Examining Neighborhood Effects Among Survivors of Health-Related Events

by

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Abstract

To date, scientists have examined how neighborhoods impact health related to mental illness (Hurd, Stoddard, & Zimmerman, 2013), obesity rates (Pruchno, Wilson-Genderson, & Gupta, 2014), and cancer rates (Beyer, Malecki, Hoormann, Szabo, & Nattinger, 2016). Studies have revealed that neighborhood disadvantage predicts stroke risk and incidence (Brown et al., 2011) and increases incident of ischemic stroke (Boden-Albala et al., 2012). The purpose of this project is to examine the moderating effects of neighborhood socioeconomic disadvantage in the relationship between stroke and activities of daily living (ADL). This study employs a longitudinal design with data from the Midlife in the United States (MIDUS) study. MIDUS began in 1994 and is a national longitudinal study of health and aging that includes a wide range of measures, including medical history, health status, physical limitations, demographic variables related to socioeconomic status, social support, employment status, health care utilization, as well as additional variables. Data from waves 1 and 2 are used in this analysis. Results support the hypothesis that neighborhood disadvantage identified through low SES moderates the relationship between stroke and ADLs and these findings remain consistent when introducing competing moderators and their interactions. Findings support the need for continued neighborhood-level support for individuals re-entering their communities following a stroke. In addition, findings imply the need for more informed public policy that will support neighborhood environments for sustained rehab outcomes.

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Introduction

In the United States each year, 140,000 people die from a stroke (CDC, 2017). In addition, ischemic stroke is the leading cause of serious long-term disability worldwide, often leading to diminished physical mobility, cognitive linguistic functioning, safety awareness, dysphagia, and reduced ability to carry out functional home and community tasks (i.e. driving, cooking, employment) (American Heart Association, 2017).

Across several disciplines including psychology, epidemiology, and sociology, characteristics of neighborhoods have been examined as predictors of stroke. Neighborhoods often serve as a resource that may either cause risk and/or provide protective factors against various outcomes. Neighborhoods may provide a sense of cohesion and space and is made up of physical characteristics related to physical structure (i.e. sidewalks or public transportation), as well as population composition, such as age groups and ethnicities. Neighborhoods have been operationalized in the literature as: (a) neighborhood perception—ones' opinion on neighborhood aesthetics, transportation, and resources (Hoeher et al., 2005); (b) black-white residential segregation (Grady, 2006); neighborhood characteristics (Mair et al., 2008); and, (c) neighborhood deprivation relating to neighborhood characteristics such as education, employment, occupation, and/or income, to name a few (Vos, Posthumus, Bonsel, Steegers, & Denktaş, 2014). Additionally, (d) neighborhood socioeconomic disadvantage has been examined in the literature as a composite related to level of education, household income, poverty line, and public assistance (Fuller-Rowell et al., 2016). The expansion of how neighborhoods are operationalized in the literature allowed for new relationships to be analyzed. To date, scientists have examined how neighborhoods impact health related to mental illness (Hurd, Stoddard, &

Zimmerman, 2013); obesity rates (Pruchno, Wilson-Genderson, & Gupta, 2014); cancer rates (Beyer, Malecki, Hoormann, Szabo, & Nattinger, 2016); mortality rates (Mode, Evans, & Zonderman, 2016); child health outcomes (Madkour, Harville, & Xie, 2014), as well as general health outcomes (Keita et al., 2014).

Neighborhood factors are established predictors of stroke. Factors such as neighborhood disadvantage predicts stroke risk and incidence (Brown et al., 2011) and has also revealed that neighborhood disadvantage is associated with incident of ischemic stroke (Boden-Albala et al., 2012). Additional studies have identified that high levels of neighborhood social cohesion serve as a protective factor against stroke risk (Kim, Park, & Peterson, 2013), while other studies have revealed that lower socioeconomic (SES) neighborhoods are associated with greater stroke risk particularly for men and individuals over the age of 75 (Lisabeth, Diez Roux, Escobar, Smith, & Morgenstern, 2007). Some neighborhood factors have also been linked to a variety of stroke risk factors related to health behaviors such as physical activity (Lenhart, Wiemken, Hanlon, Perkett, & Patterson, 2017; Stimpson, Hyunsu Raji, & Eschbach, 2007); smoking (Stimpson, Hyunsu Raji, & Eschbach, 2007); diabetes (Queen et al., 2017); and obesity (Alvarado, 2016). Other studies have addressed the connection between SES, stroke treatment, rehabilitative care, and mortality rates (Kapral, Wang, Mamdani, & Tu, 2002). However, few studies have examined the impact of SES on stroke following hospital rehabilitation and community reentry. Furthermore, we know very little about long-term outcomes of individuals who return home after hospitalization with respects to how their neighborhood may or may not support their recovery and new level of functioning and or reduced independence.

Neighborhood deprivation, operationalized here as low neighborhood socioeconomic status, or “neighborhood disadvantage” may only partially influence the relationship between stroke and activities of daily living (ADL). There may be person specific factors and traits such as additional comorbidities, or specific health behaviors such as a physical activity and smoking, that may be equally, or even more influential in better understanding profile traits that are more susceptible to deleterious long term outcomes (Stimpson, Hyunsu Raji, & Eschbach, 2007. For example, a study conducted by Ward, Wiesman, Davis, Reveille, 2005 discovered that smoking increased risk for poor ADLs in patients with ankylosing spondylitis arthritis. Physical activity has been held as a significant protective and preventive factor against progressive decline in ADLs however, few studies have examined how physical activity may mediate the relationship between stroke and ADLs (Tak, Kuiper, Chorus, & Homan-Rock, 2012). Stroke research over the decades has helped to identify stroke risks, with one of the most significant risk factors being additional chronic health conditions. The correlation between stroke and existing comorbidities or chronic health conditions such as diabetes and cardiovascular disease is significant and has been well studied (CDC, 2018). However, examining how the number of comorbidities influences a stroke survivors' ADLs over time has revealed a negative correlation and yet the relationship is not well understood (Karatepe et al., 2008).

Examining the role of community of residence, more specifically the role of SES and community level income disadvantage in stroke recovery may be significant for a few reasons. In particular, findings may inform policy decisions that help to improve stroke recovery by addressing neighborhood disadvantage, which may lead to a reduction of healthcare costs via a reduction in rehospitalization rates. In addition, examining the neighborhood as contextual factors may help us to better understand underlining mechanisms and intervention points. For example, some potential pathways that may explain how communities influence stroke recovery may include access to and community availability of resources for improved physical activity

(Rimmer, Wang, & Donald Smith, 2008), access to quality food sources within communities (Morgenstern et al., 2009), access to public transportation, availability of adult day care programs, and access to quality healthcare (Kitzman, Hudson, Sylvia, Feltner, & Lovins, 2017). Additional neighborhood mechanisms that may be associated with SES could be related to under development of a variety of skilled care options such as, assisted living and skilled care facilities as well, as reduced access to home healthcare services. Other models have examined how community characteristics have influenced recovery of other specific diseases such as breast cancer (Schootman, Deshpande, Pruitt, & Jeffe, 2012) however, few have investigated the links between role of neighborhood level characteristics in stroke recovery with regards to ADLs. We are not aware of any studies that have examined neighborhood disadvantage as a predictor of change in ADLs following a stroke.

The primary aim of this study is to evaluate neighborhood socioeconomic disadvantage as a moderator of the association between stroke occurrence and subsequent changes in ADLs. We predict that individuals who have suffered a stroke and reside in neighborhoods that are characterized as lower SES are more likely to experience reductions in levels of basic ADLs.

Methods

Data and sample

Statistical analysis was conducted using data from the Midlife in the United States (MIDUS) study. MIDUS is a national longitudinal study of health and aging that includes a wide range of measures, including medical history, health status, physical limitations, demographic variables related to socioeconomic status, social support, employment status, health care utilization, as well as additional variables. Participants included adults between the ages of 25 and 74. At MIDUS 1 (T1), which began in 1995 with 7000 non-institutionalized adults from across the U.S., questionnaires and phone interviews were administered. MIDUS 2 (T2) began 2004, with 75% retention of MIDUS 1 participants. At the T2 assessment, an oversample of African Americans (AA) from Milwaukee, WI ($N = 592$) was also recruited to increase AA representation and to allow for examination of racial health disparities. In addition, MIDUS 2 expanded assessments to include cognitive, biomarker, and neuroscience measures. MIDUS 1 and 2 have been used in the present analysis. A longitudinal and cross-sectional analysis was conducted simultaneously across one sample ($N = 4,963$). The analysis was conducted using wave 2 (2004-2009) excluding the Milwaukee oversample and wave 1. The inclusion criteria for the stroke group consisted of individuals who responded "yes" to the following item: "In the past 12 months have you experienced or been treated for any of the following: Stroke?" ($n = 47$). Demographic information for each subsample is provided in Table 1. For the purpose of obtaining demographic information the sample used in the final analysis was divided into a main and subsample for the purpose of comparing demographic information across stroke versus non-stroke group. The stroke sample consists of 48% females and 51% males between the ages of 43 to 83. The sample included 10% AA and 85% European Americans (EA). The non-stroke group ($n = 3,994$), (comparison sample) consisted of 55% females and 45% males, with 90% EA and 4% AA, and ranged in age between 30 and 84 years of age. A longitudinal analysis was conducted using data from T1. For longitudinal analysis participants at T1 were identified using the same inclusion criteria from the cross-sectional analysis with basic activities of daily living measured at T2 (10 years later).

Measures

Stroke.

At T1 and T2 assessments, participants were asked “In the past 12 months have you experienced or been treated for any of the following “Stroke?” (coded as Yes = 1, No= 0).

Neighborhood Socioeconomic Disadvantage.

For the purpose of this study, neighborhood socioeconomic disadvantage was defined using census tract socioeconomic characteristics. These characteristics were geocoded by linking participant home address at the time of data collection to tract-level data from 2000 US census. An aggregate variable was created as the mean of five standardized neighborhood level economic characteristics: percent of residents below poverty line, percent on public assistance, percent with highest level of education less than high school graduation, median household income (reverse-coded), percent with highest level of education of four-year college degree or more (reverse-coded). These items were highly correlated (r’s between 0.43 and 0.82) with a highly reliable composite scale (α = 0.91) (Fuller-Rowell et al., 2016). Similar indexes of neighborhood disadvantage has been used in previous research (Brody et al., 2001).

Basic Activities of Daily Living.

Self-administered questionnaire items assessed basic activities of daily living (BADL). At T1, participants were asked “how much does your health limit you in doing each of the following?”: Bathing or dressing yourself, walking one block. At T2, an additional item was added—climbing one flight of stairs. For this analysis, only the initial two items were used from both T1 and T2 waves. In both waves, the response items ranged from 1= *A lot* to 4 = *Not at all*. Items were reverse coded such that higher scores reflect a reduction in ADLs. These items were highly correlated (r = .54) with a reliable composite scale (α = .75). In recent literature, studies have used ADLs to understand how daily physical symptoms predicts chronic conditions and ADLs (Leger, Charles, Ayanian, & Almeida, 2015).

Competing Moderators: Health Behaviors

Physical Activity.

Physical activity levels were examined using a series of questions. Each set of questions were asked across summer and winter seasons to account for change in activity levels due to climate change. Activity levels were categorized across three levels, light, moderate, and vigorous. Light physical activity: How often do you engage in physical activity that requires little physical effort? (e.g. bowling, archery, golfing with a power cart, fishing). Moderate physical activity: How often do you engage in moderate physical activity, that is not physically exhausting but causes your heart rate to increase slightly and you typically work up a sweat? (e.g. light tennis, slow or light swimming, low impact aerobics, golfing without a power cart). Vigorous physical activity: How often do you engage in vigorous physical activity that causes your heart to beat so rapidly that you feel it in your chest and you perform the activity long enough to work up a good sweat and you are breathing heavily? (e.g. competitive sports like running, vigorous swimming). These items were rated on a 6-point Likert-type scale and the response options ranged from never (1) to several times a week (6). A composite variable was created averaging across leisure and household tasks across all three activity levels. The items form a reliable composite scale ($\alpha = .92$) and have been used in previous literature related to physical activity and wellbeing in older adults (Bae, Suh, Ryu, & Heo, 2017).

Smoking.

To assess smoking, all participants were asked "Do you smoke cigarettes regularly NOW?" The interviewer could clarify this question with "By regularly I mean at least a few cigarettes every day.” The response options included “yes”, “no”, “don’t know/not sure”, “refused”.

Control Variables

Control variables included age, sex, race, household income, and number of chronic health conditions at T2. Household income was self-reported annual income. The number of chronic health conditions is a composite variable. Participants indicated if they had experienced or been treated for any chronic health conditions related to autoimmune disorders, cardiovascular disease, hypertension, arthritis, asthma, diabetes, gastrointestinal diseases, liver disease, and cancer. A sum of 11 chronic health conditions was constructed with responses ranging from 0 to 11. Similar measures have been used to examine wellbeing and chronic health conditions (Friedman & Ryff, 2012).

Main Analysis

Main Analysis and Secondary Analysis

A series of multiple linear regression models were estimated in Mplus version 8 (Muthen & Muthen, 2017). Descriptive statics were examined for all measures to check for normality. Z-scores were obtained for all variables and transformations were attempted on the following positively skewed variables: neighborhood disadvantage, household income, and basic activities of daily living. Missing data on all variables were addressed using Full Information Maximum Likelihood (FIML) estimation which is a standard approach to addressing missing data while utilizing all available data and providing unbiased standard errors (Enders, 2010). Between .2 and 19 percent missing data was identified across all main variables (stroke .2%; neighborhood derivation .5%; BADL T1 19%; BADL T2 6.1%).

Three main models were fit to test the original hypothesis. All models controlled for age, sex, race, number of chronic health conditions at T2, household income, and ADLs at T1. Model 1 tested the main effects of stroke on ADLs at T2. Model 2 added the main effect of neighborhood disadvantage. A final main model added the interaction between stroke and neighborhood disadvantage. Finally, secondary analyses was conducted (Models 4 and 5) to examine competing moderators – i.e., to determine whether physical activity and/or smoking accounted for the moderating role of neighborhood disadvantage.

Results

Sample descriptive statistics are provided in Table 1. Correlations were examined to determine if all proposed variables were correlated with the main predictor, stroke, see table 2. Stroke was positively associated with neighborhood disadvantage and household income, and was negatively associated with ADL T1 and T2, physical activity, and smoking.

A preliminary model examined the main effects of stroke on ADLs at T2. Adjusting for age, race, sex, household income, number chronic health conditions at T2, and ADLs at T1, stroke significantly predicted ADLs at T2 ($\beta = 0.69$, $p < .01$). Next, the moderating effects of neighborhood disadvantage was tested while controlling for ADLs at T1 along with age, sex, race, household income, and chronic health condition. The main effects of stroke on ADLs at T2 remained significant, ($\beta = 0.57$, $p < .01$) along with the addition of the main effects of neighborhood disadvantage on ADLs at T2, ($\beta = 0.06$, $p < .01$), see Table 3. An interaction model (model 2) was fit testing the interaction between stroke and neighborhood disadvantage. When controlling for sex, age, race, household income, number of chronic health conditions, and ADLs at T1, the interaction between stroke and neighborhood disadvantage significantly predicts ADLs ($\beta = 0.64$, $p < .001$). In this full interaction model, 27% of the variability in ADLs can be explained by all the predictors in the model, representing a large effect, (R^2 = 27). This is a 1% increase in variance explained in ADLs when compared to the previous model which tested only the main effects of stroke and neighborhood disadvantage. Thus, individuals who have suffered a stroke and reside in lower SES areas experience lower levels of function over time.

In model 3, additional moderators were added to examine and compare additional variables that may influence the relationship between stroke and ADLs. Two health behaviors were added to the model-smoking and physical activity. Results revealed that only physical activity had a significant main effect ($\beta_{smoking}$ = 0.07, p = .08;$\beta_{physical\ activity}$ = 0.07, $p < .001$). A final interaction model examined stroke by smoking and stroke by physical activity. Results revealed no interaction effects between smoking and physical activity ($\beta_{\mathrm{strokeXphysical\ activity}}$ = .2, p = 0.23; $\beta_{\mathrm{strokeXsmoking}}$= -.30, p = 0.45). It should be noted that due to the lack of diversity in the sample, the study is not adequately powered to examine race differences, however, racial differences were tested with no differences found.

Significant interactions were plotted at –1 and +1 *SD* from the mean for levels of neighborhood disadvantage. Interaction plots were examined and compared between the full interaction model and exploratory model with competing moderators and their ADLs in individuals reporting stroke and not reporting stroke was conducted. Figure 1 illustrates the interaction of stroke by neighborhood disadvantage without competing moderators and reveals that for individuals who have suffered a stroke and reside in neighborhoods with lower SES status are likely to experience a greater decline in their ability to carry out ADLs over time. Figure 2 is illustrating the same interaction but in the presence of competing moderators (smoking and physical activity), thus demonstrating the stability in the main interaction effects of stroke by neighborhood disadvantage across models, see figure 1 and 2.

Discussion

Support for our original hypothesis was found. Results revealed that for individuals who reported a stroke in the past 12 months and reside in communities with greater neighborhood economic disadvantage experienced lower levels of ADLs over time. These findings suggest that some of the aforementioned community resources or lack thereof may be at play i.e. lack of home health services, availability of adult day care programs, and limited access to quality food sources. The findings remained consistent when controlling for age, sex, race, number of chronic health conditions, household income and ADLs at T1. Furthermore, neighborhood socioeconomic disadvantage accounted for a substantial portion of variability in ADLs by 27%. Results indicate that neighborhoods play a critical role in long-term functional outcomes for individuals who have suffered a stroke and the findings further illustrate that neighborhoods are dynamic complex resources. Additionally, these findings coincide with current literature on neighborhood effects, its impact on various health outcomes, and further emphasizes the role of neighborhoods as being both protective and causing risk (Brown et al., 2011; Alvarado, 2016).

Exploratory analysis revealed that similar main effects can be observed with other health behaviors related to physical activity. However, the interaction effects between stroke and neighborhood disadvantage was the only significant predictor of ADLs. Based on the current literature and what we already know about the relationship between neighborhood and health outcomes these findings are not surprising, however they raise additional questions and introduce additional means of intervention at the neighborhood level.

Understanding the role of neighborhood disadvantage following hospitalization and one’s ability to continue to make strides in rehabilitation outcomes is a worthwhile research pursuit in that the neighborhood has significant implications and may impact one’s ability to regain basic life skills and functioning. There are few studies that have examined personal contextual factors (i.e neighborhood context, family support) that may promote or impede progress once the individual has returned home. In addition, little is known about how personal attributes such as self-efficacy (one's belief in their ability to succeed) or locus of control (how much of one's current situation is within their control) may interact with stroke and neighborhood to predict long term outcomes related to ADLs (Bandura, 1977; Wallston, Wallston, & DeVellis, 1977). Neighborhood socioeconomic status along with individual factors provide diverse mechanisms that impact stroke recovery. For example, these mechanisms may be related to lack of services due to adult Medicaid restrictions, lack of awareness of services on behalf of the individual, and or reduced referral rates by physicians. However, the aim of this study, was to examine the main effects of stroke on ADLs and determine the degree to which neighborhood disadvantage, measured as socioeconomic disadvantage, moderates the impact of stoke on ADLs over time.

There are several strengths to be noted within this study design. First, objective neighborhood measures were utilized by using census track data resulting in aggregate variable averaged across five neighborhood economic characteristics which provides a detailed account of neighborhood economic factors. Second, pre-stroke assessments of ADLs allowed for a longitudinal measurement of ADLs change over time such that we can make statements about change in individual level of functioning overtime. Third, this novel investigation supports significant implications for healthcare rehabilitation policy that directly influences communities and healthcare providers. As previously stated we understand very little about the long term implications of stroke and its interaction with neighborhood mechanisms, however, the more we can understand about this construct the better we are able to maintain and or improve quality of life for stroke survivors.

The findings from this investigation has significant implications for inpatient rehabilitation programs that strive to have successful long-term community re-entry programs. Such rehabilitation programs will need to have a better understanding of contextual neighborhood factors that may serve as protective and/or risk factors against stability in maintaining and or maximizing rehabilitation potential upon discharge. In addition, these findings may help support clinicians in functional goal setting tasks to increase specificity, measurability, and relevancy (Bovend'Eerdt, T. J. H., Botell, R. E., & Wade, D. T. (2009). Furthermore, evidence is provided for the importance of better communication pathways between hospitals and communities as it pertains to homecare rehabilitation services. As a result of these findings, these communication pathways represent an opportunity for an interdisciplinary stage which may bring together rehabilitation therapist, physicians, hospital administration, community policy makers, and additional stakeholders.

There are a few limitations worth noting. One significant limitation is the small sample size of stroke patients. For more robust statistical power, future studies should seek larger samples. In addition, this sample lacked in diversity, with a majority EA participants. No comparisons nor conclusions could be made about racial differences.

A second limitation is the use of census track data as a means of operationalizing neighborhood disadvantage. Census track data does not necessarily capture the lived experiences of day to day interaction within a community. Future studies may consider the use of multiple measures of neighborhood disadvantage to include more measures of self-reports.

Third, a more comprehensive examination of additional competing moderators could have been examined. For example, illicit substance use, the role of social support, and type of health insurance could prove to be significant moderators. A final limitation is that this study is that this study is based in the Unites States with very unique healthcare practices and model for health insurance and benefits that cannot be generalized to the international community at large. Future research should seek to examine the many facets of a neighborhood to determine which features are most salient in impacting an individual's ADLs over time. For example, are there physical structural environment (e.g. limited sidewalks or public transportation), social barriers, or limitations within the physical environment (e.g. concern for safety or high crime rate) that prohibit continued gains in outcomes? More dynamic research question may address personal attributes such a self-efficacy and locus of control to examine how these might interact with neighborhood and stroke to predict ADLs over time. Including additional moderators that influence ADLs regarding family characteristics such as family dynamics related to caregiving may also help provide better intervention at the level of the caregiver/specific family members. Additionally, exploring more specific rehabilitation outcomes related to the different domains (i.e. occupational, physical, and speech therapy) may uncover some unique findings. For example, examining specific speech therapy outcomes (e.g. swallowing function or cognitive-linguistic skills) when predicted by stroke and neighborhood may uncover valuable findings with significant implications for speech therapy practice and patient outcomes. Overall, the findings and the implications of study has made an important contribution in furthering the conversation and examination of how long-term rehab outcomes can be impacted by contextual factors related to the neighborhood.

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Appendix A-Tables

Table 1. Descriptives of Participants in Main and Comparison Sample

Variables	Main Sample (n = 47) Mean/SD or %	Comparison Sample (n = 3,994) Mean/SD or %
Age	68/10.39	56/12.34
Female	48%	55%
Male	51%	44%
European American	85%	90%
African American	10%	4%
Other	2%	2%
Household income	26,521	38,858
Chronic Health Conditions	3/1.61	1/1.11
Neighborhood Disadvantage	-.15/1.03	-.13/.89
Health Behaviors	26,521	38,858
Physical Activity[a]	15/5.93	12/5.17
Smoking	17%	15%%

[a]Physical activity is the average of percentage of participants reported being physically active several times a week.

Table 2

Correlations among study variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Funcational Limitationas T1	-											
2. Functional Limitations T2	.38***	-										
3. Chronic Health Conditions	.18***	.36***	-									
4. Age	.10**	.23***	-.2***	-								
5. Sex	-.06	-.07***	-.11***	.01	-							
6. Household Income	-.11***	-.18***	-.03	-.06	.23***	-						
7. Stroke	-.05**	-.14***	.31***	.12***	-.09***	.39***	-					
8. European Americans	-.09***	-.05**	-.01	.03	.02	.06***	.1***	-				
9. African Americans	.1***	.07***	-.01	-.01	-.04*	-.07***	-.08***	-.64***	-			
10. Neighborhood Disadvantage	.02	.02	.02	.03*	-.01	.00	.00	0.02	-.02	-		
11. Physical Activity	.1***	.16***	.01***	.21***	-.04**	-.12***	-.05**	-.08***	.09***	-.01	-	
12. Smoking	.05*	.03	-.08***	-.11***	.09***	-.1***	-.08***	-.05	.02	.02**	.06**	-

(0 = female; 1 = male;)

* *p* < .05. ** *p* < .01. *** *p* < .001.

Table 3

Series of regression models demonstrating neighborhood disadvantage moderating stroke and functional limitations (*N* = 4,963)

Outcome: Functional Limitations T2	Model 1		Model 2		Model 3		Model 4	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Functional limitations T1	0.33***	0.02	0.33***	0.02	0.32***	0.02	0.27***	0.02
Chronic health conditions	0.23***	0.02	0.23***	0.02	0.22***	0.22	0.27***	0.02
Age	0.10***	0.02	0.11***	0.02	0.10***	0.02	0.10***	0.02
Race/Ethnicity	0.04	0.07	0.02	0.07	0.00	0.07	-0.01	0.12
Household Income	-0.07***	0.02	-0.07***	0.02	-0.07***	0.02	-0.09**	0.03
Sex	0.01	0.03	-0.01	0.03	0.01	0.03	-0.06	0.05
Stroke	0.57***	0.13	0.63***	0.13	0.70***	0.13	0.42	0.23
Neighborhood disadvantage	0.06***	0.02	0.06***	0.02	0.05**	0.02	0.07*	0.07
Stroke X Neighborhood disadvantage			0.64***	0.12	0.72***	0.14	0.60**	0.18
Physical activity					0.07***	0.01	0.07**	0.07
Smoking					0.07	0.04	0.09	0.05
Stroke X Physical Activity							0.2	0.17
Stroke X Smoking							-0.30	0.39

Note: Unstandardized parameter estimates and standard errors are shown. ***p <.001, **p < .01, *p < .05.

Appendix B- Figures

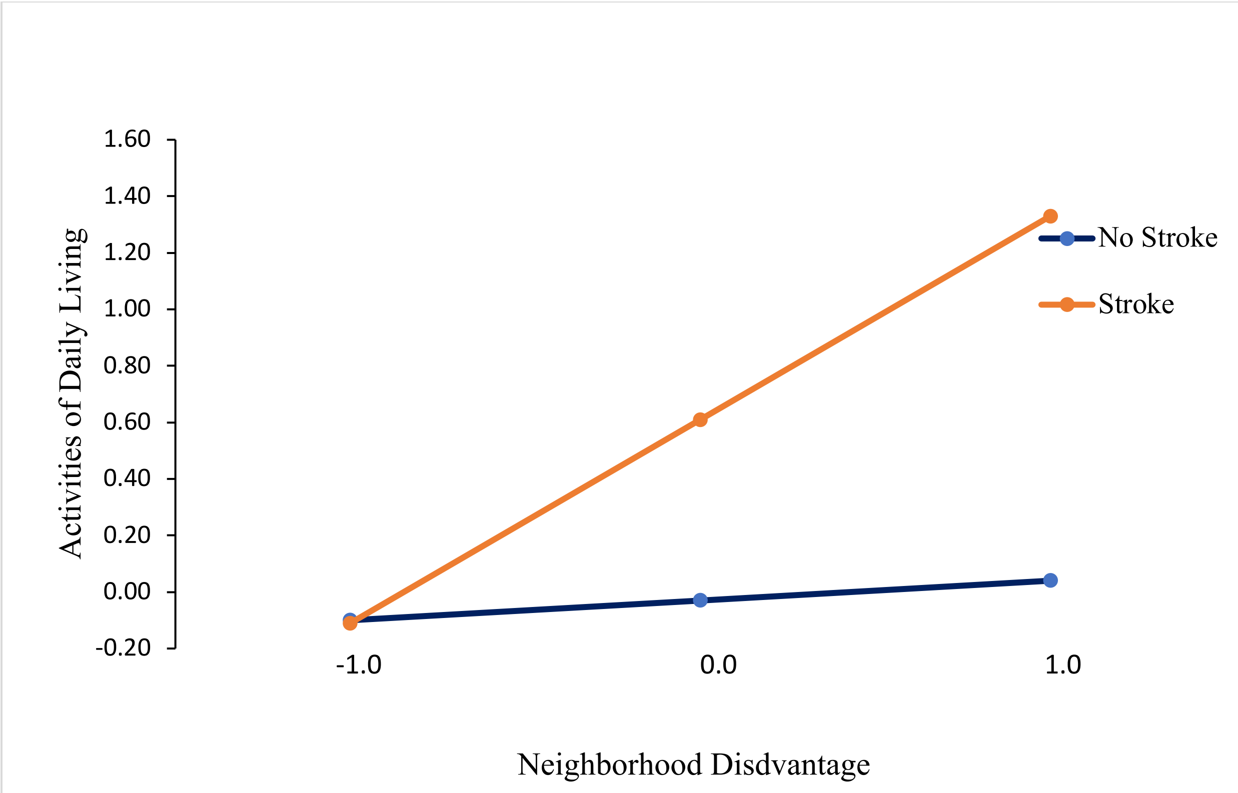

Figure 1. **Associations between neighborhood disadvantage and basic activities of daily living in individuals reporting stroke and not reporting stroke without competing moderators. Higher values of neighborhood disadvantage corresponds with greater neighborhood economic disadvantage. Higher values of ADL corresponds with greater decline in ADL.**

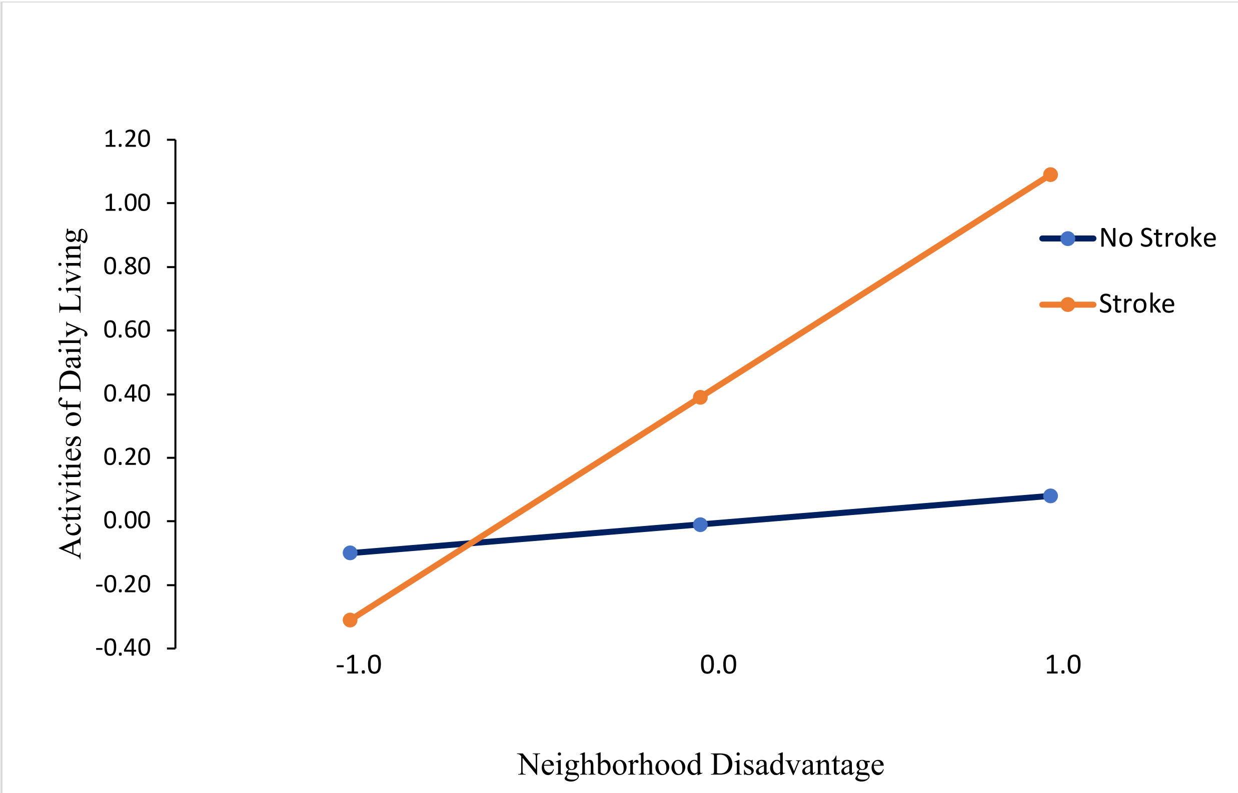

***Figure 2*. Associations between neighborhood disadvantage and basic activities of daily living in individuals reporting stroke and not reporting stroke with competing moderators demonstrating the stability in the interaction effects across models. Higher values of neighborhood disadvantage corresponds with greater neighborhood economic disadvantage. Higher values of ADL corresponds with greater decline in ADL.**