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[TABLE OF CONTENTS](#)

Neighbourhood Amenities and Depressive Symptoms in Urban-Dwelling Older Adults

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SUMMARY OF PRACTICAL IMPLICATIONS

The current findings support public policy to promote neighbourhoods with dynamic and diverse amenities to maintain the mental health and reduce the prevalence of depression in older adults. This is particularly important for older adults with optimal mobility. Further, interventions should be devised that increase mobility and life space among older adults.

Abstract

Objective: Adults living in poorer neighbourhoods are at increased risk of developing depression, possibly as a result of

disproportionate exposure to stressors and limited access to beneficial resources in the immediate neighbourhood. The aims of this paper were to assess the association between amenity diversity in urban neighbourhoods and depression in older adults, and to evaluate how this effect was modified by older adult mobility.

Methods: This cross-sectional study used data from a random digit dial sample of community-dwelling older adults in Philadelphia, PA (age range: 65-98, n=658). Amenity diversity was assessed using the Leadership in Energy and Environmental Design Neighbourhood Development (LEED-ND) index for participants' neighbourhoods (census tracts = 276). Mobility was assessed using the Life-Space Assessment (LSA), which quantified the distance and frequency individuals moved past their bedroom and home within the past month. Depressive symptoms were measured using the 10-item Centre for Epidemiological Studies Depression Scale (CES-D); those with 4 or more symptoms were categorised as having symptoms of depression.

Results: We found a population prevalence of depression of 14%. Mobility significantly modified association between amenity, diversity and depression. After adjustment for factors such as: age, sex, education, marital status, race/ethnicity, smoking, and income among high mobility older adults living in low amenity and moderate amenity neighbourhoods were more likely to have symptoms of depression compared to people living in high neighbourhood amenity neighbourhoods (Odds ratio, 95% confidence interval: 5.75, 1.14 – 28.91, 3.93, 0.80-19.19, respectively). Neighbourhood amenity diversity was not associated with depression among low mobility older adults.

Conclusion: The findings support public policy to promote neighbourhoods with diverse amenities as a means to support mental health in older adults.

Introduction

Depression is the most common form of mental illness and its prevalence is projected to increase (CDC, 2013a). Older adults are at an increased risk for developing depression, as they are more prone to chronic health complications and mobility restrictions, which act as stressors and have the potential to destabilise their mental health (CDC, 2013b). Despite the importance of understanding risk factors for depression in older adults, they are generally left out of studies on mental health (Aneshensel et al., 2007; Cairney & Krause, 2004; Fiske, Wetherell, & Gatz, 2009; Galea et al., 2007).

Neighbourhood factors may be important independent contributors to the etiology of depression (Kim, 2008; Mair et al., 2008). Research consistently demonstrates an inverse relationship between mental health and individual, as well as neighbourhood-level socioeconomic status (Back & Lee, 2011; Galea et al., 2007; Kim, 2008). The 'differential vulnerability' theory suggests that adults living

in poorer neighbourhoods are at increased risk of developing depression, possibly as a result of disproportionate exposure to stressors and limited access to beneficial resources in the immediate neighbourhood (Galea et al., 2007). Neighbourhood poverty is inversely associated with quantity and quality of neighbourhood amenities, as fewer businesses are willing to invest in low-income environments (Williams, 1999). Neighbourhoods with high poverty rates are more likely to have significant structural decay, poorly built environments, and a lack of important amenities (Kim, 2008; Ming Wen, Browning, & Cagney, 2007). Neighbourhood amenity diversity reflects a range of resources available to those living in a neighbourhood.

The greater the diversity of amenities in a neighbourhood, the more exposure individuals have to resources that support a stable lifestyle.

The presence of amenities in an older adults' immediate neighbourhood is associated with mobility (Rosso et al., 2013a; Yeom, Fleury, & Keller, 2008). Amenities associated with greater mobility among older adults include food retail, such as chain grocery stores and farmers markets; services, consisting of banks, restaurants and gyms; community-serving retail, like pharmacies and convenient stores; and civic and community facilities, such as community or senior centres, medical clinics, public parks, and police stations (Rosso et al., 2013a). Studies of neighbourhood amenities typically focus on the quantity of the built environment within a neighbourhood (Clarke & Nieuwenhuijsen, 2009; Kim, 2008). However, a greater quantity of amenities does not ensure a high diversity of amenities. In fact, the repeated occurrence of similar resources in proximity may not have significant benefits to the neighbourhood. In some cases, this repetition was a detrimental factor leading to poor health outcomes (Brown et al., 2008).

Optimal mobility, defined as the “relative ease and freedom of movement in all of its forms”, is central to healthy ageing (Satariano et al., 2012). When mobility is severely restricted, older adults may experience limited exposure to neighbourhood amenities, thus creating a barrier to sustaining their mental health. The association between mobility and neighbourhood amenities may be reciprocal. Consistent with a relational approach to place and health, older adults' mobility may also be influenced by their perceptions of their neighbourhood environment (Amarantos, Martinez, & Dwyer, 2001; Beard et al., 2009; Berke et al., 2007; Rosso et al., 2013a; Vallee et al., 2011). Undesirable neighbourhood characteristics could include a lack of amenities, social disorder or infrastructural decay (Beard et al., 2009; Kim, 2008). Older adults living in high stress neighbourhoods may limit their mobility to avoid their perceived problems with the neighbourhood environment (Shumway-Cook et al., 2003), thus further reducing access to critical amenities that support stable mental health.

The goal of the current research was to evaluate the association between neighbourhood amenities and mental health in adults over the age of 65 living in Philadelphia, Pennsylvania. We hypothesised that those living in areas with low diversity of amenities were at an

increased risk of depression compared to adults living in neighbourhoods with greater amenity diversity. Further, we examined how this association was modified by older adults' mobility.

Methods

The Life Space Mobility in Older Adults survey is a sub-study of the Household Health Survey, a biennial, population-based survey of South-eastern Pennsylvania conducted by the Public Health Management Corporation. The sub-study was conducted in 2010 among participants aged 65 and older in the city of Philadelphia (n=675) with a participation proportion of 74.1% (Rosso et al., 2013a). The study sample for the current analysis excluded participants missing data smoking status (n=3), race/ethnicity (n=11) and highest level of education (n=3) for a final study sample of 658.

Measures

To calculate neighbourhood amenity diversity, neighbourhoods were defined by census tract as defined by the 2010 US Census and American Community Survey (census tracts = 276). The definition for amenity diversity was adapted from Leadership in Energy and Environmental Design-Neighbourhood Development criteria (LEED-ND) (US Green Building Council, 2009). Four categories of amenity were defined based on LEED-ND and included: 1) food retail—supermarket, farmers market, other food store with produce; 2) community-serving retail—clothing store, hardware store, pharmacy, etc.; 3) services—bank, gym or health club, laundry or dry cleaner, etc.; and 4) civic and community facilities—senior or child care, community centre, educational facility, places of worship, etc. Amenities were geocoded using data from the 2010 Esri Business Analyst database (Esri, Inc., Redlands, California) and classified based on the 9-digit North American Industry Classification System codes. Using the LEED-ND algorithm, up to 2 occurrences of any single amenity was counted and then summed across each of the 27 amenity types resulting in a scale that ranged from 0 to 54. Neighbourhood amenity diversity was categorised into three categories, each containing a third of the population, representing low diversity (amenity score less than or equal to 17), moderate diversity (amenity score between 18 and 24), and high diversity (amenity score greater than or equal to 25).

Mobility was assessed using a modified version of the Life-Space Assessment (LSA). The LSA was designed to measure achieved function and incorporates aspects of mobility beyond the ability to walk (Peel et al., 2005). The LSA score assess mobility in the past month over five levels of increasing distance: 1) home, 2) areas immediately outside of the home, 3) neighbourhood, 4) city beyond neighbourhood, and 5) beyond the city. In the modified version used for the current study, the second level of LSA was excluded as this level lacks relevance to many urban residents. For each of the 4 remaining levels, participants provide information about how

frequently they travelled to that area and whether they needed assistance from another person or from equipment. Scores for distance travelled, frequency travelled and need for assistance were totalled to create an overall score. In prior research validating the modified version of the LSA, we reported that overall score was the most highly correlated with physical performance (Rosso et al., 2013b). Confirmatory validity and reliability have been established in this population of older adults (Rosso et al., 2013b). Internal consistency of the modified LSA was adequate ($\alpha=0.77$). Total scores ranged from 0 – 104, with higher scores indicating greater mobility.

Depressive symptoms were assessed using the 10-item Center for Epidemiological Studies Depression Scale (CES-D). Respondents were asked to indicate yes or no to the following questions (about feelings in the previous week): (a) I felt depressed, (b) I felt that everything I did was an effort, (c) My sleep was restless, (d) I was happy, (e) I felt lonely, (f) People were unfriendly, (g) I enjoyed life, (h) I felt sad, (i) I felt that people disliked me, and (j) I could not get going. Respondents indicating 4 or more symptoms were identified as depressed. The reliability and validity of this scale and this cut-off point for depression was well established for older adult populations (Irwin, Artin, & Oxman, 1999).

Statistical Analyses

Descriptive statistics were calculated for main effects and potential confounders. Bivariate analyses of these statistics were conducted examining their relationship with category of neighbourhood amenity (low, moderate, high). P-values for categorical values were obtained using the Kruskal Wallis test and analysis of variance (ANOVA) was used to obtain p-values for continuous variables.

Logistic regression was used to assess the association between categories of neighbourhood amenity and presence of depression, as indicated by 4 or more symptoms. Confounders in the adjusted models included age, sex, education, marital status, race/ethnicity, smoking status, and income. Statistical significance was set at .05 for assessing main effects.

Given the low level of missing data on key confounders (2.5% for race/ethnicity, education, and smoking), we conducted a complete case analysis. However, 175 (26.6%) of respondents were missing data on income. Given the potential for income being an important confounder in this analysis, we used a missing data indicator to conduct these analyses. We also conducted two sensitivity analyses wherein missing values for income were set to either the minimum or maximum value to evaluate the influence of this approach to addressing the missing data.

To test for the modifying effect of mobility status, we included a mobility*neighbourhood amenity interaction term in our models. In the presence of significant interaction, final results were stratified by mobility status dichotomised at the midpoint (median = 52) to

represent “high” and “low” mobility and stratified ORs reported. To visualise the relation between mobility, neighbourhood amenity diversity, and depression, we plotted the risk of being classified as depressed or not depressed by amenity diversity and mobility score. All significance tests were 2-tailed. Statistical analyses were conducted using SAS 9.2 (SAS Institute, Cary, NC).

Results

The mean age of the population was 74.5 (standard deviation, 0.3) years (Table 1). The population was primarily white or black race: 52% white, 42% black, and 6% other. The majority of the participants were female and had an education level of high school graduation or above. Almost 20% were disabled and 65% were overweight or obese. The prevalence of depression in this population was 14%. Participants living in neighbourhoods with greater amenity diversity were more likely to be white, single, higher level of education, and not homeowners.

Table 1. Characteristics of Participants Included in the Life Space Mobility in Older Adults study, Philadelphia, PA, 2010, n=658

	All (%)	Low Amenity Diversity (%)	Moderate Amenity Diversity (%)	High Amenity Diversity (%)	pval
Depression					
Yes	92 (14%)	33 (14.6%)	42 (15.1%)	17 (11%)	0.479
No	566 (86%)	193 (85.4%)	236 (84.9%)	137 (89%)	
Mobility					
Low Mobility	328 (49.8%)	105 (46.5%)	152 (54.7%)	71 (46.1%)	0.106
High Mobility	330 (50.2%)	121 (53.5%)	126 (45.3%)	83 (53.9%)	
Age					
Mean (std)	74.51 (0.266)	73.86 (0.447)	75.06 (0.41)	74.47 (0.56)	0.123
Median (IQR)	73.13 (68.03-79.09)	72 (67.43-77.82)	73.85 (68.73-79.71)	72.86 (68-79.17)	
Sex					
Male	185 (28.1%)	70 (31%)	68 (24.5%)	47 (30.5%)	0.203
Female	473 (71.9%)	156 (69%)	210 (75.5%)	107 (69.5%)	
Race/ethnicity					
White	344 (52.3%)	104 (46%)	143 (51.4%)	97 (63%)	0.007
Black	276 (41.9%)	108 (47.8%)	118 (42.4%)	50 (32.5%)	
Other	38 (5.8%)	14 (6.2%)	17 (6.1%)	7 (4.5%)	
Highest level of education					
Less than high school	122 (18.5%)	38 (16.8%)	58 (20.9%)	26 (16.9%)	0.006
High school graduate	273 (41.5%)	85 (37.6%)	131 (47.1%)	57 (37%)	
Some college or more	263 (40%)	103 (45.6%)	89 (32%)	71 (46.1%)	
Marital status					
Married or living with					

partner	210 (31.9%)	86 (38.1%)	68 (24.5%)	56 (36.4%)	0.039
Widowed	237 (36%)	73 (32.3%)	117 (42.1%)	47 (30.5%)	
Divorced or seperated	103 (15.7%)	38 (16.8%)	46 (16.5%)	19 (12.3%)	
Single	108 (16.4%)	29 (12.8%)	47 (16.9%)	32 (20.8%)	
What is your income?					
Below \$36,700	316 (48%)	109 (48.2%)	135 (48.6%)	72 (46.8%)	0.141
\$36,700 or Above	167 (25.4%)	65 (28.8%)	58 (20.9%)	44 (28.6%)	
Missing	175 (26.6%)	52 (23%)	85 (30.6%)	38 (24.7%)	
Do you own your home?					
Yes	484 (73.7%)	184 (81.8%)	188 (67.6%)	112 (72.7%)	0.002
No	173 (26.3%)	41 (18.2%)	90 (32.4%)	42 (27.3%)	
General health status					
Excellent or Very Good	211 (32.1%)	70 (31.1%)	83 (29.9%)	58 (37.7%)	0.401
Good	251 (38.2%)	95 (42.2%)	106 (38.1%)	50 (32.5%)	
Fair or Poor	195 (29.7%)	60 (26.7%)	89 (32%)	46 (29.9%)	
Disability status					
Yes	117 (17.9%)	43 (19.2%)	54 (19.5%)	20 (13.1%)	0.206
No	537 (82.1%)	181 (80.8%)	223 (80.5%)	133 (86.9%)	
Obesity					
Underweight	17 (2.6%)	5 (2.2%)	9 (3.3%)	3 (1.9%)	0.558

In this population of community-dwelling older adults, mobility was strongly associated with depression. Increasing mobility was associated with reduced odds of depression ($p < 0.001$). Being male and smoking were associated with increased odds of depression. After controlling for individual level factors, living in neighbourhoods with the lowest diversity of neighbourhood amenities was associated with a non-significant increase in depression compared with neighbourhoods with the highest diversity (OR=1.43, 95% CI: 0.74 - 2.76) (Table 2).

Table 2. Adjusted Odds Ratios for Depressive Symptoms, Life Space Mobility in Older Adults Study, Philadelphia, PA, 2010, n=658

	OR (95% CI)	p-value	p-value (trend)
Neighborhood Amenity			
Low diversity	1.43 (0.74 - 2.76)	0.283	
Moderate diversity	1.19 (0.63 - 2.24)	0.596	0.545
High diversity	1	Ref.	

Age	0.98 (0.94 - 1.02)	0.252	
Sex			
Male	1.84 (1.08 - 3.12)	0.025	
Female	1	Ref.	
Highest level of education			
Less than high school	1	Ref.	
High school graduate	0.75 (0.42 - 1.34)	0.335	0.418
Some college or more	0.64 (0.32 - 1.26)	0.197	
Marital status			
Married or living with partner	1	Ref.	
Widowed	1.80 (0.93 - 3.46)	0.080	0.231
Divorced or separated	1.93 (0.90 - 4.15)	0.092	
Single	1.24 (0.57 - 2.71)	0.589	
Race/ethnicity			
White	1	Ref.	
Black	0.66 (0.40 - 1.10)	0.113	0.282
Other	0.85 (0.33 - 2.23)	0.743	
Current smoker			
Yes	1.85 (1.05 - 3.25)	0.033	
No	1	Ref.	
Income	0.97 (0.91 - 1.03)	0.324	
Missing Income			
Missing	1.03 (0.56 - 1.92)	0.923	
Not missing	1	Ref.	
Mobility score	0.98 (0.97 - 0.99)	<0.001	

Mobility significantly modifies the association between neighbourhood amenity diversity and depression (p-value: 0.022). Table 3 provides the model results stratified by mobility status dichotomised at the median point to represent “high” and “low” mobility. Decreasing amenity diversity was associated with increasing risk for depression among older adults with high mobility (p-value for trend = 0.105). After adjustment for confounders, living in neighbourhoods with the lowest diversity of amenities was associated with almost a 6-fold increase in the odds of depression, compared with living in neighbourhoods with the highest diversity of amenities (OR=5.75, 95% CI: 1.14, 28.91). We observed no association between neighbourhood amenity diversity and depression among older adults with low mobility.

Table 3. Adjusted Odds Ratios for Depressive Symptoms and neighborhood amenity status by mobility status, Life Space Mobility in Older Adults Study, Philadelphia, PA, 2010, n=658

Low Mobility (n=328)			
	OR (95% CI)	p-value	p-value (trend)
Neighborhood Amenity			
Low Amenity	0.94 (0.44 - 2.03)	0.874	0.977
Moderate Amenity	0.92 (0.45 - 1.91)	0.830	
High Amenity	1	Ref.	
High Mobility (n=330)			
	OR (95% CI)	p-value	p-value (trend)
Neighborhood Amenity			
Low Amenity	5.75 (1.14 - 28.91)	0.034	0.105
Moderate Amenity	3.93 (0.80 - 19.19)	0.091	
High Amenity	1	Ref.	

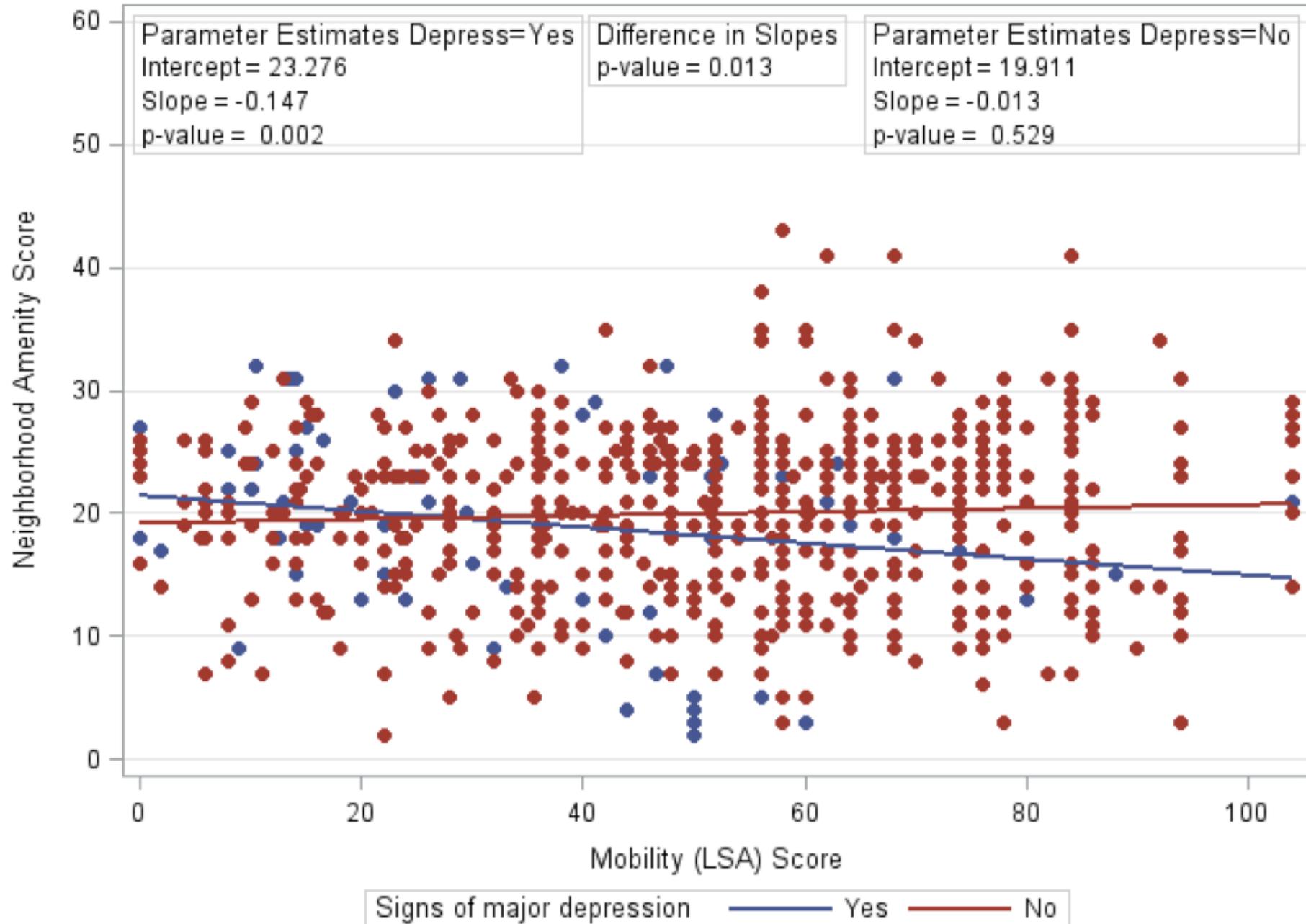
* Model adjusted for age, sex, education, marital status, race/ethnicity, smoking, income

Figure 1 provides a visual summary of the unadjusted relation among mobility, neighbourhood amenity diversity, and depression status. We have estimated the risk of being classified as depressed or not depressed by mobility score and neighbourhood amenity diversity. Among older adults at the very low end of the mobility scale, those who were not depressed were more likely to live in a neighbourhood with slightly lower amenity diversity compared to those who were depressed. The association between depression and neighbourhood amenity diversity reverses above the mobility score of 30. Above that point, those who were not depressed were more likely to live in a neighbourhood with higher amenity diversity compared to those who were depressed when holding mobility score constant. The p-value for the difference in the two regression lines is 0.013.

Sensitivity analyses showed minimal change in the adjusted odds of depression by neighbourhood amenity score, when all missing values of income were set to the minimum or maximum values (data not shown).

Figure 1: Neighborhood amenity score and mobility score by depression status

Scatterplot of Neighborhood Amenity Score and Mobility Score by Depression Status



Discussion

Our findings suggest that the association between neighbourhood amenity environments and depression was moderated by mobility status. Among older adults with higher mobility, poor neighbourhood amenity environments were associated with depression among older adults. We observed no association between neighbourhood amenity diversity and depression among older adults with limited mobility.

Restricted life-space mobility is well documented as a stressor on health status, leading to a poor health status when coupled with undesirable neighbourhood environments (Rosso, Auchincloss, & Michael, 2011; Vallee et al., 2011; Yeom et al., 2008). Research has also found that physical impairments are a risk factor for depression. Physical impairments are likely to limit an individual's life-space mobility, and therefore they may experience more depression than an able-bodied individual (Gayman, Turner, & Cui, 2008; González et al., 2013; Simning et al., 2012). Physically impaired individuals may also have fewer social activities and a smaller social network and therefore may have limited access to neighbourhood amenities that facilitate social interaction, among other necessary and desirable benefits (Yeom et al., 2008, Rosso et al, 2013b).

Past research suggests that the effect of a poor neighbourhood's environment on mental health is exacerbated with restricted life-space mobility; low quality built environments, including structural decay and dilapidated housing, have been found to lead to depressive symptoms, particularly among individuals who are more restricted to their residential neighbourhood (Melis et al., 2015, Vallee et al., 2011). In this study, the lack of diverse amenities within the neighbourhood was associated with depression among those older adults with greater mobility, i.e. the capacity to travel into the neighbourhood. Consistent with other findings in our study, amenity diversity was more relevant to older adults that engaged in regular walking behaviour, or had high mobility status (Nagel et al., 2008). Among those older adults with low mobility, we observed no difference in depression by amenity diversity. Older adults with restricted mobility may be less aware of the resources available (or not available) in their neighbourhood.

Future research should assess the perceptions of older adults on their neighbourhood environment. It is possible that low mobility individuals, regardless of neighbourhood amenity diversity, have a different perception of the environment due to their inability to access and assess the environment. Prior research has found that once older adults have internalised their deprived neighbourhood environment, they may be prone to deliberately limiting their life-space to avoid their perceived problems with the neighbourhood environment (Shumway-Cook et al., 2003). Less positive perceptions of the environment may reflect masked resentment for their isolation and restricted life-space. This may provide an opportunity for interventions to improve perceptions of neighbourhood environment as a mechanism to increase mobility and reduce depression. Additionally, research is needed to better understand the

mechanisms through which exposure to neighbourhood amenities may influence depressive symptoms among those older adults who are mobile. Collecting additional data from older adults about how they use their neighbourhood and their experience with these amenities may help to identify the behavioural and cognitive processes linking neighbourhood environment to mental health (Kestins et al., 2016).

Limitations

There were several limitations to this study. Our cross-sectional study design cannot evaluate causality. Future longitudinal studies can address this limitation. We were limited to information on amenities in the neighbourhood around the participants' home residence. Exposure to other amenities within the participants' full activity space would provide a more complete measure of exposure (Kestens et al., 2016). We were not able to control for dementia in our analyses. Dementia would impact people's ability to get out and about in their neighbourhoods and is a risk factor for depression. We also did not evaluate neighbourhood walkability and thus were unable to evaluate whether this is a confounder or modifier of the association. Additionally, while some evidence suggests gender differences in the environmental risk factors for depression (Melis et al., 2015), we did not have sufficient sample size to stratify by sex. Finally, as the study was based on adults over 65 living in Philadelphia, our results may not be extrapolated to other cities or regions in the country.

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