1-1-2013

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Conceptualizing age-friendly community characteristics in a sample of urban elders: An exploratory factor analysis

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Abstract Accurate conceptualization and measurement of age-friendly community characteristics would help to reduce barriers to documenting the effects on elders of interventions to create such communities. This article contributes to the measurement of age-friendly communities through an exploratory factor analysis of items reflecting an existing U.S. Environmental Protection Agency policy framework. From a sample of urban elders (n =1,376), we identified six factors associated with demographic and health characteristics: *Access to Business and Leisure*, *Social Interaction*, *Access to Health Care*, *Neighborhood Problems*, *Social Support*, and *Community Engagement*. Future research should explore the effects of these factors across contexts and populations.

Keywords age-friendly communities, factor analysis, social environment, urban communities, social policy

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Although older adults express a desire to maintain social networks and meaningful self-identities by aging in place (Chaudhury & Rowles, 2005), many become vulnerable to relocation due to decline in health and physical functioning or financial struggles (Choi, 1996). These relocations can lead to a number of negative outcomes; for example, nursing home admission has been linked to psychological distress for caregivers (Schulz et al., 2004), poor quality of life and increased mortality risk for elders (Scocco, Rapattoni, & Fantoni, 2006). Therefore, there has been a growing interest among social work scholars to research and develop interventions to help older adults remain in their own homes and neighborhoods and out of long-term care institutions (e.g., Greenfield, 2012; McDonough & Davitt, 2011; Scharlach, 2009). One promising intervention is to make existing communities more "age-friendly"; that is, communities "where older adults are actively involved, valued, and supported with infrastructure and services that effectively accommodate their needs" (Alley, Liebig, Pynoos, Benerjee, & Choi, 2007, p.5). To date, however, there is little evidence regarding the relationship between making communities more age-friendly and outcomes in older adults. Also lacking are accurate and appropriate conceptualizations and measurements of age-friendly community characteristics, which would help in documenting their effects on older adults. Furthermore, little is known about potential variations in the presence of age-friendly community characteristics among those with limited resources or living in deprived neighborhoods. The main contribution of the current article is to be the first to measure the social and physical environmental characteristics of an age-friendly community. Using data from a representative sample of elders living in a city in which many residents are economically disadvantaged, we conducted an exploratory factor analysis of items reflecting an existing policy framework from the U.S. Environmental Protection Agency (EPA).

Over the past decade, a number of organizations (e.g., World Health Organization, AdvantAge Initiative, AARP, National Association of Area Agencies on Aging and Partners for Livable Communities) have developed checklists and guides that propose adaptations to the social and physical environment of cities, towns, and neighborhoods to promote elder health, well-being, and the ability to age in place. The idea that developing more age-friendly environments can result in positive outcomes in older adults emerges from the ecological model of aging (Lawton & Nahemow, 1973), which proposes that outcomes in later life result from the interaction between the competence of older individuals and the press of their environments. The proliferation of age-friendly initiatives reflects a recognition that the traditional long-term care system often fails to account for the social and physical environmental influences on elders. Additionally, surveys documenting the desire of an overwhelming majority of older adults to remain in their own homes and communities for as long as possible (e.g., AARP, 2000) highlight the increased importance of the surrounding environment on health and well-being.

The framework for age-friendly communities used in this study is from the EPA, which combines principles of smart growth (i.e., compact, walkable community design that aims to foster a sense of community and improve public health) with principles of active aging (i.e., opportunities for activities that improve public health) (U.S. EPA Aging Initiative, 2011). The EPA framework organizes characteristics of age-friendly communities into four categories: (1) Staying Active, Connected and Engaged (e.g., social interaction, access to social support, and civic engagement opportunities), (2) Neighborhoods and Housing (e.g., appropriate housing conditions, neighborhood access to services and shopping, neighborhood safety), (3) Transportation and Mobility (e.g., freedom to move around using one's own preferred mode of transport, accessible and convenient public transit), and (4) Access to Healthy Activities (e.g., access to food and recreational activities). As with other age-friendly frameworks (e.g., AdvantAge Initiative), the EPA focuses attention on both community-level characteristics (e.g., existence of public transportation), and individual traits potentially indicative of community characteristics (e.g., access to social support).

While the EPA policy framework has yet to be evaluated holistically, research from a variety of disciplines (e.g., psychology, public health, social work, city planning) documents the beneficial effects of the social and physical environmental characteristics selected for inclusion. In terms of the social environment, for example, social interaction is related to a reduced risk of mortality, higher self-rated health, and fewer depressive symptoms (Antonucci, Fuhrer, & Dartigues, 1997; Uchino, 2004). Further, older adults who have friends and family members living nearby are more likely to receive tangible assistance with errands and other activities of daily living (Fiori, Antonucci, & Cortina, 2006). Volunteering, one aspect of civic engagement, is associated with longer survival (Oman, Thoresen, & McMahon, 1999), lower levels of functional impairment (Lum & Lightfoot, 2005), fewer depressive symptoms (Li, 2007; Morrow-Howell, Hinterlong, Rozario, & Tang, 2003), and better self-rated health (Hinterlong, 2006; Morrow-Howell, et al., 2003).

There is also evidence that supports the relationship between characteristics of the physical environment and outcomes in older adults. As older adults spend a great deal of time in their homes and neighborhoods, the physical infrastructure of the surrounding environment, including the walkability of streets and the supply of shops and services, becomes particularly important. Studies indicate that mixed-use and walkable neighborhoods are associated with an increase in physical activity (Berke, Koepsell, Moudon, Hoskinds, & Larson, 2007), a decrease in limitations in instrumental activities of daily living (Freedman, Grafova, Schoeni, & Rogowski, 2008), and fewer symptoms of depression (Berke, Gottlieb, Moudon, & Larson, 2007). Alternatively, Balfour and Kaplan (2002) report that older adults living in neighborhoods with multiple problems, such as excessive noise, poor lighting, or heavy traffic, have a higher risk for functional limitations than those living in neighborhoods without these problems. Driving is the overwhelmingly preferred mode of transportation among older adults (Burkhardt, McGavock, & Nelson, 2002; Rudman, Friedland, Chipman, & Sciortino, 2006), and those who are no longer able to drive experience loneliness (Johnson, 1998), decreased social interaction (Mezuk & Rebok, 2008), and a decline in well-being (Siren, Hakamies-Blomqvist, & Lindeman, 2004). Additionally, about 1/3 of older adults do not have public transit in their communities (Rosenbloom and Herbel, 2009), limiting the ability of those who stop driving (or never started) to access goods, services, and social connections in the community. The majority of studies exploring food access indicate that individuals with access to supermarkets and grocery stores eat healthier than those who depend on other stores (i.e., convenience stores) for food (Bodor, Rose, Farley, Swalm, & Scott, 2008; Moore, Diez-Roux, Nettleton & Jacobs, 2008; Morland, Wing, & Diez Roux, 2002). Additionally, White and colleagues (2010) found that older adults who do not live near parks are less likely to participate in social and recreational activities.

Although age-friendly community frameworks typically do not discuss the potentially unique needs of specific segments of the elderly population, a great deal of research indicates the existence of disparities in health, well-being, and aging in place among older adults. For example, a higher percentage of older African Americans experience limitations in activities of daily living (ADLs) (Dunlop, Song, Manheim, Daviglus, & Chang, 2007) and poorer self-rated health (Cagney, Browining, & Wen, 2005) than their White counterparts. These disparities in health and functioning result, in part, from differences in income and education levels between these two racial groups (Fuller-Thompson, Nuru-Jeter, Minkler, & Guralnik, 2009). There is also evidence that African Americans and those with low SES experience an increased risk of nursing home placement (Feng, Fennell, Tyler, Clark, & Mor, 2010), suggesting that they are less likely to age in place. This evidence raises questions regarding whether the presence or absence of age-friendly characteristics could also contribute to disparities in health, well-being, and the ability to age in place. While the EPA policy framework is supported by previous research reviewed in the previous section, to date there are no widely-accepted measures of the characteristics of age-friendly communities. Recognizing that the EPA policy framework for the characteristics of an age-friendly community presents a set of categories, as opposed to a set of theoretically-informed or empirically-validated latent variables, we selected an exploratory factor analysis approach as an initial step towards measuring age-friendly community characteristics. We argue that because the EPA has already developed a policy framework, social science first needs a focused response regarding measurement, before analyzing the association to potential outcomes, to prevent the premature institutionalization of policies without sufficient empirical justification. Because many existing age-

friendly frameworks (including the EPA's) do not explicitly take into account the potentially unique needs of older adults from diverse backgrounds with limited financial resources, we used a representative sample of elders living in the city of Detroit, most of whom were African Americans with low incomes. Finally, given the current limited funding climate, we used data from existing sources to provide social work scholars, practitioners, and policymakers with an example of a cost-effective approach to conducting research on age-friendly communities.

METHODS

As an initial step towards measuring and understanding the effects of age-friendly community characteristics, we conducted an exploratory factor analysis (EFA) of items reflecting the EPA framework. The study received human subject approval from the institutional review boards of the University of Michigan and Wayne State University.

Sample and Data Collection Procedures

Data for the EFA came from the Detroit City-Wide Needs Assessment of Older Adults collected by the Wayne State University Center for Urban Studies (Chapleski, Massanari & Herskovitz, 2002). The needs assessment sample was drawn from a sample of non-institutionalized persons aged 60 years or older who resided in the City of Detroit. The needs assessment sample 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 was majority African American and had fewer socioeconomic resources than the older U.S. population as a whole (U.S. Census Bureau, 2002; Bishaw & Iceland, 2003).

Details about the data collection procedures for the Detroit needs assessment were reported elsewhere (Chapleski et al., 2002). Briefly, data were collected during 2001 via telephone interviews, with a 54% response rate, from a stratified random digit dialing sample of 1,310 older adults and via in-person interviews with 100 older adults living in census tracts with telephone coverage of 84% or lower. The stratified sampling frame for the RDD sample was based on ten city-designated neighborhood planning clusters. For the current analyses, we deleted seven respondents who were not living in the city of Detroit and one whose address was listed only as 'Detroit'. We also deleted 26 respondents with missing data for the outcome variables we plan to use for future analyses (i.e., self-rated health and expectation to age in place). We present descriptive statistics for the final sample of n=1,376 in Table 1.

We combined data from the needs assessment with business and service location data, for the first quarter of 2001, purchased from Dun & Bradstreet. This is the best source of proprietary business data because the U.S. government uses the Dun & Bradstreet unique identifier (DUNS number) for all grants and contracts. These data have been used previously for research on business (Audia & Freeman, 2006), non-profit organizations (Bielefeld & Murdoch, 2004) and health (Wang, Gonzalez, Ritchie & Winkleby, 2006). We also used public data from the Detroit Department of Transportation and the Southeast Michigan Council of Governments to identify the location of bus stops and parks, respectively. The business data and public data were organized and geocoded in ArcGIS 10 (Beyer, 2011). Geocoding is a procedure that assigns place data to an observation (in this case, a latitude and longitude to the street address of respondents). We used a buffer drawn 400 meters around each respondent's address to calculate the number of amenities (e.g., parks, bus stops) within walking distance. Four hundred meters has been used in previous studies as a reasonable walking distance for older adults (Satariano et al., 2010).

Table 1. Unimputed Sample Characteristics

Demographic Characteristics	**%/Mean (*N*=1376)**	**% Missing**
Female	70.64	0
Race/Ethnicity		
White	13.76	1.23
African American	81.09	
Other	5.15	
Education		
No high school diploma	40.84	1.23
High school graduate	23.91	
Some college or higher	35.25	
Household income <$20K	55.25	21.73
Age	71.62 (range: 60-97)	1.74
Health Characteristics		
Self-Rated Health		
Poor	8.72	
Fair	23.84	
Good	31.76	0
Very Good	27.11	
Excellent	8.58	

Measures

Table 2 presents details on the measures included in the EFA and their distribution in this sample of elders.

Staying active, connected and engaged. We selected nine items from the needs assessment data indicative of individual's social relationships and participation, which, in turn may reflect the community's social environment. These included questions about feeling close to family and friends, frequency of contact with family and friends, whether the respondent lived alone, anticipated support (i.e., short-term, long-term, and emergency assistance), and satisfaction with support. We also used two items from the needs assessment related to community engagement: fre-

quency of participation in community groups and frequency of participation in volunteer activities.

Neighborhoods and housing. The eight items within this category included a GIS analysis of business contact data and survey items from the needs assessment. We created three items related to access to business and services within 400-meters of the respondent's home address: 1) the total number of any businesses or services, 2) health care services, and 3) mental health services. We also selected three additional items from the needs assessment: whether the respondent 1) lived in a single-family home; and 2) reported feeling safe alone in the surrounding neighborhood during the day; and 3) reported feeling safe at night. The needs assessment also included questions about housing problems (e.g., inadequate heat in winter, non-working or leaking toilet) and neighborhood problems (e.g., heavy traffic, abandoned buildings). Based on these responses, we created count variables that ranged from 0 to 10 and 0 to 9, respectively.

Transportation and mobility. We included two items for the transportation and mobility category. First, using data from the department of transportation, we created a variable of the total number of bus stops within a 400-meter buffer of the respondent's residence. Second, the needs assessment asked respondents to indicate if driving their own vehicle was their primary mode of transportation.

Access to healthy activities. We included two items to reflect respondents' access to healthy activities: 1) the number of grocery stores within 400 meters and 2) the number of parks within 400 meters.

Table 2. Measures and Distribution of Potential Aging in Place Items (*N*=1376).

	Measures										
Potential Aging in Place Item	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Staying Active, Connected and Engaged											
Feels close to friends and family	No	Yes									
(% Missing: 0.29)	9.33	90.67									
Talks or visits with friends and family	Never	Rarely	Few ×/ Yr	Monthly	Few ×/ Mo	1×/ Wk	Few ×/ Wk	Daily			
(% Missing: 0.44)	9.34	1.53	1.68	2.48	7.59	10.73	27.66	38.98			
Lives alone	No	Yes									
(% Missing: 0.22)	57.83	42.17									
Someone would help for short period of time	No	Yes									
(% Missing: 2.40)	6.63	93.37									
Someone would help for long period of time	No	Yes									
(% Missing: 14.90)	18.87	81.13									
Someone would help in an emergency	No	Yes									
(% Missing: 1.00)	4.41	95.59									
Satisfaction with support		Very Dissatisfied	Somewhat Dissatisfied	Somewhat Satisfied	Very Satisfied						
(% Missing: 0.73)		5.20	3.81	20.20	70.79						
Frequency of participation in community groups	Never	Rarely	Few ×/Yr	Monthly	Few ×/Mo	1×/Wk	Few ×/Wk	Daily			
(% Missing: 0.36)	71.99	1.31	2.55	10.58	3.72	4.08	4.16	1.60			
Frequency of participation in volunteer activities	Never	Rarely	Few ×/Yr	Monthly	Few ×/Mo	1×/Wk	Few ×/Wk	Daily			
(% Missing: 0.73)	70.35	1.10	2.86	3.37	5.86	4.90	7.76	3.81			

	Measures										
Potential Aging in Place Item	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Neighborhood and Housing											
Total number of business-es/services within 400 m	21.57										
Total number of health svc within 400 m	1.52										
Total number of mental health svc within 400 m	0.12										
Lives in a single-family house	No	Yes									
(% Missing: 0.94)	29.49	70.51									
Count of housing problems	0	1	2	3	4	5	6	7	8	9	10
(% Missing: 6.25)	35.74	21.24	13.49	9.15	4.96	3.80	3.33	2.40	2.87	2.48	0.54
Feels safe alone in neighborhood during day		Very Safe	Somewhat Safe	Somewhat Unsafe	Very Unsafe						
(% Missing: 0.58)		57.09	34.36	5.04	3.51						
Feels safe alone in neighborhood at night		Very Safe	Somewhat Safe	Somewhat Unsafe	Very Unsafe						
(% Missing: 4.14)		28.05	32.37	22.82	16.76						
Count of neighborhood problems	0	1	2	3	4	5	6	7	8	9	
(% Missing: 8.87)	22.25	22.81	18.34	11.88	7.50	7.66	5.34	2.79	1.20	0.24	
Transportation and Mobility											
Drives own vehicle as primary mode of transportation	No	Yes									
	39.31	61.13									
Total number of bus stops within 400 m	14.23										
Access to Healthy Activities											
Total number of grocery stores with-in 400 m	1.04										
Total number of parks within 400 m	0.85										

Analytic procedures

Prior to conducting the EFA, we imputed missing data from the needs assessment (See Tables 1 and 2 for the percent missing) using Multiple Imputation with Chained Equations (MICE) to preserve sample size and statistical power. The percent missing for each of the items in these data were generally low, and the item with the largest amount of missing data (household income) was approximately 22%, and therefore within the recommended range of missing values for imputation (Scheffer, 2002). We replicated our exploratory factor analysis across each of five imputed data sets. Although we present results for one selected imputed data set, the factor structure and individual item loadings were consistent across each imputed data set.

We used EFA to begin to develop a parsimonious set of measures of age-friendly community characteristics, using items informed by the EPA's framework. Exploratory factor analysis brings together intercorrelated variables into a reduced number of variables that reflect underlying constructs and can be used in future analyses (Rietveld & Van Hout, 1993). EFA can address multicollinearity in regression models by combining correlated variables into one factor and using orthogonal rotation to create uncorrelated factors by construction. Furthermore, factor analysis can convert binary and polytomous variables to continuous variables to aid in interpretation of a complex model.

Our approach follows the literature in sociology (e.g. Massey & Denton, 1988; Massey, White & Phua, 1996; Sampson, Raudenbush & Earles, 1997), policy, planning and urban studies that use factor analysis for the purpose of data reduction to understand neighborhoods (e.g. Chow, 1998; Cutsinger & Galster, 2006; Oh, 2003). We decided to use only EFA at this stage because, while we did have an organizing framework to guide our selection of items to include, we did not have a strong a priori theory regarding the underlying structure of our data (Henson & Roberts, 2006). In general, methodologists and statisticians recommend EFA for pilot studies and other situations in which there is no developed theory (Nunnally & Bernstein, 1994; Bandalos & Finney, 2010). Indeed, Kline (2010) notes that confirmatory factor analysis (CFA) may only be used if there is an a priori measurement model that contains testable hypotheses.

Table 3. Factor item loadings, communalities, and percentage variance explained by the EFA.

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	h^2
Factor 1: *Access to Business and Leisure*							
Total number of bus stops within 400 m buffer	0.931						0.88
Total number of businesses/services within 400 m	0.921						1.00
Total number of grocery stores within 400 m	0.527						0.28
Total number of parks within 400 m	0.419						0.20
Factor 2: *Social Interaction*							
Feels close to friends and family		0.895					0.84
Talks or visits with friends and family		0.851					0.77
Factor 3: *Access to Health Care*							
Total number of health svc within 400 m			0.857				0.79
Total number of mental health svc within 400 m			0.787				0.68
Factor 4: *Neighborhood Problems*							
Feels safe alone in neighborhood at night				0.640			0.45
Feels safe alone in neighborhood during the day				0.592			0.37
Count of neighborhood problems				0.552			0.33
Count of housing problems				0.441			0.21
Factor 5: *Social Support*							
Someone would help for short period of time					0.698		0.50
Someone would help for long period of time					0.615		0.41
Someone would help in an emergency					0.481		0.25
Factor 6: *Community Engagement*							
Frequency of participation in community groups						0.643	0.42
Frequency of participation in volunteer activities						0.553	0.31
Percentage variance explained	13.43	9.21	9.13	7.71	6.94	4.55	50.96

We employed standard criteria from the literature on conducting exploratory factor analysis (Costello & Osborne, 2005; 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. Weights were not used in the EFA because the weighted, constructed variables will be used in bivariate and multivariate tests. Finally, we conducted t-tests and correlations using sample weights to examine the bivariate associations of the six factors to demographic and health variables. These show how different subgroups in our sample fall in the distribution of these measures of age-friendly communities. All statistical analyses were conducted using SPSS 19, except the imputation, which was performed in Stata 11.

RESULTS

We retained six factors from the EFA that have strong face validity and met our criteria described above (see Figure 1 for a scree plot of the eigenvectors). Four items did not have rotated loadings greater than or equal to .4 ("lives alone", "lives in a single-family home", "drives as primary mode of transportation", and "satisfaction with support"), so we removed these items from the final analysis. We named the six factors: 1) *Access to Business and Leisure,* 2) *Social Interaction* 3) *Access to Health Care*, 4) *Neighborhood Problems*, 5) *Social Support*, and 6) *Community Engagement*. See Table 3 for the all of the factor item loadings, communalities, and percentage variance explained by the EFA.

Table 4. Bivariate Statistics (*n*=1386)

Variable Above Reference Group	Parameter	Access to Business and Leisure	Social Interaction	Access to Health Care	Neighborhood Problems	Social Support	Community Engagement
Gender							
Female	Mean Diff.	-0.01	0.29	-0.03	0.14	0.01	0.06
Male	t	-0.15	4.81 **	-0.60	2.87 **	0.24	1.48
	Sig. (2-tailed)	0.88	0.00	0.55	0.00	0.81	0.14
Race/Ethnicity							
African American	Mean Diff.	-0.01	0.14	-0.01	-0.13	0.15	0.08
White/Other	t	-0.12	1.97 *	-0.20	-2.18 *	2.26 *	1.52
	Sig. (2-tailed)	0.90	0.05	0.84	0.03	0.02	0.13
Education							
Some college or higher	Mean Diff.	0.03	0.06	-0.08	-0.02	-0.04	0.41
High School or Less	t	0.63	1.18	-1.72	-0.41	-0.93	9.58 **
	Sig. (2-tailed)	0.53	0.24	0.09	0.68	0.35	0.00
Socio-Economic Status							
Income < $20,000	Mean Diff.	-0.02	-0.05	0.19	0.17	-0.17	-0.22
Income >= $20,000	t	-0.37	-0.95	4.24 **	3.96 **	-4.12 **	-5.46 **
	Sig. (2-tailed)	0.71	0.34	0.00	0.00	0.00	0.00
Age							
Range: 60-97	Pearson Correlation	0.08 **	-0.04	0.05	-0.06 *	-0.06 *	-0.03
	Sig. (2-tailed)	0.00	0.11	0.07	0.02	0.02	0.29
Health							
Self-Rated Health	Pearson Correlation	-0.02	0.01	0.03	-0.13 **	0.12 **	0.16 **
Range: 1 to 5	Sig. (2-tailed)	0.51	0.69	0.23	0.00	0.00	0.00

*Note 1: * p<0.05; **p<0.01*

Three of the factors related to the respondents' physical environments. *Access to Business and Leisure* reflected proximity to stores and amenities, and was comprised of the following: "total number of bus stops," "total number of any businesses," "total number of grocery stores," and "total number of parks." *Access to Health Care* was made up of the "total number of health services" and "total number of mental health services". Items in the *Neighborhood Problems* factor included "feels safe alone in neighborhood during the day" (reverse coded), "feels safe alone in neighborhood at night" (reverse coded), "count of neighborhood problems," and "count of housing problems." The other three factors reflected the individual's social environment. *Social Interaction* included the items "feels close to friends and family" and "talks or visits with friends and family." *Social Support* included three items: "someone would help for short period of time," "someone would help for long period of time," and "someone would help in an emergency." *Community Engagement* consisted of two measures: the "frequency of participation in community groups" and the "frequency of participation in volunteer activities."

The four-factor solution was analyzed for face validity as an alternate specification, because the scree plot had an elbow at two places. If constrained to four factors, *Social Support* and *Community Engagement* exited the model, even though the item loadings for those factors are above .32. Because social support and community engagement are central to the concept of age-friendly communities, we decided to keep those factors and use the six-factor solution.

The results of the bivariate analysis, in which factors are examined in relation to demographic characteristics, are found in Table 4. Women in this sample reported more social interaction and more neighborhood problems than men. African Americans reported more social interaction and social support, but fewer neighborhood problems than those in the White/Other racial category. Elders with some college or higher reported more community engagement than those with lesser educational attainments. While low-income households had more access to health care, those households also had more neighborhood problems, less social support, and less community engagement.

DISCUSSION AND CONCLUSION

This exploratory factor analysis identifies six potential measures of age-friendly community characteristics reflecting the social and physical environment concepts included in the EPA's policy framework. There is a call for social work researchers to revisit the influence of the environment in order to understand the relationship between the social and physical community characteristics and individual outcomes, such as child maltreatment, educational, and health outcomes (Coulton, 2005; Freisthler, Gruenewald, Lery & Chow, 2006; Hillier, 2007; Grogan-Kaylor, et al., 2007; Holland, Burgess, Grogan-Taylor, & Delva, 2011; Kemp, 2011). We believe that social work researchers should also play a major role in developing an evidence base of the impact of age-friendly communities on older adults. This article is an initial step towards measuring this concept. One of the first articles describing age-friendly communities was in a social work journal (Alley et al., 2007) and social work scholars have been integral in the conceptualization of this intervention for health, well-being, and aging in place (e.g., Scharlach, 2009). In order to understand more about the trade-offs between investing in individual elderly persons versus investments in the built and social environment, it is critical to conduct further research using factors derived from geospatial information as potential explanatory variables.

While the idea of making communities more age-friendly to promote elder health, well-being, and the ability to age in place has received an increasing amount of attention from governments, organizations, and scholars over the past decade, the empirical literature remains scarce. There are a number of barriers to conducting rigorous research on age-friendly communities, including the absence of environmental measures from many existing data sets, the existence of multiple age-friendly frameworks and guides, and the large number of social and physical environment features proposed to comprise an age-friendly community. Our study presents an example of a cost-effective approach to conducting research on age-friendly communities by using previously collected needs assessment data. While the needs assessment data included limited questions on respondents' surrounding environment, we were able to combine this with data collected by governments and Dun & Bradstreet on the location of businesses and amenities. The EFA resulted in six factors that do not match up entirely with the EPA framework, yet reflect many features of the social and physical environment identified as age-friendly by the EPA, as well as the WHO, AdvantAge Initiative, AARP, and others. Our hope is to begin a research trajectory that will clarify the essential elements of an age-friendly community that may be applicable for future research across populations and contexts, with the ultimate goal of developing reliable and valid measures that reflect a universally-accepted age-friendly community framework.

Results from the EFA (as well as future analyses on the relationship between these factors and elder outcomes) should be replicated using a more nationally-representative sample of older adults. Our current focus, however, is on understanding the influence of age-friendly characteristics on those at a high risk of poor health and well-being as they age. In general, African Americans experience higher levels of segregation than Hispanics and Asians (Massey, White, & Phua, 1996) and segregation is associated with poor health outcomes (Kramer & Hogue, 2009). Our sample comes from a Midwestern central city that has been experiencing population decline with only piecemeal redevelopment. The metropolitan area is also characterized by racial residential segregation, and in 2000 over 81% of the city's population was African American, while nearly 85%

of those living in nearby suburbs were White (Michigan Metropolitan Information Center, nd). Since the civil rights movement of the 1960s, the city has enjoyed African American political representation. Our bivariate findings show that African Americans have more social interaction and social support, and fewer neighborhood problems than respondents in other racial categories. This suggests a potential advantage in terms of these age-friendly characteristics. A plausible explanation from the literature is that African Americans in this sample are empowered socially and politically by living in clustered African American neighborhoods (Kramer & Hogue, 2009). While findings from the EFA and future analyses may not be generalizable to the entire elder population of the United States, they are relevant to elders living in cities (or neighborhoods within cities) that are also characterized by high poverty, low educational attainment, high crime, a majority African American population, high unemployment, declining population, and low property values. In contrast, studies in majority White communities may find that White elders report higher levels of social interaction and social support, and fewer neighborhood problems than in this sample.

Phillipson (2007) notes that while some older adults have the necessary resources to choose where they live, others are aging in place in neighborhoods undergoing a rapid transformation in residents and businesses. In our sample, bivariate analyses provided preliminary evidence that older adults with low incomes have less social support or community engagement and are living in communities characterized by more neighborhood problems. These findings may be due to a pattern of disinvestment and gentrification, as neighborhoods declining in value are redeveloped in ways that change the character of the community by attracting younger and higher income residents (Lees, Slater, & Wyly, 2007). This in turn can change the social environment by disrupting social cohesion, a potential protective factor for health (Jacobs, 1992). Gentrification also changes the market of retail establishments and social services in order to appeal to a changing culture. Because redevelopment has a ripple effect on rents, it can also price out people and organizations seeking better real estate in their own neighborhoods. Social service agencies for elders may be entrapped and unable to expand (DeVerteuil, 2010). Likewise, elders may be "stuck-in-place" (Torres-Gil & Hofland, 2012) due to constraints on income and on the supply of affordable, accessible housing. That is, even without the presence of age-friendly community characteristics (e.g., access to business and leisure, social interaction, and few neighborhood problems), low SES elders may be aging in place because they are unable to relocate to a neighborhood that can better meet their needs. Future research should examine variations in age-friendly characteristics and aging in place across different contexts, focusing not only on the potential deficits of neighborhoods, but also on the strengths, assets, and resilience of systems in the social and physical environment.

This study has the following limitations that should be addressed in future research. First, we relied on secondary data that was not initially designed to measure aging-friendly community characteristics. The items we selected may not entirely capture all relevant aspects of the social and physical environment. For example, although walkable neighborhoods, characterized by connected street networks that support walking to a variety of destinations (Frank et al., 2003) may be an important component of transportation and mobility, we were not able to include these data. The EPA framework reflects observable community and individual characteristics. Furthermore, some of the items included in the EFA, particularly in terms of social interaction, social support, and community engagement, are measures of individual respondents rather than characteristics of their communities. In part, this reflects the EPA framework and other characteristics that have been proposed in the literature (e.g., Alley et al., 2007). Future research should distinguish individual-dependent from community-dependent age-friendly characteristics and differences found in other age-friendly frameworks (e.g., WHO) in an effort to develop universal age-friendly measures. To address challenges of assessing the social environment using existing data, future research should incorporate emerging techniques to measure the community, such as the collection of ancillary data from community residents not included in the study sample (Sanchez, Raghunathan, Diez- Roux, & Lee, 2008). Our study does demonstrate how the combination of existing data from multiple sources, including public aging services, city transportation departments, and business data providers, can be used in research on age-friendly communities. Second, there are some concerns regarding the use of binary variables in the factor analysis. The consequences of this decision are unknown, and inclusion of binary variables is acceptable if the "underlying correlation" of the variables are less than 0.60 (Kim & Mueller, 1978). Our use of dichotomous or polychotmous variables was justified because they were not highly correlated under the assumption that the latent variable was continuous and had a tetrachoric correlation (Bandalos & Finney, 2010; Kim & Mueller, 1978). Finally, because the emerging field of age-friendly communities is still in theoretical development, we followed literature in sociology, policy, planning and urban studies (e.g. Sampson, Raudenbush & Earles, 1997) and conducted an EFA. We did not follow up with a confirmatory factor analysis (CFA) because our primary purpose is data reduction and not testing specific hypotheses about the factor structure of a model. For researchers interested in following up with hypotheses about mediating and moderating variables, future research should design data collection with a sufficient sample size to allow for CFA because EFA is a data driven approach based on the correlation matrix.

These limitations notwithstanding, to our knowledge, this article is one of the first attempts to operationalize and measure age-friendly community characteristics. In this

representative sample of Detroit elders, the majority of which were African American and a disproportionate number of which were low income, the EFA suggests that a combination of items from individual level needs assessment data and public and business location data can be used to measure concepts reflecting the EPA policy framework. Our immediate next step is to examine the effects of these measures on elder outcomes in this sample, such as self-rated health and considering aging in place. Our future goals are to explore the effects over time and across contexts.

ACKNOWLEDGEMENTS

We would like to acknowledge Dr. Anne Hughes and Dr. Amanda Woodward from Michigan State, Dr. Letha Chadiha of the University of Michigan School of Social Work for her comments on a draft and our statistical consultant, Ms. Giselle Kolenic of the UM Center for Statistical Consultation and Research.

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