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On the Relationship Between Neighborhood Perception, Length of Residence and Co-Ethnic Concentration

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Abstract

We investigate how co-ethnic concentration and length of residence are related to neighborhood perception in aged Mexican Americans, and discuss sources of information for measuring social environments. Neighborhood perception scale, length of residence in current home, and all individual-level covariates in a hierarchical linear model are derived from data on community-dwelling older adults. Tract-level measures are obtained from Census data. We find no relationship between co-ethnic concentration and positive neighborhood perception, and find a direct relationship between length of residence and positive neighborhood perception. Until further evidence is found, different sources of information when measuring place should be treated equally.

Keywords

Neighborhood perception; Ageing; Mexican; HLM; Length of residence

Introduction

A multitude of both external (Greenberg and Crossney 2007) and internal factors (Kamphuis et al. 2010) influence how a person perceives his/her neighborhood. Exploring the relationship between neighborhood perceptions, co-ethnic concentration, and length of residence is important because the first has been linked with emotional (Weden et al. 2008) and physical (Humpel et al. 2004) wellbeing. For example, an investigation found that neighborhood perception was highly predictive of subsequent depressive symptoms (Latking and Curry 2003). A study delineating the relationship between a person's neighborhood perception and their walking time in Japan, found that individual's perceptions generally reflected the actual physical environment characteristics and that those in more walkable regions walked more (Lee et al. 2007)—a behavior related to the prevention of cardiovascular disease (Bassuk and Manson 2003). Thus, expanding our understanding of how neighborhood perception is related to other factors is important.

Place effect research has been expanding at a rapid pace over the last two decades. At the core of this research agenda is the idea that a person's social and physical context influence their behaviors and physiology (e.g., Galster 2011). Investigators who seek to explore the effects of environment on individuals must decide *how* to measure it. In order to measure context, investigators must decide the source from which the measure should be derived from. For example, researchers must choose whether to use a subjective source of information (e.g., the person's neighborhood perception) or an objective source of information (e.g., percent minority as per Census data). This study explores the relationship between a person's neighborhood perception (subjective) and their co-ethnic concentration (objective). In doing so, we discuss three general categories in the available sources for information when measuring social environments: (1) indirect; (2) intermediate; and (3) direct sources. Our specific aims are to investigate the relationship between neighborhood perception and percent co-ethnic concentration, explore how length of residence plays a role in neighborhood perception, and argue for how available sources of information for measuring context should be treated.

We begin by discussing the basic requirements in place effect research (sometimes referred to as neighborhood effect research). Place effect research simply refers to investigations that primarily explore individual-level (i.e., micro-level) outcomes while accounting for one or more context factors (i.e., macro-level measures). In order for said research to proceed, researchers must determine which source of information should be used to produce macro-level measures. In many instances, the availability of data dictates these decisions. The point is that place effect researchers make explicit and implicit decisions in the process of deriving their context measure(s). Our discussion focuses on delineating the information source from which macro-levels measurements are formed. The main goal of this paper is to evaluate the relationship between two measurements of context, and thus avoid offering a detailed critique on the current methods employed and the place measurements they produce.

There is a broad continuum of available sources of information when attempting to measure social environments. On one end of the social environment measurement continuum, we have “indirect” information sources—which include U.S. Census Bureau data. In the central part of the spectrum, we have “intermediate” information sources—which can include a person's perceived neighborhood. On the other extreme end of the continuum, we have “direct” information resources—where audits of the environment are conducted by trained observers. In our study, we model how an *indirect* (tract's percent Mexican) variable is related to an *intermediate* (subjective neighborhood perception) measurement.

Please note that in our previous paragraph, the labels of the information sources give an implicit ranking of importance/reliability. That is, the closer a source of information is to a direct method; the more accurate it is believed to reflect the reality on the ground—and is thus perceived as a better measurement of the environment. Booth and colleagues (2005) explain that “research should strive to strictly define an individual's neighborhood based on both objective and perceived measures of the neighborhoods [,]” but argue that direct methods (i.e., measures of context with trained observers) “provide the most accurate and consistent descriptions of the neighborhood environment” (S116). Please note that Booth

and colleagues (2005) wrote on measuring physical environments while we are discussing the measurement of social environments.

Our core critique regarding this matter with social-context measurements is that measurements of social phenomenon (e.g., neighborhood safety) by a trained observer should not be seen as more “accurate” than measurements derived from a study-subject's perception of his/her neighborhood. A discourse on this matter is burgeoning at this point. We contribute here, by simply interjecting that a person's own perception of his/her neighborhood should be given equal importance as other measures of context when investigating social behaviors—because a study-subject's point of view may offer an equal quality measure to indirect and direct sources of information. This would be the case until methodologies for measuring social-contexts are established and validated through rigorous scientific exploration. Since an agreed upon definition of how “neighborhoods” are geographically boundarized remains elusive, our arguments here are particularly important for publications that purport their context measurements capture a person's “neighborhood.”

To ground this theoretical discussion with a hypothetical example, we ask: When investigating a person's body mass index (BMI), should the view of a trained observer on the availability of sidewalks in his/her environment be given greater importance than what the survey participant perceives is the level of sidewalk availability? We would argue that until scientific merit can be established saying otherwise, a person's perception of sidewalk availability should be treated on equal ground as the objectively measured availability of sidewalks. In relations to our hypothetical question above, we could say that an answer would require four components; at the micro-level, both social attributes (e.g., exercise) and physiological factors (e.g., hypothyroidism) affect BMI; at the macro-level, both social (e.g., cultural habits) and physical (e.g., food availability) factors affect BMI. Our study does not account for any physiological or physical factors. We only focus on self-reported perceptions of neighborhood and social measurements of context.

In more theoretical terms, if social action is to be understood in causal terms, then we would argue that both structure and within-person processes should be accounted for when modeling social behavior. Furthermore, until it can be fully established that structural factors have a more intense and consistent effect on social behaviors, scientists should not give structural factors preference over within-person mechanisms. Also, until more scientifically derived methodologies for deciphering how conscious and subconscious mechanisms operate in within-person processes, investigators should give conscious beliefs and perceptions as much credence as other more observed and measurable phenomenon. The point is that subjective neighborhood perception need not be related, without proper scientific evidence, to the lower echelons of academic importance.

This investigation primarily seeks to expand scientific knowledge on the relationship between an indirect and intermediate source of information. To model their relationship, we make use of a Neighborhood Perception (NP) scale at the micro-level (interchangeably referred to as Level-1) and of Census data to calculate the percent of Mexicans at the macro-level (interchangeably referred to as Level-2). Accounting for co-ethnic concentration while investigating neighbourhood perception is important because previous work has show that

an individual's sense of cohesion with his/her neighborhood is a product of both individual and community level characteristics (Laurence and Heath 2008). Research on the determinants of individual place attachment has also found that the relationship between an area's ethnic mix and neighborhood attachment varies between social groups (Bailey et al. 2011). NP, length of residence in current neighborhood, and co-ethnic concentration may be closely related to how individuals decide where to live. In our paper, we expect that as co-ethnic concentration increases, individuals will report a more positive outlook of their neighborhood.

There are three general approaches available for researchers to investigate how a macro-level factor is related to a micro-level outcome. There are some approaches that ignore grouping structure. For example, a *micro*-single-layer-model could be used where the macro-level factor is included as an individual-level attribute. This approach is naïve because it violates the assumption of independence in multivariate linear models and thus underestimates standard errors—which could lead to an increased probability of committing a Type-I error (i.e., claiming a significant statistical relationship exists when it does not). In the second scenario, researchers could use a *macro*-single-layer-model and ignore individual-level attributes. This approach fails to incorporate individual-level predictors by aggregating them to the level-2 unit. Results from this approach cannot be interpreted to the individual; doing so would result in an ecological fallacy (Robinson 1950).

The third approach, being employed in this project, reduces both the chances of incorrectly rejecting the null hypothesis and the chances of committing the ecological fallacy, by making use of a hierarchical linear model (interchangeably referred to as multilevel model). In our approach, we take the non-independence between individuals on their macro-level measure into account by estimating a cluster effect, obtaining the more appropriate standard errors for the parameter estimates, and having a more accurate statistical test of the parameter estimate (Raudenbush and Bryk 2002). From Fig. 1 below, our investigation explores the micro-on-micro level association (line “A” in figure) between a person's length of residence and his/her NP. We also explore the macro-to-micro association (line “B” in figure) on how a tract's percent Mexican is related to NP.

While length of residence at the national level is frequently used as a covariate in spatial health research, the impact it has on neighborhood perception remains uncertain. For example, research has found that prevalence of obesity amongst Hispanic immigrants varied as a function of length of residence in the U.S.—where an increase in the time living in the U.S. increased the odds of being obese (Kaplan et al. 2004). More recent work has even shown that NP is related to with body mass index in aged Mexican Americans (Siordia and Saenz 2012). Our investigation makes use of the length of residence at the individual-level rather than the national-level. We explore how a persons' length of residence in their own home is related with co-ethnic concentration and neighborhood perception.

Why study co-ethnic concentration and length of stay as they relate to neighborhood perception? Studies have previously shown that co-ethnic concentration plays a significant role in different psychological and physical health outcomes for minority group members. For example, one study on aged Mexican Americans showed that an increase in co-ethnic

concentration was protective against negative mental health outcomes (Ostir et al. 2003). Others have found that areas with high co-ethnic concentrations even affected the cognitive status of aged Mexican Americans (Espino et al. 2001). More recently, researchers have found co-ethnic concentration to be a key factor in “language shift” (the abandonment of mother tongue for the use of host majority language) amongst aged Mexican Americans (Siordia and Díaz 2012). Interestingly, investigations have found there were stronger co-ethnic density effects on psychological outcomes than on physical health outcomes (Stafford et al. 2009).

In general, increases in co-ethnic concentration are found to be associated with increases in social cohesion (Stafford et al. 2010). We argue that social cohesion is related to neighborhood perception—where an increase in social cohesion increases positive neighborhood perception. We propose this because previous work on minorities has shown that ethnic density is protective against the perception of interpersonal racism (Bécares et al. 2009) and because co-ethnic concentration has also been found to be associated with higher odds of reporting people in the area of residence get along well—leading authors to conclude that ethnic density increases social cohesion (Stafford et al. 2010).

The basic idea is that an increase in co-ethnic concentration increases interactions between like-ethnic individuals, which reduces feelings of insecurity or feeling threatened (Vervoort et al. 2011)—simultaneously fostering a sense of community and positive neighborhood perception. In other words, we assume that areas with high co-ethnic concentrations provide more supportive environments for aged Mexican Americans. We assume that the comfort provided by ethnic density would be further complimented by the length of stay—where a positive view of the environment (resulting from high co-ethnic concentration) is intensified/solidified as the person resides in that environment for a longer period of time. We believe these dynamics are operative with all racial-ethnic groups and that their mechanics are multidimensional—being influenced by additional person-level characteristics and other neighborhood factors (like neighborhood deprivation as measured by percent of people living below the federal poverty line).

Our investigation is important because research on the relationship between NP and co-ethnic concentration remains inconclusive. For example, Kennedy (1977) found that increased length of residence in one neighborhood was related to an increased number of neighbors known. Early research using less than 100 subjects suggested that length of residence had little impact on neighborhood perception (Haney and Knowles 1978). In their study, Haney and Knowles (1978) created a measure of neighborhood perception by asking their subjects to describe their neighborhood in their own words and then classified responses as positive, negative, and neutral. A subsequent study, found a statistically significant and negative relationship between length of residence and neighborhood satisfaction, where an increase in length of stay showed a *decrease* in neighborhood satisfaction (Hartnagel 1979). In his study, Hartnagel (1979) measured neighborhood satisfaction by simply asking respondents about their degree of satisfaction with their area of residence. In another study, neighborhood attachment and length of residence were found to have a direct association (Bonaiuto et al. 1999)—they used a six-item scale to determine an individual's degree of attachment with their neighborhood.

Why focus on a sample of aged adults? Most aged adults “age in place” (Fisher et al. 2007; Yen and Anderson 2012)—in general, aged adults stay in their residence as they age. When combined with the fact that as age increases into very advance stages, physical mobility decrease (Wiles et al. 2009), it is important to investigate how a shrinking geography plays a role in their NP—as the latter may be related with emotional and physical wellbeing. Our focus on a sample of aged adults is thus partially born of necessity (because the dataset with the variables of interest only have these aged groups) and by the conceptual argument that aged adults may have a greater sensitivity to their neighborhoods than younger more mobile counterparts. Understanding the relationship between an aged adult's neighborhood perception and place of residence has important implications for both social policy and public health programs in the US as the number of aged people and the population as a whole continues to increase. This project contributes to the limited publications focusing on aged ethnic minorities (Yen et al. 2009).

Since neighborhood satisfaction, perception, and sense of community have yet to be formally differentiated on theoretical grounds, we also include evidence from a recent study where length of residence is found to be a significant predictor of higher reported sense of community (Wood et al. 2010). Wood and colleagues (2010) measured a person's sense of community with a six item Likert scale after a review of measures used in research. Methodological, data, and software advances allow us to explore the same topic while more fully accounting for the nested structure of the data. We hope to substantively contribute to the literature by investigating how length of residence is related to neighborhood perception in aged adults. Given the inconclusive nature of existing research, we use a sample of aged Mexican origin Latinos (hereafter referred to as Mexican Americans), to ask the following: Do tracts with higher percent Mexican have aged Mexicans with more positive NP?; and how is the aged Mexican's length of residence related to their NP?

Data and Methods

All micro-level measures are derived from Wave-5 of the Hispanic Established Population for the Epidemiological Study of the Elderly (HEPESE) longitudinal datasets. The HEPESE study at baseline (during 1993–1994) collected data on 3,050 community-dwelling Mexican Americans aged 65 years and above who resided in one of the five southwestern states of Arizona, California, Colorado, New Mexico and Texas (Markides et al. 1999). In Wave 5, during 2004–2005, when members of the surviving cohort were aged 75 and over were interviewed ($n=1,167$) and an additional representative sample of 902 Mexican Americans also aged 75 and over residing in the same region were added. Macro-level measures are created from 2000 US Census tract-level data.¹ Please note that because of the selectivity of the analytic sample, the findings in this study should not be generalized beyond the sample.

Since many readers may not be familiar with the geographical polygons *Census tracts*, we include Fig. 2. This image represents the South-most peak in Texas (the Brownsville-McAllen area). We make use of this small area because the small nature of tracts is lost when they are depicted in state-level maps. The polygons in the figure are tracts, note that

¹For more information see <http://www.census.gov/geo/www/tractez.html>.

they vary in size and shape. Although a full discussion on how tracts are created is beyond the scope of this investigation, please note that population size influences their size, while population distribution and physical environment forms their shapes.²

The dependent variable, NP was created from six Wave-5 HEPSE questions (see Appendix A for detail on questions used in survey). The NP scale is only available in Wave-5. We reverse coded four items (f1neigh5, f3na5, f3nb5, f3ne5) to add them to the other two (f3nc5, f3nd5) and calculate the total NP score. Because we have no *a priori* hypothesis of why any of these questions would be more important than the others, we give then all equal weight when creating our NP scale. Higher numbers indicate the person feels more: satisfied with the neighborhood, that it is a close-knit neighborhood, that people are willing to help; that people in the neighborhood get along with each other, that people in the neighborhood share similar values and that people in the neighborhood can be trusted. Thus, the term “perception” refers to how a person feels about their neighborhood—how they perceive people within the area interact and their level of satisfaction with how they perceive their area of residence. Self-reports on how individuals perceive how others in their neighborhood interact is one way to measure what is here being called neighborhood perception. As with other measurements of place, this approach has some limitations. For example, no objective measure is taken to measure the actual amount of interaction between neighbors. Please note that since each of the six items can range from 0 to 4, the scale has the possibility of ranging from zero to 24—where large numbers indicate a greater degree of positivity towards the neighborhood.

The micro-level independent variable, “stability,” was created from answers to the question: What year did you move into current residence? Low values on stability indicate an aged Mexican who recently moved in to his/her house and high numbers on the variable reflect that the aged adult has been in their residence for a long time. The macro-level independent variable “percent Mexican in tract” was obtained from pre-fabricated tables from the US Census Bureau.

We include other micro- and macro-level covariates in the model to account for several items. At level-1, we include their age to account for any life-span and/or cohort effects. We also control for gender, nativity, and marital status in case NP is affected by either one of them. We also account for whether a person lives alone as it may affect how they feel in general about interacting with others or their current social network conditions. We also decided to measure if household income is less than \$10,000 per-year as a way to account for socioeconomic status.

Because personal physical attributes may affect NP, we include for whether they can be categorized as “obese” from their BMI score, their total Basic and Instrumental Activities of Daily Living scores (BADL and IADL). In order to assess their global cognitive ability, we include their total Mini-Mental State Exam (MMSE) score. Beyond the physical, emotional well-being may also influence NP, thusly, we account for their self-health rating and both their “positive” and “negative” affect using the Center for Epidemiologic Study Depression

²For more information see <http://www.census.gov/geo/www/reference.html>.

(CES-D). We also develop a chronic health condition scale to determine if any other health conditions beyond those measured above are affecting NP.

At level-2, we also include the percent of people living in-poverty—as a covariate that accounts for a tract's economic hardship. Research has found that economic hardship plays a role in how a person feels about and interacts with their neighborhood. For example, investigations on social cohesion have generally shown that socioeconomic deprivation undermines an individual's willingness to socialize with neighbors (Laurence 2011; Letki 2008; Marschall and Stolle 2004). Previous work has shown that poverty and disorder tend to be highly correlated with the racial composition of the neighborhood (Sampson and Groves 1989; Sampson et al. 1997). Socioeconomic deprivation has also been linked to different health related outcomes—including risky behaviors (Lakshman et al. 2011) and mental health problems (Fone et al. 2007). In our study, we assume neighborhood attachment affects how an individual perceives the neighborhood and thus account for percent in poverty in the tract along with percent Mexican.

The MMSE is a common measure of cognitive functioning with scores ranging from 0 to 30 (see Tombaugh and McIntyre 1992). BADL scores are based on required assistance with basic activities of daily living and IADL scores are based on required assistance with instrumental activities of daily living (see Sikkes et al. 2009). The CES-D is a validated measure of the count of and severity of depressive symptoms, the scale is split into positive and negative affect scores which range from 0 to 12 and 0 to 21 respectively (Radloff 1977). Obesity is classified as BMI at or above 30 and self-rated health ranges from 1 to 4 with 1 as “excellent” and 4 as “poor”. The chronic conditions scale ranges from 0 to 8 and is a count of the following self reported conditions: hypertension, pain when standing, diabetes, ever having cancer, ever having a stroke, ever having a heart attack, ever having a hip fracture and ever having any other fracture (see Salinas and Peek 2008).

Please note that all data management and variable coding are generated using SAS 9.2 software (Copyright, SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary NC, USA). We conduct four multilevel linear models in HLM 6.04 (Raudenbush et al. 2004a, b) to: first validate the need for a hierarchical model; then to test the effect of a tract's percent Mexican on the NP score; then to investigate micro-level associations with no macro-controls; and finally to include a full model to discuss how an aged Mexican's length of residence and how co-ethnic concentration is related to their NP score after controlling for various other level-1 and level-2 factors.

The HLM software estimates equations that help explain cross-level statistical associations by accounting for the fact that individuals are dependent at the context level (in our case the tract). Our multilevel linear model is preferred over the classical ordinary least square regression because it does not assume micro- and macro-level factors come from simple random samples (Arnold 1992). In simpler terms, using HLM software allows us to investigate how micro-level neighborhood perceptions are *on average* associated with length of residence *across* and *within* tracts and how percent Mexican is on average associated with

neighborhood perception across tracts—after accounting for various other micro- and macro-level factors.

Please note some research publications that make use of hierarchical models do not clearly disclose the minimum amount of level-1 units allowed per each level-2 unit. Since this type of modeling, in effect, executes a regression for each level-2 unit, having a *regression slope* based on one, two, or three people may be of concern (e.g., equation parameters may be biased on their standard errors leading to erroneous conclusions on their statistical significance). We admonish, and show by example here, that researchers making use of nesting models be explicit with the minimum amount of units allowed per cluster. In our project, we are interested in reducing the chances of making a Type-I error (i.e., finding false statistical significance) with our model and parameters, we thus, make use of micro- and macro-level units where there are at least 5 micro-units for each macro-unit (at least five observations per-tract). Although some have argued that one observation per nesting unit is acceptable (Gelman and Hill 2007), we opted for having at least 5 people per-tract because more recent studies using simulated analyses have shown that using a small number of macro-units, which contain a small number of micro-units, may erroneously influence the computation of standard error estimates for both random and fixed effects (Theall et al. 2011). We have 1,581 individual-level units being nested in 131 tract-level units and interpret “population-average” coefficients with “robust standard errors” from our HLM outputs (Mass and Hox 2004a, b).

After discussing our data and methods, we now formally state our specific aims, to answer how (R^1) tract co-ethnic concentration and (R^2) length of residence are related to neighborhood perception, in hypothetical terms: on R^1 , we hypothesize (H^1) that as the percent of Mexicans in the tract increases, neighborhood perception will be more positive—we expect to see a direct relationship between co-ethnic concentration and positive neighborhood perception; on R^2 , we hypothesize (H^2) a direct relationship between length of residence and neighborhood perceptions—as the length of residence increases, positive neighborhood perception will increase.

Findings

From the descriptive statistics in Table 1, we see that on average, HEPSE respondents have a neighborhood perception score of about 16. On length of residence, we see that respondents average about 27 years in the same home. Respondents average approximately 82 years of age. The sample is 62 % female and 58 % foreign born, while 44 % of the sample is married and 29 % live alone. We also see from Table 1 that 54 % report a household income below \$10,000. In terms of health characteristics, the most common response for self-rated health is “fair.” The average MMSE score is 21. The mean number of reported ADLs and IADLs are 1 and 4 respectively. We also note that about 22 % of the sample is classified as obese. The CESD positive affect and negative affect scores are about 2 and 3 respectively. Respondents have on average about 5 chronic health conditions. At the tract level, we see that the average tract is 66 % Mexican and 29 % in poverty.

In order to justify the need for a multilevel approach, we first conduct a “random-intercept model” (sometimes referred to as the variance components model) with level-1 as:

$$NP_{ij} = \beta_{0j} + r_{ij}$$

And at level-2:

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

In this model, we only include the dependent variable to estimate how much of its variance is explained at level-1 and -2. From our HLM outputs on the null-model, we calculate the intra-class correlation (ICC)—the *between-tracts* explained variance on aged Mexican American's NP score. By inserting values from our outputs into this equation, $ICC = \tau_{00}/(\tau_{00} + \sigma^2)$ —where τ_{00} is the level-2 variance and σ^2 is the level-1 variance component, we get: $ICC = 4.186/(4.186 + 14.059) = 0.23$. This means that about 23 % of the variance in NP scores is explained by *between* -tract mechanisms (i.e., structural phenomenon). Since the model (reliability estimate=0.74; deviance: 8,324) shows τ_{00} is significant with a P-value (i.e., α) of 0.000, and our ICC calculation is substantial, the use of a multilevel model is not only permissible: it is necessary.

After finding that 23 % of the variance on NP score is between-tracts and that 77 % is at the individual-level, we then executed a “means-as-outcomes model” to test our first hypothesis. Where, at level-1, Model-1 is:

$$NP_{ij} = \beta_{0j} + r_{ij}$$

And at level-2, Model-2 is:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Percentmexican}) + u_{0j}$$

where, β_{0j} —the *mean NP score* amongst i^{th} observations in j^{th} tract, is the outcome variable. From our outputs (reliability estimate=0.74; deviance: 8,329), as seen in Table 2, we found that the direct-effect of percent Mexican on NP score is not significant ($\alpha=0.31$)—although it is positive as predicted ($\gamma_{01}=0.01$). Our model shows no support for the association between co-ethnic concentration and neighborhood perception, thus we are able to falsify H^1 —we find no evidence that the indirect measure of percent Mexican in a person's tract of residence is related to their neighborhood perception.

We subsequently explored a “random-coefficients model” to assess the significance of micro-level factors without macro-level controls (outputs available from lead author upon request). From Table 2, we observed from the model (reliability estimate=0.72; deviance: 7,418) with no level-2 controls that for each year increase on the length of residence, there is

a 0.02 ($\alpha < 0.01$; SE 0.01) increase in the NP score—prohibiting us from falsifying the hypothesis that length of residence is directly related to positive neighborhood perception. Because we found that a direct relationship between length of residence and neighborhood perceptions was supported (H^2), we decided to continue to our final model—where, at level-1, our Model-3 is:

$$\begin{aligned} NP_{ij} = & \beta_{0j} + \beta_{1j}(\text{USborn})_{ij} + \beta_{2j}(\text{SelfRatedHealth})_{ij} + \beta_{3j}(\text{MMSE})_{ij} + \beta_{4j}(\text{ADLs})_{ij} \\ & + \beta_{5j}(\text{IADLs})_{ij} + \beta_{6j}(\text{Age})_{ij} + \beta_{6j}(\text{Female})_{ij} + \beta_{8j}(\text{LivesAlin})_{ij} + \beta_{9j}(\text{Married})_{ij} \\ & + \beta_{10j}(\text{IncomeBelow10k})_{ij} + \beta_{11j}(\text{LegthResidence})_{ij} + \beta_{12j}(\text{Obese})_{ij} \\ & + \beta_{13j}(\text{CESDPossitiveAffect})_{ij} + \beta_{14j}(\text{CESDNegativeAffect})_{ij} \\ & + \beta_{15j}(\text{ChronicConditions})_{ij} + r_{ij} \end{aligned}$$

where, NP_{ij} is the predicted score on the neighborhood perception scale; i and j refer to i^{th} HEPSE respondent in j^{th} tract; β_{0j} is the intercept in j^{th} tract; β_{1j} through β_{15j} are the 15 average slopes for each of the individual-level variables, in j^{th} tract; and r_{ij} is the micro-level error term for i^{th} HEPSE person in j^{th} tract. At level-2, our abbreviated Model-4 is:

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{PercentMexican}) + \gamma_{02}(\text{PercentInPoverty}) + u_0 \\ \beta_{1j} &= \gamma_{10} + \gamma_{11}(\text{PercentMexican}) + \gamma_{12}(\text{PercentInPoverty}) \end{aligned}$$

...and so forth until we reach beta 15th:

$$\beta_{15j} = \gamma_{150} + \gamma_{151}(\text{PercentMexican}) + \gamma_{152}(\text{PercentInPoverty})$$

where, γ_{00} is the intercept of the model; γ_{01} is the intercept of percent Mexican; γ_{02} is the intercept of percent in-poverty; γ_{k0} (k^{th} ranging from 0 to 15) are the *direct effects* of the individual-level factor on the neighborhood perception scale; γ_{k1} are the *indirect effects* of percent Mexican on the micro level slope; γ_{k2} are the *indirect effects* of percent in-poverty on the micro level association; and where u_0 is the error measurement for all intercepts. From this final “intercepts and slopes-as-outcomes model,” we see the inclusion of all level-1 (non-centered) and level-2 (grand-centered) variables. Our research test is H^1 with γ_{01} and H^2 with γ_{110} —our discussion of the findings focuses on these gammas.

H^1 remains falsified in this last model (reliability estimate=0.71; deviance: 7,648) as can be seen from Table 2. We also see that H^2 retains its un-falsifiability, because there is a 0.02 increase on the NP score for every year of residence in same home ($\alpha < 0.01$). Please note that the relationship between length of residence and NP remains the same in all models. In addition to our substantive discussion of why intermediate information sources, like neighborhood perceptions, should be given as much credence as other forms of place measurements, we make two important findings: (1) tract-level co-ethnic concentration is not related to NP in aged Mexican American adults; and (2) length of residence seems to be an important predictor when modeling an aged Mexican American's neighborhood perception. These unique and important findings can help advance place and health research.

Conclusions

In answer to our first research question, we find no significant relationship between a tract's percent Mexican and an aged Mexican's positive neighborhood perceptions— H^1 is falsified. In response to our second research question, we find that an aged Mexican's length of residence is directly related to their neighborhood perception— H^2 is unfalsifiable.

As with most studies, we too have some limitations in our investigation. For example, we account for the co-ethnic concentration as measured about 4 years before the items on the NP scale were answered—the degree to which this lagged tract level measure may have played a role in determining the statistical insignificance between a tract's co-ethnic concentration and a person's neighborhood perception is un-measurable. Although “neighborhood stability” has been measured using proxies like percent of new arrivals in area, percent of empty residences, and percent homeowners, we omit such measures in our study.

On a more theoretical and complex note, an individual's perception of their *neighborhood* may not match the tract polygon we used to measure their areas percent Mexican. We have no way of knowing the degree of mismatch between what people perceive as their neighborhood and how well their tract of residence overlaps with the geographic boundaries they assigned their “neighborhoods.” If cognitive maps from what a person perceives as their neighborhood vary by functional activities (e.g., work-related versus family-related-neighborhoods: see Galster 2011), then the geographical boundaries of “true neighborhoods” may be porous/fluid—rendering our attempts to measure how their percent co-ethnic concentration affects their neighborhood perception with a high degree of scientific uncertainty. Although this seems grave, the limitation plagues most academic place effect publications (for an example of an exception see Coulton et al. 2011). Here, we are forthright about it in the hopes that theory, measures, and methods can continue moving towards a more advance stage from tackling this deep and highly complex challenge.

Future investigations should seek to answer a question that arises out of this project: Why are subjective measures (like NP) not related to the objective measures (like percent Mexican)? The research should be conducted using samples with different age ranges, from different racial-ethnic groups, and from different parts of the world. Future work could also explore if co-ethnic concentration at other non-tract geographical levels makes a difference on the research question—or maybe include a third level of analysis (e.g. counties). In first exploring how neighborhood perceptions are created within a person, how people assign geographical boundaries to their neighborhood(s), and how each of these affects their behaviors, researchers should continue to establish that context matters above and beyond individual- and network-level attributes—the validity of future place effect research depends on this.

Notwithstanding these limitations, we feel our project makes a substantive contribution by making the case that a person's own perception of his/her neighborhood should not be rendered as inferior (with regards to reliability and validity) in reference to measures obtained from either indirect or direct sources—a partially justified argument since we are

unable to explore how non-intermediate measures would compare to our measure. As we move towards bridging the gap between place effects theory and scientific research, we should continue to prove the validity and reliability of information sources in the measurement of neighborhoods.

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Appendix A

HEPESE Neighborhood Perception Questions

F1NEIGH5

All things considered, would you say you are very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied, or very dissatisfied with your neighborhood as a place to live?

- (1) Very Satisfied
- (2) Satisfied
- (3) Neither Sat or Dissatisfied
- (4) Dissatisfied
- (5) Very Dissatisfied
- (8) Don't know
- (9) Refused
- (.) Missing

Now I am going to read you some statements, which may or may not be true about your neighborhood. Please look at this card. For each statement tell me whether you strongly agree, agree, disagree, or strongly disagree. (If interviewee is unsure, mark neutral)

- This is a close-knit neighborhood **F3NA5**
 - People around here are willing to help their neighbors **F3NB5**
 - People in this neighborhood generally don't get along with each other **F3NC5**
 - People in this neighborhood do not share the same values **F3ND5**
 - People in this neighborhood can be trusted **F3NE5**
- (1) Strongly agree
 - (2) Agree
 - (3) Neutral

- (4) Disagree
- (5) Strongly disagree
- (8) Don't know
- (9) Refused
- (.) Missing

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Problem

- Are co-ethnic concentration and length of residence related to neighborhood perception in aged Mexican-Americans?

Findings

- No evidence of a relationship between co-ethnic concentration and neighborhood perception was found
- Support was found for a direct relationship between length of residence and neighborhood perception

Conclusions

- Length of residence should be considered when predicting neighborhood perception
- Subjective measures of neighborhood perception should not be treated as inferior to objective measures

Fig. 1. Micro- and macro-relationships with neighborhood perception. ¹Micro-to-micro-relationship. ²Macro-to-micro-outcome. ³Macro effect on micro-to-micro-relationship

Fig. 2. Southmost peak of Texas: HEPese respondents 1990 geographical distribution by tracts

Table 1

Descriptive statistics of analytic sample

	N ^a	Mean	SD ^b	Min ^c	Max ^d
Dependent variable					
Neighborhood perception	1,485	16.20	4.24	1	24
Independent variable					
Length of residence	1,477	26.77	17.92	0	96
Demographics					
Age	1,581	81.91	5.16	74	109
Female	1,581	0.62	0.49	0	1
US-born	1,581	0.58	0.49	0	1
Lives alone	1,581	0.29	0.45	0	1
Married	1,581	0.44	0.50	0	1
Household income<\$10,000	1,581	0.54	0.50	0	1
Health					
Self-rated health	1,581	2.79	0.86	1	4
MMSE	1,501	20.90	7.04	0	30
ADLs	1,580	1.36	2.23	0	7
IADLs	1,581	3.67	3.45	0	10
Obese	1,581	0.22	0.41	0	1
CESD: positive affect	1,460	2.37	2.56	0	12
CESD: negative affect	1,464	2.95	4.06	0	21
Chronic health conditions	1,581	4.77	1.18	0	9
Tract-level					
Percent Mexican	131	66.34	16.54	14.56	95.51
Percent in-poverty	131	29.09	11.34	5.46	55.72

^aNumber of observations with response to variable^bStandard deviation^cMinimum^dMaximum

Table 2
Hierarchical linear regression results modeling neighborhood perception

	MO ^a	RC ^b	ISO ^c
	Coeff ^d	Coeff	Coeff
Intercepts			
Intercept	15.4**	16.44**	16.53**
Tract percent Mexican ^e	0.01		0.01
Tract percent in-poverty ^f			0.04
Independent variable			
Length of residence		0.02**	0.02**
Demographics			
Age		-0.01	-0.02
Female		0.34	0.37
US-born		0.07	0.23
Lives alone		0.51	0.57
Married		0.94**	0.99**
Household income<\$10,000		-31	-0.31
Health			
Self-rated health		-0.41**	-0.43**
MMSE		0.04	0.03
ADLs		0.03	0.01
IADLs		0.08	0.07
Obese		0.47**	0.44*
CESD: positive affect		-0.16**	-0.16**
CESD: negative affect		-0.05	-0.04
Chronic health conditions		0.04	0.06

* α 0.05,

** α 0.01

^a Means as outcomes model

^b Random coefficient model with no tract-level controls

^c Intercepts and slopes as outcomes model with tract-level controls on all person-level factors

^d Coefficients

^e This tract-level effect is included with all the other Level-1 variables in the ISO model

^f This tract-level effect is also included with all the other Level-1 variables in the ISO model