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Amanda J. Lehning
University of Michigan, alehning@umich.edu

Richard J. Smith
Wayne State University, smithrichardj@wayne.edu

Ruth E. Dunkle
University of Michigan, redunkle@umich.edu

Age-Friendly Environments and Self-Rated Health: An Exploration of Detroit Elders

AMANDA J. LEHNING[a], RICHARD J. SMITH[b], RUTH E. DUNKLE[c]

[a] Assistant Professor, University of Maryland School of Social Work, alehning@ssw.umaryland.edu

[b] Assistant Professor, Wayne State University School of Social Work, smithrichardj@wayne.edu

[c] Wilbur J. Cohen Collegiate Professor of Social Work and Associate Dean, Academic Programs, University of Michigan School of Social Work, redunkle@umich.edu

Abstract While a number of organizations and government entities have encouraged the development of more "age-friendly" environments, to date there has been limited research linking these environment features to elder outcomes. Using a representative sample of older adults living in Detroit, this study examined the association between age-friendly environment factors and self-rated health. Results indicated that access to health care, social support, and community engagement were each associated with better self-rated health, while neighborhood problems were associated with poorer self-rated health. Moreover, individual-level income and education no longer predicted self-rated health once age-friendly environment factors were taken into account. These findings highlight the need for more research documenting the effects of age-friendly environments, particularly across diverse contexts and populations.

Keywords Aging; Self-Rated Health; Social Environment; Physical Environment

Corresponding author Amanda Lehning, Ph.D., University of Maryland, School of Social Work
E-mail address: alehning@ssw.umaryland.edu

Over the past decade, a number of organizations and government entities, such as the World Health Organization, AdvantAge Initiative, and U.S. Environmental Protection Agency (EPA), have encouraged the development of more "age friendly" environments to promote elder health and well-being. Age-friendly environments are those in which "older adults are actively involved, valued and supported with infrastructure and services that effectively accommodate their needs" (Alley et al., 2007, p. 5). Age-friendly environment characteristics typically include proximally located goods, services, and amenities; transportation options beyond the personal automobile; safe and pleasant neighborhoods and housing; access to sources of social support; and opportunities to engage in meaningful activities (Hanson and Emlet, 2006; Scharlach and Lehning, in press). Since this concept has only recently received attention from academics, policymakers, and health and social service providers, there is limited empirical evidence linking age-friendly environments to outcomes in older adults. It remains unclear, for example, whether there are differences in the relative importance of specific age-friendly environment characteristics. Furthermore, there is little understanding of potential variations in the influence of age-friendly environments across contexts (e.g., urban and rural) or populations (e.g., elders with limited socioeconomic resources or from diverse racial and ethnic backgrounds). The purpose of this study is to examine the association between measures of age-friendly environment characteristics and self-rated health in a representative sample of older adults in Detroit, Michigan.

LITERATURE REVIEW

The idea that developing more age-friendly environments can result in positive outcomes in older adults is based, in part, on the ecological model of aging (Lawton and Nahemow, 1973), which posits that well-being in later life emerges from the interaction between the competence of the older individual and the press of his or her environment. Competence is defined as a characteristic of the individual, including such attributes as biological health, sensory capacity, motor skills, ego strength, and cognitive functioning (Lawton, 1982). Environmental press is comprised of the characteristics of the physical and social environment that place demands on the individual. As individuals age and experience a decline in competence, they may be unable to meet the demands of their surrounding environment. Once the level of environmental press is adjusted to better meet their needs, however, they are able to return to a level of adaptive functioning and high quality of life (Lawton, 1982). The ecological model of aging further stipulates that the environment plays a larger role in determining outcomes among those who have reduced competence, known as the environmental docility hypothesis (Lawton, 1990). It is possible that this hypothesis is also applicable to those

with fewer financial resources (i.e., reduced socioeconomic competence), though this idea has yet to be empirically tested.

A number of organizations have developed checklists and guides that propose age-friendly adaptations to the social and physical environment of cities, towns, and neighborhoods. One framework is from the EPA, which combines principles from city planning with principles from gerontology and organizes age-friendly characteristics into four categories: staying active, connected and engaged (e.g., social integration, access to social support, and civic engagement opportunities); neighborhoods and housing (e.g., appropriate housing conditions, neighborhood access to services and shopping, neighborhood safety); transportation and mobility (e.g., accessible and convenient public transit); and access to healthy activities (e.g., access to food, access to recreational activities) (U.S. EPA Aging Initiative, 2011). We based our selection of age-friendly environment characteristics on the EPA framework because it is informed by empirical evidence of the social and physical environment characteristics associated with health and well-being (e.g., Berke et al., 2007; Fiori et al., 2006; Freedman et al., 2008; Mezuk and Rebok, 2008; Morrow-Howell et al., 2003; Moore et al., 2008). To our knowledge, however, there have not yet been any published studies taking a holistic approach to understanding the impact of age-friendly environments, whether based on the EPA framework or another conceptualization. Furthermore, there is little research that has examined the relationship between many of these age-friendly environment characteristics and self-rated health.

Self-rated health is a multidimensional measure that captures not only one's physical health status, but also social, emotional, and psychological well-being (Diener et al., 1999; Dowd and Zajcova, 2007; Ferraro et al., 1997). Prior research has demonstrated that the subjective measure of self-rated health is predictive of a number of objective health outcomes, including mortality (Idler and Benyamini, 1997; Mossey and Shapiro, 1982), morbidity (Ferraro et al., 1997), disability (Idler and Kasl, 1995; Kaplan et al., 1993), and health care utilization (Malmstrom et al., 1999). Although one recent study found that self-rated health was a better predictor of mortality among Whites than African Americans (Lee et al., 2007), other researchers report that it leads to similar outcomes across diverse populations (Ferraro and Kelly-Moore, 2001), and a number of studies have explored racial and economic disparities in self-rated health. For example, self-rated health tends to be poorer among those with low SES (Chandola, et al., 2007) or living in neighborhoods characterized by low SES (Malmstrom et al., 1999; Subramanian et al., 2006; Wen et al., 2006). African Americans have an increased risk for lower self-rated health compared to Whites (Borrell and Crawford, 2006; Cagney et al., 2005; Spencer et al., 2009), and this difference may increase with age (Kington and Nickens, 2001).

The self-rated health literature has moved beyond examining only individual-level factors towards an exploration of place effects. The neighborhood may be particularly important for older adults, who often have been exposed to environmental characteristics for longer than younger adults, and who depend more on their immediate social and physical environments due to changes in their activities and potential reductions in social networks (Glass and Balfour, 2003). Many of the studies that assess environmental characteristics, however, include measures that reflect socioeconomic status, rather than other aspects of the social and physical environment (Wen et al., 2006). One exception is the work of Cagney and colleagues (2005), which included neighborhood social cohesion and health-related informal social control in their study, but neither of these measures was associated with self-rated health in their sample of Chicago elders. Additionally, much of the previous research that examines the environmental context looks at aggregate measures at the census tract level, which may not accurately reflect the environment encountered by an older adult on a daily basis (Keysor et al., 2010).

The existing literature indicates that making social and physical environments more age-friendly will benefit older adults. There is a need, however, for research that takes a holistic approach to examining the association of age-friendly environments to reliable and valid measures related to health and well-being, such as self-rated health. Evidence of racial and economic disparities in health outcomes, including in self-rated health, highlights the need for research focusing on those with fewer resources and from diverse racial and ethnic backgrounds. While a burgeoning literature calls attention to place effects on self-rated health, few studies have been able to look at the environment immediately surrounding the home. In order to begin addressing these gaps in the literature, our study used a representative sample of community-dwelling Detroit elders to test two hypotheses: (1) age-friendly environment characteristics are be associated with better self-rated health after adjusting for individual demographic and health characteristics, and (2) age-friendly environment characteristics reduce the impact of individual demographic and health characteristics on self-rated health.

METHODS

Sample and Study Setting

This study is a secondary data analysis of the Detroit City-Wide Needs Assessment of Older Adults collected by the Center for Urban Studies for the Institute of Gerontology and the Center for Healthcare Effectiveness of Wayne State University (Chapleski et al., 2002). The needs assessment used a representative sample of non-institutionalized persons aged 60 years or older who resided in the City of Detroit, and was selected to reflect those eligible for Older Americans Act programs so that the city could plan more effectively for future service needs. These

data give insight into an elderly urban population that is majority African American and has fewer socioeconomic resources than the older U.S. population as a whole (US Census Bureau, 2002; Bishaw and Iceland, 2003).

We focused on Detroit because the city's environment over the lifetime of the study's respondents may have placed them at an increased risk of poor self-rated health in later life. Specifically, over the second half of the twentieth century, many Detroit neighborhoods transitioned as African Americans migrated from the South, and Whites and many businesses relocated to the nearby suburbs (Sugrue, 1996). As the U.S. moved away from being a manufacturing-based economy, the city lost approximately 350,000 jobs (Schulz et al., 2002), and dropped from the population peak in 1950 of 1.8 million to nearly 950,000 in 2000 (U.S. Census Bureau, 2000). While institutional segregation through discriminatory housing policies and restrictive covenants no longer exists, Detroit remains a city characterized by economic and racial segregation (Zenk et al., 2005). Access to goods and services can be a challenge, as Detroit currently has many neighborhoods that contain urban prairie in which a combination of arson, neglect, and demolition has created large tracks of vacant land that have reverted back to a natural habitat.

Details about the data collection procedures for the Detroit needs assessment are reported elsewhere (Chapleski et al., 2002). Briefly, data were collected during 2001 via telephone interviews with a stratified random digit dialing sample of 1,310 older adults and in-person interviews with 100 older adults living in census tracts with low telephone coverage. The stratified sample targeted city-designated neighborhood area clusters, and we used post-stratified sampling weights in the present analyses so that that all areas of the city of Detroit were represented in the research analyses in proportion to the total population of eligible respondents. We deleted six records that were not living in the city of Detroit and one whose address was listed only as 'Detroit, MI'. We also deleted 26 respondents missing data for outcome variables of interest (for both the current analyses and two future analyses) and 4 respondents missing the sampling weight, resulting in a final unweighted sample of 1,372 elders and a final weighted sample of 1,386. This study was classified as exempt by both the [Blinded for Review] and Blinded for Review] Institutional Review Boards.

Measures

Self-rated health. The needs assessment included a single-item measure of self-rated health: "In general, would you say your health is poor, fair, good, very good, or excellent?" with scores ranging from 1 to 5.

Demographic and health characteristics. Based on previous research on self-rated health, we included a number of covariates reflecting sociodemographic position, including gender (comparing females to males), age (measured as a continuous variable), race (comparing Black/African American, Other, and White as the reference group), education (high school graduate, some college or higher, and less than a high school diploma as the reference group), and household income below $20,000 per year. We also assessed the individual's residential stability using a continuous measure of the number of years the respondent reported living at their current address. Health measures included a count of the seven most common chronic conditions affecting the elderly (i.e., bone or joint problems, chronic bronchitis or emphysema, heart problems, stroke, hypertension, diabetes, cancer) (Federal Interagency Forum on Aging-Related Statistics, 2010). We also included two measures of potential functional limitations: health limits ability to engage in moderate physical activity, and health limits ability to climb stairs (both measured with three categories: not limited at all, limited a little, and limited a lot).

Age-friendly environment characteristics. To develop parsimonious measures and avoid multicollinearity in our regression model, we measured age-friendly environment characteristics using scores derived from exploratory factor analysis. Items included in the factor analysis came from the needs assessment survey, as well as public and business data on characteristics of the respondent's surrounding environment. We obtained business and service location data from Dun & Bradstreet for the first quarter of 2001, and data on the location of bus stops and parks from the Detroit Department of Transportation (DDOT) and the Southeast Michigan Council of Governments, respectively. We selected items for inclusion in the exploratory factor analysis based on the EPA framework (U.S. EPA Aging Initiative, 2011), although we did not have any *a priori* theory regarding item intercorrelations. Public and business location data were organized and geocoded in ArcGIS 10 (Beyer, 2011). For addresses that did not match, we manually corrected them using Google Maps and then geocoded again. We drew a buffer of 400 meters around each respondent's address to calculate the number of amenities (e.g., parks, bus stops) within walking distance. This distance has been used in previous studies as a reasonable walking distance for older adults (Satariano et al., 2010.).

The six factors included: *access to business and leisure* , *access to health care* , *neighborhood problems* , *social interaction* , *social support* , and *community engagement* . Table 1 provides a list of the items in each factor.

Statistical Analyses

First, using all the variables in our model, as well as the respondent's zip code, we imputed missing data from the needs assessment using Multiple Imputation with Chained Equations (MICE) in Stata 11 to create five data sets (see Table 1 for the percent of missing data for each of the variables included in the analyses). Second, we ran an explora-

tory factor analysis to calculate the factor scores described above. Because multiple imputation methods do not work with Stata's factor command, we report results for only one of the imputed data sets, although each of the five imputations factored in the same way and produced nearly identical results. We employed standard criteria from the literature on conducting exploratory factor analysis (Cabrera-Nguyen, 2010). We retained factors with eigenvalues that had a value greater than 1 and plotted above the elbow of a scree plot. We retained items whose factor loadings were greater than or equal to 0.4 and had face validity. We selected principal axis factoring with a varimax rotation and Kaiser normalization because our data were not normally distributed and we did not have an *a priori* theory about factor intercorrelations. Third, we ran descriptive statistics, using frequencies and percentages to describe categorical and dichotomous data, and means and standard deviations to describe continuous data.

We used linear regression to test the association of age-friendly environment characteristics and respondents' demographic and health characteristics on self-rated health. In order to investigate whether age-friendly environmental factors affect the association between demographic and health characteristics and self-rated health, we fit two models: Model 1 included only demographic and health characteristics, while Model 2 added the six age-friendly environment characteristics. We measured self-rated health as a continuous variable, because diagnostic tests suggested no major violations of heteroscedasity and normality assumptions. Tolerance and variance inflation factor (VIF) results indicated multicollinearity was not a concern with independent variables. We tested for the presence of residual spatial auto-correlation by calculating Moran's I, which was not statistically significant, indicating that it is unlikely that there are neighborhood-specific effects in this sample. We used an alpha of .05 for statistical tests.

RESULTS

Descriptive Statistics. Table 1 presents a list of measures and their distribution for the weighted sample. In this sample, which was majority African American and inordinately low-income and low educational attainment, we observed an approximate normal distribution for self-rated health. Respondents reported a mean age of slightly less than 72 years, and had lived at their current address for an average of nearly 25 years. These Detroit elders had been diagnosed with an average of two chronic health conditions, and a minority reported that their health limited their ability a lot to engage in moderate activities or climb stairs. Table 1 also presents the distribution of the items that comprised the six age-friendly environment factor scores. The six factor scores were standardized variables, so each had a mean of zero and a standard deviation of one (not shown).

Table 1. Characteristics of Sample (*N*=1,372)

	Distribution	Missing
Self-Rated Health		0
Poor	8.5	
Fair	27.1	
Good	31.8	
Very Good	23.8	
Excellent	8.7	
Demographic Characteristics		
Female	70.8	0
Age	71.6 (7.6) Range 57-97	1.7
Race		1.2
White (ref)	13.9	
Black/African American	80.8	
Other	5.3	
Education		1.2
Less than High School Diploma (ref)	40.9	
High School Graduation	23.8	
Some College or Higher	35.3	
Income Below $20,000	58.5	21.7
Years at Current Address	24.1 (15.7) Range 0-83	0.94
Health Characteristics		
Number of Chronic Conditions	2.0 (1.3) Range 0-6	1.5
Health Limits Activities		0.7
Not at all	55.1	
A Little	21.5	
A Lot	23.4	
Health Limits Stairs		0.9
Not at all	43.6	
A Little	26.3	
A Lot	30.1	
Age-Friendly Environment Factor Items		
Factor 1: Access to Business and Liesure		
Total Number of Bus Stops Within 400 Meters	14.1 (21.5) Range 0-321	
Total Number of Businesses Within 400 Meters	21.4 (28.4) Range 0-333	
Total Number of Grocery Stores Within 400 Meters	1.0 (1.2) Range 0-11	
Total Number of Parks Within 400 Meters	.9 (1.1) Range 0-16	
Factor 2: Access to Health Care		
Total Number of Health Services Within 400 Meters	1.5 (4.8) Range 0-47	
Total Number of Mental Health Services Within 400 Meters	.1 (.5) Range 0-3	
Factor 3: Neighborhood Problems		
Feels Safe Alone at Night (Very Safe to Very Unsafe)	2.3 (1.1) Range 1-4	4.1
Feels Safe Alone during the Day (Very Safe to Very Unsafe)	1.5 (.7) Range 1-4	0.6
Count of Neighborhood Problems (e.g., Heavy Crime, Abandoned Buildings, Trash and Litter)	2.3 (2.1) Range 0-9	0.6
Count of Housing Problems (e.g., Insects or Rodents, Inadequate Heating, Excessive Noise)	2.1 (2.5) Range 0-10	6.3
Factor 4: Social Interaction		
Feels Close to Friends and Family	90.7	0.3
Talks or Visits with Friends and Family (Never to Everyday)	5.4 (2.1) Range 0-7	0.4
Factor 5: Social Support		
Believes Someone Available Short Term	93.2	2.4
Believes Someone Available Long Term	81	14.9
Believes Someone Available in Emergency	95.6	1
Factor 6: Community Engagement		
Frequency of Participation in Community Groups (Never to Everyday)	1.1 (1.9) Range 0-7	0.4
Frequency of Volunteering (Never to Everyday)	1.4 (2.3) Range 0-7	0.7

Notes: Table entries are for unweighted data. Percentages are shown for categorical variables. Means with standard errors in parentheses and range below are shown for continuous variables. ***Distribution*** *refers to distribution of variables after missing data imputation.* ***Missing*** *refers to percent of missing data prior to missing data imputation.*

Multivariate Results. Linear regression results are presented in Table 2. In the first model with only self-reported demographic and health characteristics, gender, age, and race were not significant. As expected from prior research, education and income had a significant relationship with self-rated health, with those in the highest education group reporting better self-rated health compared to those without a high school diploma (B = .128, SE = .064, p<.05) and those with annual incomes below $20,000 reporting poorer self-rated health compared to those with higher incomes (B = -.137, SE = .059, p<.05). Years at current address had a positive effect on self-rated health (B = .005, SE = .002, p<.01). All of the health covariates were significant in the first regression model, with poorer objective measures of health associated with poorer self-rated health. Specifically, those who had a higher number of chronic conditions (B = -.201, SE = .022, p<.001), or reported that their health limits their ability to engage in activities (B = -.272, SE = .041, p<.001) or climb stairs (B = -.171, SE = .041, p<.001) rated their health lower.

Model 2 included the six age-friendly environment factors. The results of Model 2 provided partial support for our first hypothesis regarding the association between age-friendly environment factors and self-rated health. When adjusting for demographic and health covariates, access to health care was associated with better self-rated health (B = .086, SE = .029, p<.01). Social support (B = .096, SE = .032, p<.01) and community engagement (B = .098, SE = .036, p<.01) also had a significant positive relationship with self-rated health. As expected, neighborhood problems had a negative effect on self-rated health (B = -.081, SE = .032, p<.01). However, neither the access to business and leisure nor the social interaction factors were significant in the regression model.

The result also offered some support for our second hypothesis proposing that the impact of demographic and health characteristics on self-rated health would be reduced when taking into account the age-friendly environment. The addition of age-friendly factors slightly attenuated the association of the three health measures and self-rated health, but they remained significantly negatively associated with self-rated health (B = -.197, SE = .022, p<.001 for chronic health conditions; B = -.259, SE = .040, p<.001 for health limits activity; and B = -.155, SE = .040, p<.001 for health limits climbing stairs). The number of years the respondent had lived in their current home remained significant and in the positive direction (B = .006, SE = .002, p<.001), though this effect was small. Education and income, however, were no longer significant once age-friendly social and physical environment factors were in the linear regression model.

Table 2. Linear Regression of Age-Friendly Factors on Self-Rated Health (n=1,386)

	Model 1			Model 2		
	B	***SE B***	**β**	***B***	***SE B***	**β**
Demographic Characteristics						
Female	0.059	0.057	0.024	0.060	0.057	0.025
Age	0.000	0.004	-0.003	-0.002	0.004	-0.011
Race						
Black/African American	-0.059	0.079	-0.020	-0.096	0.078	-0.033
Other	-0.022	0.135	-0.004	-0.050	0.134	-0.010
Education						
High School Graduate	0.022	0.067	0.009	0.028	0.066	0.011
Some College or Higher	.128*	0.064	0.056	0.111	0.065	0.048
Income Below $20,000	-.137*	0.059	-0.062	-0.114	0.059	-0.051
Years at Current Address	.005**	0.002	0.072	.006***	0.002	0.088
Health Characteristics						
Number of Chronic Conditions	-.201***	0.022	-0.240	-.197***	0.022	-0.234
Health Limits Activities	-.272***	0.041	-0.206	-.259***	0.040	-0.196
Health Limits Stairs	-.171***	0.041	-0.132	-.155***	0.040	-0.120
Age-Friendly Community Factors						
Access to Business and Leisure				-0.003	0.028	-0.002
Access to Health Care				.0860**	0.029	0.070
Neighborhood Problems				-.0810**	0.032	-0.060
Social Interaction				-0.011	0.028	-0.009
Social Support				.0960**	0.032	0.070
Community Engagement				.0980**	0.036	0.066

*p ≤.05; **p ≤.01; ***p ≤.001.
Notes: Table entries reflect post-stratified sampling weights

DISCUSSION

Creating more age-friendly environments to promote elder health and well-being is a relatively recent area of interest, dating back only to the early 2000s. Since that time, a number of organizations have proposed age-friendly social and physical environmental modifications that could positively impact older adults. More recently, academic scholars have published primarily descriptive articles providing an overview of particular frameworks (Hanson and Emlet, 2006; Plouffe and Kalache, 2010) or of the age-friendly concept as a whole (Alley et al., 2007; Scharlach, 2009). To date, however, there has been little research linking age-friendly environment features to elder outcomes. This study one of the first to conceptualize age-friendly environments using the EPA framework and assess the effect of these environments on self-rated health. We used exploratory factor analysis because, in general, methodologists and statisticians recommend EFA for pilot studies and other situations where there is no developed theory (Bandalos & Finney, 2010) Our study addresses some of the problems of relying only on self-report data by using GIS techniques to link the location of public amenities and businesses to characteristics of residents' surrounding environment. Furthermore, while prior research has used census tracts as a proxy for neighborhood (e.g., Subramanian et al., 2006), this approach has been criticized as an imperfect reflection of individual's perceptions of their neighborhood (Sampson, Morenoff, & Gannon-Rowley, 2002). This study avoids this limitation by relying primarily on point level data within a reasonable distance of survey respondents' residences rather than on aggregate census data. Finally, we chose to use a sample that is urban, majority low income, and predominantly African American because this is an understudied segment of the elderly population in need of policy and programmatic attention.

We found partial support for our first hypothesis: when adjusting for demographic and health characteristics, the access to health care, social support, and community engagement factors were associated with better self-rated health, while the neighborhood problems factor was associated with poorer self-rated health. While we did not explicitly test the ecological model of aging, results support the proposition that the environmental press of the surrounding area can impact health and well-being.

Our findings are consistent with previous research that has demonstrated the importance of available health care for both subjective and objective measures of health. For example, Liu (2007) found that adults living in a health provider shortage area (HPSA) are likely to have worse self-rated health and physical health, and less likely to have a usual place for medical care, particularly outpatient care. Allen and colleagues (2011) reported that those living in HPSAs have more cardiovascular disease risk factors than those who do not, though these differences may be due to a higher proportion of African Americans, Hispanics, and those with low SES living in these areas. Access to health care is important to health outcomes because among older adults who are in poor health, those who live in HPSAs are more likely to have a preventable hospitalization (Parchman and Culler, 1999).

Prior research has also reported a significant association between social support and positive outcomes in older adults, including better mental health, higher quality of life, improved physical health, and reduced mortality risk (Borglin et al., 2006; Everard et al., 2000; Krause, 1997). Indeed, perceived support, which was measured in our study, has been found to be associated with well-being (Patrick et al., 2001), suggesting that the belief that support would be available if needed acts as a stress buffer (Aday et al., 2006). Social support may be particularly important for the health of those living in low-resourced neighborhoods (Eschbach et al., 2004), as it can mobilize individuals to engage in social action (Cattell, 2001).

We found a positive association between community engagement and self rated health, corresponding to other studies that report that engaging in productive activities, including volunteering, is associated with better self-rated health (Morrow-Howell et al., 2003) and that this association is greater for older adults than their younger counterparts (Van Willigen, 2000). While Hinterlong (2006) observed this relationship only for White elders, the present study suggests that the relationship may hold true for Blacks as well in certain environments. Participation in productive activities is also associated with fewer symptoms of depression (Morrow-Howell et al., 2003), decreased risk of dementia (Wang et al., 2002), lower levels of disability (Mendes de Leon et al., 2003; Walsh and Gannon, 2011), and reduced mortality risk (Glass et al., 1999; Musick et al., 1999).

Other researchers have documented that neighborhood problems, such as traffic, excessive noise, poor lighting, and crime, have deleterious effects, including increased risk of disability, higher incidence of depression, and decreased quality of life (Echeverria et al., 2008; Balfour and Kaplan, 2002; Walsh and Gannon, 2011; Yen et al., 2006). It has been suggested that neighborhoods characterized by many problems produce stress in their residents, which in turn can lead to poor mental health or unhealthy behaviors, such as smoking and drinking (Echeverria et al., 2008; Latkin and Curry, 2003, Hill and Angel, 2005). For older adults in particular, neighborhood problems may cause them to limit their physical activity and mobility outside of their home (Ambrose Gallagher et al., 2010; Rantakokko et al., 2010), which could negatively affect their health and well-being.

Contrary to our hypothesis and some previous research, neither the social interaction nor the access to business and leisure factors had a significant effect on self-rated health in this sample. While numerous studies have found that social contacts protect against disability and functional decline in older adults (e.g., Avlund et al., 2004; Everard et al., 2000), Seeman and colleagues (1995) did not find a significant positive association between social relation-

ships and disability. Our results and prior research indicates a need for additional research exploring the relationship between this measure and health outcomes. In previous studies, individuals who live in mixed use neighborhoods or within a reasonable walking distance of businesses and amenities engage in more physical activity and have a decreased odds of being obese (Frank, et al., 2006; King et al., 2005). However, one study, which focused only on older adults, found no significant association between density of businesses and services and self-rated health (Subramanian et al., 2006). These mixed findings suggest the need for more research examining the impact of access to goods and services on older adults.

We also found support for our second hypothesis, and our findings contribute to a growing body of evidence of the importance of taking into account the environment when examining predictors of self-rated health (Browning and Cagney, 2002; Cagney et al., 2005; Krause, 1996; Malmstrom et al., 1999). Prior studies have found that education and income are associated with self-rated health for adults of all ages (Franks et al., 2003) as well as for older adults in particular (Chandola et al., 2007; Yao and Robert, 2007). This was also true in our study when we only accounted for individual demographic and health characteristics. When we adjusted for the six age-friendly environment measures, however, education and income were no longer significant. It is unclear whether these results are relevant only to this particular sample of Detroit elders, and future research should examine the relationship between individual SES, age-friendly environment features, and self-rated health across contexts (e.g., urban, suburban, and rural) and segments of the elderly population (e.g., those with limited socioeconomic resources or from diverse racial and ethnic backgrounds). Furthermore, while this study did not directly test whether Lawton's environmental docility hypothesis also applies to those with reduced socioeconomic "competence," the findings indicate this is a promising area for future research, particularly since few age-friendly environment frameworks call attention to the potential differential effects of these features on those with limited resources.

The current study has a number of limitations that should be addressed in future research. First, this study contains limitations commonly found in observational, cross sectional research, including the possibility of reciprocal causation. Second, this study is at risk of endogeneity due to selection bias because there may be an unobserved variable that influences both the residential preferences of a resident and also affects health directly (Rogowski et al., 2006). In this study we have adjusted estimates for individual characteristics that influence residential selection and health. Future research should use observational designs that employ matching with sensitivity analysis in order to address the problem of selection bias, attenuation bias, and endogeneity (Diez Roux, 2004). Third, there is the potential for self-report or recall bias (Keysor et al., 2010). In order to enhance measures of social and physical environments, we combined this survey data with measures from public and business data. Finally, this study draws from a representative sample of elders in one city. While it is not generalizable globally, it can inform future work in other North American cities that have low income, predominantly African-American populations who live in neighborhoods that have experienced disinvestment.

CONCLUSION

This study is one of the first to examine the relationship between age-friendly environments and elder outcomes, in this case self-rated health, and provides a foundation for future research. It supports previous findings regarding effects of access to health facilities, neighborhood problems, social support, and community engagement on elder health, and suggests the importance of including both social and physical environment characteristics in future studies of self-rated health. Future research should examine potential variations in the effects of age-friendly environments on health across contexts and populations, as well as other outcomes potentially associated with age-friendly environments, including quality of life, life satisfaction, and aging in place.

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