older adults. *Annu Rev Clin Psychol* 5: 363-389.
- Joshi S, Mooney SJ, Rundle AG, Quinn JW, Beard JR, et al. (2017) Pathways from neighborhood poverty to depression among older adults. *Health Place* 43: 138-143.
- Wang R, Lu Y, Zhang J, Liu P, Yao Y, et al. (2019) The relationship between visual enclosure for neighborhood street walkability and elders' mental health in China: using street view images *Journal of Transport & Health* 13: 90-102.
- Shaw BA, Krause N, Liang J, Bennett J (2007) Tracking changes in social relations throughout late life. *J Gerontol B Psychol Sci Soc Sci* 62: S90-S99.
- Yen IH, Scherzer T, Cubbin C, Gonzalez A, Winkleby MA (2007) Women's perceptions of neighborhood resources and hazards related to diet, physical activity, and smoking: Focus group results from economically distinct neighborhoods in a mid-sized US city *American journal of health promotion*. *AJHP* 22: 98-106.
- Yen IH, Michael YL, Perdue L (2009) Neighborhood environment in studies of health of older adults: A systematic review. *American J Prev Med* 7: 455-463.
- Wahl HW, Fänge A, Oswald F, Gitlin LN, Iwarsson S (2009) The home environment and disability-related outcomes in aging individuals: what is the empirical evidence? *The Gerontologist* 49: 355-367.
- Aneshensel CS, Wight RG, Miller-Martinez D, Botticello AL, Karlamangla AS, et al. (2007) Urban neighborhoods and depressive symptoms among older adults. *J Gerontol B Psychol Sci Soc Sci* 62: S52-S59.
- Ivanova K, Dystra P (2015) Aging without children. *Public Policy of Aging Report* 25: 98-101.
- Schnettler S, Wohler T (2015) No children in later life but more and better friends? Substitution mechanisms in the personal and support networks of parents and the childless in Germany. *Ageing and Society* 36: 1339-1363.
- Cramm JM, van Dijk HM, Nieboer AP (2013) The importance of neighborhood social cohesion and social capital for the well being of older adults in the community. *The Gerontologist* 53: 142-152.
- Perez LG, Arredondo EM, McKenzie TL, Holguin M, Elder JP, et al. (2015) Neighborhood Social Cohesion and Depressive Symptoms Among Latinos: Does Use of Community Resources for Physical Activity Matter? *Journal of Physical Activity & Health* 12: 1361-1368.
- Mcguire P, Robson P, Cubala WJ, Vasile D, Morrison PD, et al. (2018) Cannabidiol (CBD) as an adjunctive therapy in schizophrenia: A multicenter randomized controlled trial. *The American Journal of Psychiatry* 175: 225-231.
- Brooks SK, Dunn R, Amlôt R, Greenberg N, Rubin GJ (2016) Social and occupational factors associated with psychological distress and disorder among disaster responders: A systematic review. *BMC Psychol* 4: 18.
- Kim YC, Kang J (2010) Communication neighbourhood belonging and household hurricane preparedness. *Disasters* 34: 470-488.
- Generaal E, Timmermans EJ, Dekkers J, Smit JH, Penninx B (2019) Not urbanization level but socioeconomic physical and social neighbourhood characteristics are associated with presence and severity of depressive and anxiety disorders. *Psychol Med* 49: 149-161.
- Stafford M, De Silva M, Stansfeld S, Marmot M (2008) Neighbourhood social capital and common mental disorder: testing the link in a general population sample. *Health Place* 14: 394-405.
- Murayama H, Fujiwara Y, Kawachi I (2012) Social capital and health: A review of prospective multilevel studies. *J Epidemiol* 22: 179-187.
- Fujiwara T, Kawachi I (2008) A prospective study of individual-level social capital and major depression in the United States. *J Epidemiol Community Health* 62: 627-633.
- Fone D, White J, Farewell D, Kelly M, John G, et al. (2014) Effect of neighbourhood deprivation and social cohesion on mental health inequality: A multilevel population-based longitudinal study. *Psychol Med* 44: 2449-2460.
- Mair C, Diez Roux AV, Galea S (2008) Are neighbourhood characteristics associated with depressive symptoms? A review of evidence *J Epidemiol Community Health* 62: 940-946.
- Welsch H (2006) Environment and happiness: Valuation of air pollution using life satisfaction data. *Ecological economics* 58: 801-813.
- Winters JV, Li Y (2017) Urbanisation natural amenities and subjective well-being: Evidence from US counties. *Urban Studies* 54: 1956-1973.
- Stafford M, Chandola T, Marmot M (2007) Association between fear of crime and mental health and physical functioning. *Am J Public Health* 97: 2076-2081.
- Beard JR, Blaney S, Cerda M, Frye V, Lovasi GS, et al. (2009) Neighborhood characteristics and disability in older adults. *J Gerontol B Psychol Sci Soc Sci* 64: 252-257.
- Jones R, Heim D, Hunter S, Ellaway A (2014) The relative influence of neighbourhood incivilities cognitive social capital club membership and individual characteristics on positive mental health. *Health Place* 28: 187-193.

32. Waite Linda J (2019) National Social Life Health and Aging Project (NSHAP): Round 2 and Partner Data Collection [United States] 2010-2011 Inter-university Consortium for Political and Social Research.
33. Heeringa SG, Conner J (1995) Technical Description of Health and Retirement Study Sample Design. (HRS/AHEAD Documentation Report DR-002). University of Michigan, Institute for Social Research, Ann Arbor, Michigan.
34. Payne C, Hedberg EC, Kozloski M, Dale W, McClintock MK (2014) Using and interpreting mental health measures in the National Social Life Health and Aging Project. *J Gerontol B Psychol Sci Soc Sci* 69: S99-S116.
35. York Cornwell E, Cagney KA (2014) Assessment of neighborhood context in a nationally representative study. *J Gerontol B Psychol Sci Soc Sci* 69: S51-S63.
36. Vasilopoulos T, Kotwal A, Huisingh-Scheetz MJ, Waite LJ, McClintock MK, et al. (2014) Comorbidity and chronic conditions in the National Social Life Health and Aging Project (NSHAP) Wave 2. *J Gerontol B Psychol Sci Soc Sci* 69: S154-S165.
37. Kraha A, Turner H, Nimon K, Zientek LR, Hensen RK (2012) Tools to support interpreting multiple regression in the face of multicollinearity. *Front Psychol* 4: 44.
38. Calvo R, Zheng Y, Kumar S, Olgiati A, Berkman L (2012) Well-being and social capital on planet earth: Cross-national evidence from 142 countries. *PLoS One* 7: e42793.
39. Doran BJ, Burgess MB (2011) Putting fear of crime on the map: Investigating perceptions of crime using geographic information systems Berlin Germany: Springer Science & Business Media.
40. Weich S, Twigg L, Lewis G, Jones K (2005) Geographical variation in rates of common mental disorders in Britain: Prospective cohort study. *Br J Psychiatry* 187: 29-34.
41. Propper C, Jones K, Bolster A, Burgess S, Johnston R, et al. (2005) Local neighbourhood and mental health: Evidence from the UK. *Soc Sci Med* 61: 2065-2083.
42. Barefoot JC, Mortensen EL, Helms MJ, Avlund K, Schroll M (2001) A longitudinal study of gender differences in depressive symptoms from age 50 to 80. *Psychol Aging* 16: 342-345.
43. Ohrmberger J, Fichera E, Sutton M (2017) The relationship between physical and mental health: A mediation analysis. *Social Science & Medicine* 195: 42-49.
44. Pudrovskaya T, Schieman S, Pearlin LI, Nguyen K (2005) The sense of mastery as a mediator and moderator in the association between economic hardship and health in late life. *J Aging Health* 17: 634-660.
45. Sami MB, Nilforooshan R (2015) The natural course of anxiety disorders in the elderly: A systematic review of longitudinal trials. *Int Psychogeriatr* 27: 1061-1069.