



The influence of HOPE VI neighborhood revitalization on neighborhood-based physical activity: A mixed-methods approach



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ABSTRACT

Objectives: This study uses a mixed methods approach to 1) identify surrounding residents' perceived expectations for Housing Opportunities for People Everywhere (HOPE VI) policy on physical activity outcomes and to 2) quantitatively examine the odds of neighborhood-based physical activity pre-/post-HOPE VI in a low socioeconomic status, predominantly African American community in Birmingham, Alabama.

Methods: To address aim one, we used group concept mapping which is a structured approach for data collection and analyses that produces pictures/maps of ideas. Fifty-eight residents developed statements about potential influences of HOPE VI on neighborhood-based physical activity. In the quantitative study, we examined whether these potential influences increased the odds of neighborhood walking/jogging. We computed block entry logistic regression models with a larger cohort of residents at baseline ($n = 184$) and six-months ($n = 142$, 77% retention; $n = 120$ for all informative variables). We examined perceived neighborhood disorder (perceived neighborhood disorder scale), walkability and aesthetics (Neighborhood Environment Walkability Scale) and HOPE VI-related community safety and safety for physical activity as predictors.

Results: During concept mapping, residents generated statements that clustered into three distinct concepts, "Increased Leisure Physical Activity," "Safe Play Areas," and "Generating Health Promoting Resources." The quantitative analyses indicated that changes in neighborhood walkability increased the odds of neighborhood-based physical activity ($p = 0.04$). When HOPE VI-related safety for physical activity was entered into the model, it was associated with increased odds of physical activity ($p = 0.04$). Walkability was no longer statistically significant.

Conclusions: These results suggest that housing policies that create walkable neighborhoods and that improve perceptions of safety for physical activity may increase neighborhood-based physical activity. However, the longer term impacts of neighborhood-level policies on physical activity require more longitudinal evidence to determine whether increased participation in physical activity is sustained.

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1. Background

Research findings indicate that built and socioeconomic features of neighborhoods are underlying factors that contribute to the geographic patterning of physical inactivity and related chronic diseases (Keita et al., 2014; Sallis et al., 2009; Sugiyama et al., 2015).

In socioeconomically disadvantaged areas, built environment features that facilitate physical activity (e.g., quality sidewalks, green spaces, recreational facilities, parks, walking trails and low traffic density) are often nonexistent or underutilized because of poor quality and safety concerns (Sugiyama et al., 2015). The social and economic contexts of disadvantaged neighborhoods often provide visual cues of neighborhood social and physical disorders such as graffiti, abandoned buildings and heightened risks for victimization that may exacerbate built environment impediments to physical activity (Burdette and Hill, 2008). These barriers may lead to the promotion and internalization of social norms for physically inactive lifestyles (Cockerham, 2005). As a result of these neighborhood effects, interventions may be needed to promote neighborhood-based physical activity.

Socio-ecological frameworks suggest that in order to be effective, interventions must address not only individual level factors (e.g., attitudes and beliefs) that shape physical activity-related behaviors but also more distal factors including the social environment (e.g., social and cultural norms and social support/reinforcement), physical environment (e.g., neighborhoods and communities), and policy (e.g., local-, state-, or national-level). A growing body of research is beginning to examine multilevel interventions which assess how policies, urban redesign and/or changes in perceptions of neighborhood social environments may influence physical activity related behaviors (Giles-Corti et al., 2013; Gustat et al., 2012; Hirsch et al., 2014; Wilson et al., 2014). Results from several interventions demonstrate that changes to the built and social environments increase participation in neighborhood-based physical activity (Kinney et al., 2012; Krieger et al., 2009; Wilson et al., 2014; Zenk et al., 2009). For example, results from the research of Kreiger et al. (2009) indicate that improving walking routes, advocating pedestrian safety, and improving access to parks and recreational centers increase residents' participation in neighborhood-based walking, jogging and biking. Other interventions increase participation in neighborhood-based physical activity by increasing knowledge of safety precautions, changing social norms, implementing police patrolled walking and social marketing campaigns (Kinney et al., 2012; Krieger et al., 2009; Wilson et al., 2014). The research findings from these interventions provide compelling evidence that modifying built and social environments increase neighborhood-based physical activity among residents in disadvantaged communities.

While important insights are gleaned from these intervention studies, more research is needed to understand how policy-level factors that integrate built and social environment modifications influence neighborhood-based physical activity outcomes. Also, more research studies that utilize mixed methods approaches to understand both residents' perspectives of the impact of such policies on their health behaviors and behavioral outcomes are also warranted. As such, we conducted a community-based natural experiment to understand how the HOPE VI (Housing Opportunities for People Everywhere) program might influence participation in neighborhood-based physical activity. HOPE VI was implemented in 1992 by an act of the United States' Congress, with the goals of replacing distressed public housing, improving surrounding neighborhoods, reducing the concentration of low-income families, and building sustainable communities (Popkin et al., 2004). The community that experienced HOPE VI transition met the criteria for funding because the public housing residents needed high levels of social support services, the public housing was severely deteriorated and distressed and the surrounding community was economically and socially disadvantaged and disordered (Howell et al., 2005; Popkin and Cove, 2007).

Federal level policies and programs such as HOPE VI attempt to revitalize distressed communities by: 1) redressing the effects of

concentrated poverty on economically disadvantaged communities; 2) altering the physical environment to create mixed income housing developments in low-income communities; and 3) improving the physical activity environment by incorporating principles of new urbanism to create green spaces such as parks and walking trails that are expected to promote physical activity (Popkin et al., 2004). The HOPE VI framework is well aligned with a socio-ecological approach as it incorporates multiple components of a socioecological model to affect neighborhood changes to the built and social environments that might influence participation in neighborhood-based physical activity.

Research evidence on the beneficial effects of urban revitalization policies on health outcomes is mixed (Kleinmans, 2004; McIntyre and McKee, 2012, 2008). Some research findings suggest that improving neighborhood walkability, constructing new public spaces, and creating community programs positively affect the physical and emotional wellbeing of residents (Kelaher et al., 2010). However, the results from HOPE VI studies provide mixed support for improvements in mental health, lower rates of obesity and related comorbidities (Greenbaum, 2011; Howell et al., 2005; Keene and Geronimus, 2011; Kingsley et al., 2003; Manjarrez et al., 2007; Popkin and Cove, 2007). Although important insights have been gained from these studies, additional research is critical to understand how these policies may transform communities into areas with infrastructures that support healthier lifestyle behaviors.

To achieve our study objectives, we used a community engaged research approach, which emphasizes partnerships and collaborations with community organizations and/or representatives from the population of interest to identify and address issues that affect their wellbeing (Mulligan and Nadarajah, 2008). First, we used group concept mapping to identify surrounding residents' perceived expectations of how the HOPE VI revitalization might potentially influence participation in neighborhood-based physical activity. Concept mapping is a structured "methodology that produces pictures/maps of ideas or concepts developed by an individual or group" (Trochim and Kane, 2005) and is well-aligned with a community engaged approach because of the balance of the power dynamic between researchers and participants (Freeman and Jessup, 2004). Second, we quantitatively examined whether the emergent themes from concept mapping influenced the odds of neighborhood-based leisure time physical activity from baseline to six-month follow-up for residents surrounding HOPE VI.

2. Methods

2.1. Study location

We obtained data for the current study from a community (~94% African American) in Birmingham, Alabama that experienced HOPE VI revitalization from 2006 to 2010. Between 2000 and 2010, there was a 19.9% decline in the population living in the four Census Tracts (United States Census Bureau, 2013, 2000) within the community; this decline was mostly due to relocation of public housing residents from the pre-revitalized HOPE VI site to other communities. The community was mostly female (52%) and 37.4% of residents lived below poverty. The median household income was \$27,078, about 23% had less than a high school diploma and 21% were unemployed.

2.2. Research strategy

To achieve our study aims, we used a sequential mixed methods research design (Creswell et al., 2003). For the first phase, we used a group concept mapping approach to examine surrounding residents' perceived expectations for how HOPE VI revitalization might

affect their community, health and physical activity. The second phase involved collecting quantitative data using a standardized questionnaire that incorporated the themes derived from the group concept mapping results. Eligibility criteria required that adults self-report that they were age 19 years or older, reside in the surrounding community, and were African American. We conducted work in the focus community between January 2010 and June 2011. All study related protocols received approval from the Institutional Review Board at the University of Alabama at Birmingham.

2.2.1. Phase 1 study design: group concept mapping

2.2.1.1. Sampling procedures. We used purposive, convenience sampling which is an established method of recruitment to engage minority populations (Keyzer et al., 2005). To develop effective recruitment strategies, we worked with two community partners (i.e., faith- and business-based organizations). A staff member from the faith-based organization and the study Principal Investigator (PI) distributed flyers at the two libraries, one health clinic, two recreation centers and two churches. We also attended several community, church and two neighborhood association meetings and relied upon snowball sampling. A total of 76 residents responded to the recruitment efforts, of which 18 were excluded due to not meeting eligibility criteria ($n = 3$), non-working telephone numbers ($n = 3$), lack of availability on meeting dates ($n = 5$), cancellations/no shows ($n = 4$), refusal to participate ($n = 2$) or unreported ($n = 1$). The remaining 58 residents participated in the group concept mapping data collection events. Residents' characteristics were fairly similar to those reported in the US Census Bureau; 32% were unemployed and ~70% reported having a high school diploma or more. However, the median income was lower and a larger percentage was female (71%).

2.2.1.2. Data collection. Group concept mapping includes both data collection and analysis and incorporates qualitative and quantitative methods. The qualitative portion refers to generating ideas through the use of qualitative methods such as the nominal group technique used in the current analyses and unstructured sorting of ideas. The quantitative portion includes the statistical methods of multidimensional scaling, hierarchical cluster analysis of the statements based on the rating metric, and t -tests for significant differences between clusters of statements based on the rating metric (Trochim and Kane, 2005). This methodology provides participants with the ability to actively engage in generating, structuring and identifying ideas that are most relevant to the study aims. While we collected insights from participants regarding potential changes to the community, health and physical activity, to align with current study objectives, we only present the subset of data regarding physical activity.

Group concept mapping includes five sequential phases: preparing for group concept mapping, generating the statements, structuring the statements, analysis and interpretation. To *prepare for group concept mapping*, we developed a focus prompt to elicit responses from study participants. The focus prompt is a focused question to guide qualitative data collection with study participants. After attending community meetings related to HOPE VI, reviewing theories and the extant literature on neighborhoods and health, we developed a focus prompt related to physical activity, "How do you think the new Tuxedo housing will affect participation in physical activity?"

During the *generation phase* of group concept mapping, we conducted modified nominal group sessions (Gallagher et al., 1993). We held four nominal group meetings with 10–12 residents at each. The meetings occurred at libraries in the HOPE VI community and each lasted approximately 1.5 h. The study co-investigators facilitated the nominal groups. Residents generated ideas in

response to the physical activity focus prompt. Using a round-robin format, we elicited residents' generated statements until all ideas were exhausted. Next, residents edited statements for relevancy to the focus prompt, redundancy and provided additional statements at this stage. During these sessions, residents did not prioritize ideas. Residents also reported demographics, length of residence in the neighborhood, socioeconomic status and home ownership. We achieved content saturation of ideas related to HOPE VI after four nominal group sessions. The residents developed 86 statements related to physical activity. The study PI transcribed the statements into an Excel spreadsheet and each data coder (PI and two study Co-investigators) conducted an independent review of the statement set. During this process, we reviewed and edited the statements based on relevance to the focus prompt, for clarity and judgmental statements, for removal of duplications and separation of compound statements. The final statement set contained 50 unique statements related to physical activity. We used this statement set for all subsequent data collection and analysis activities.

For the *structuring phase*, residents sorted and rated the 50 statements. The structuring meetings occurred after completion of all generation meetings. We held five meetings with seven to 10 residents at each meeting. For the sorting task, each resident received a stack of cards (in random order) with one statement printed on each card. The meeting facilitator (study PI) instructed participants to sort the statements into piles based on similarity in meaning that "made sense to them." There were several restrictions to the sorting process: 1) statements could not be sorted into more than one pile and 2) there could not be a miscellaneous pile of cards. Upon completion of sorting, participants received a rating sheet and rated each of the statements based on relative importance to the other statements included in the set (5 = most important to 1 = least important). Residents also completed the surveys that were included in the generation phase.

2.2.1.3. Data analysis. To analyze the clustering and rating of statements, we used Concept Systems® Software (Concept Systems Incorporated, Ithaca, NY). To conduct cluster analysis, the software uses a multidimensional scaling method to create visual maps that represent relationships between statements, how the statements cluster into underlying themes and the relationships between clusters (for more detail see Kane and Trochim, 2007). For cluster rating analyses, we used the rating data to identify statements and clusters that residents perceived as important. We integrated these statements/themes into the second phase of the study to inform development of subscales for the questionnaire. We also conducted t -tests to examine whether the physical activity-related cluster ratings significantly differed based on perceived relative importance. Significance criterion was set at $\alpha < 0.05$.

During the *interpretation phase*, two volunteer study participants developed labels that represented the main theme of each of the clusters. Concomitantly, the PI and Co-Investigators conducted an independent review of the statements to identify emergent themes within each cluster. While the cluster labels presented are not the volunteers' labels verbatim, the labels integrate their suggestions and represent the main theme of each cluster.

2.2.2. Quantitative data

2.2.2.1. Data collection. We collected data with surrounding residents at baseline (prior to completion of HOPE VI) and at six month follow-up (after the initial wave of HOPE VI housing rentals and green spaces, play areas, walkways and bike paths had been completed). The questionnaires included the themes derived from the concept mapping results, theory and literature reviews. The six month follow-up questionnaire also included HOPE VI related subscales developed from the group concept mapping results.

2.2.2.2. Sampling procedures. We recruited participants from the four Census Tracts using multi-modal sampling methods to reach a total of 522 residents (see Fig. 1). Our initial recruitment strategy included randomly mailing study recruitment letters to $N = 200$ households using a list of household addresses purchased from Genesys. We used the Dillman protocol (2000) and sent three letters of invitation to each household. We excluded 138 households due to non-response ($n = 114$), undeliverable mailing address ($n = 22$), ineligible ($n = 1$) or refusal to participate ($n = 1$). Thirty-one residents agreed to participate and a total of 27 residents completed surveys. While the random mailings resulted in a 13.5% response rate which is within the range of response rates for mailed surveys (Dillman, 2000), this did not yield a sufficient sample size. Thusly, we employed two additional sampling methods. We recruited residents who participated in the group concept mapping phase of data collection. We re-contacted these participants via telephone and 56% ($n = 33$) agreed to participate and also completed surveys. We also relied upon study referrals (snowball sampling) from previous participants. Snowball sampling resulted in an initial recruitment of 263 'walk-ins' who we screened for eligibility. A total of 83 residents received an appointment on-site of which 87% ($n = 72$) completed surveys. We placed the remaining 180 residents on a waiting list from which 121 were randomly selected to participate. At this stage, 51% ($n = 62$) of wait-list residents were excluded due to nonresponse ($n = 36$), refusals ($n = 5$), non-working telephone numbers ($n = 4$) or ineligibility ($n = 4$). The remaining 49% ($n = 59$) of residents scheduled an appointment and 88% ($n = 52$) completed surveys. These multimodal methods yielded a sample size of 184 residents at baseline. Residents' characteristics were fairly similar to those reported in the US Census in that 52% were female. However, the median income was lower (\$14,000–\$16,999), a larger percentage reported having at least a high school diploma (85%) and a larger percentage was unemployed (30.4%).

2.3. Measures

2.3.1. Dependent measure

2.3.1.1. Neighborhood-based leisure physical activity. Participants reported whether they engaged in leisure time walking or jogging physical activity in their neighborhood (yes/no). Response options were 0 = no physical activity and 1 = physical activity.

2.3.2. Independent measures

2.3.2.1. Perceived neighborhood disorder. Participants reported neighborhood conditions using the 10-item version (Cronbach's $\alpha = 0.84$) of the Perceived Neighborhood Disorder Scale (Ross and Mirowsky, 1999). The statements assessed respondent's perceptions of physical and social disorder and a prosocial neighborhood environment. This measure has demonstrated construct validity and reliability with ethnically diverse populations.

2.3.2.2. Neighborhood aesthetics. To examine perceptions of neighborhood aesthetics, residents completed the aesthetics subscale (Cronbach's $\alpha = 0.74$) of the Neighborhood Environment Walkability Scale (NEWS) (Saelens et al., 2002). The subscale has demonstrated test-retest reliability and validity with ethnically diverse samples of adults.

2.3.2.3. Neighborhood walkability. Residents completed the walkability NEWS subscale (Cronbach's $\alpha = 0.70$; Saelens et al., 2002). The subscale has demonstrated test-retest reliability and validity with ethnically diverse samples of adults.

2.3.2.4. HOPE VI-related neighborhood constructs. In the six-month follow-up questionnaire, we included highly rated statements/themes generated from the Phase One concept mapping results. We asked participants to answer questions about changes within the community, changes to health, or changes in physical activity that

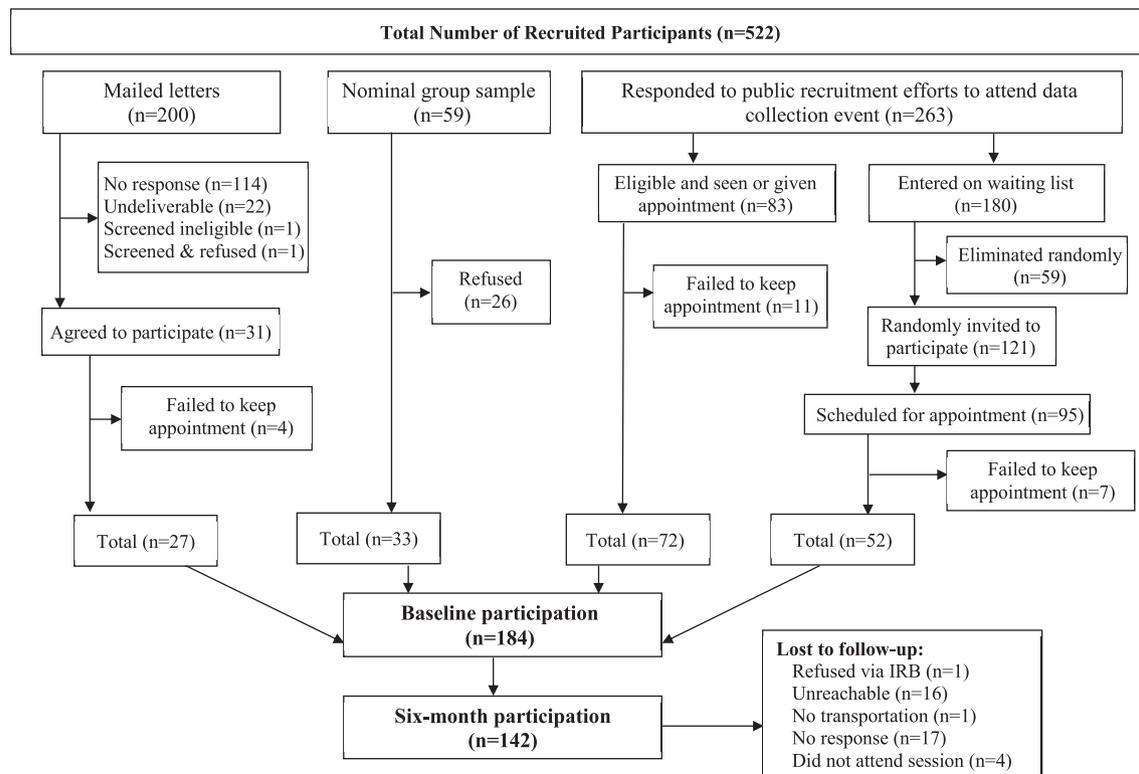


Fig. 1. Recruitment flow chart.

may have taken place as a result of HOPE VI. We conducted exploratory factor analysis to identify factors.

2.3.2.5. HOPE VI safety subscale. Because changes in general neighborhood safety related to HOPE VI may be an important determinant of neighborhood-based physical activity, we included this subscale. The eigenvalue was greater than one and factor loadings for each item were greater than 0.57. Participants responded to the following 4 statements: “I feel less likely to be a victim of a crime,” “I feel less fearful in the community,” “There has been a reduction in crime,” and “I feel safer in the community.” Response options ranged from strongly agree (5) to strongly disagree (1). Scores ranged from 4 to 20 and higher scores corresponded more favorable perceptions and the scale showed good internal consistency (Cronbach's $\alpha = 0.86$).

2.3.2.6. HOPE VI perceived safety for physical activity. The exploratory factor analysis indicated that the three participant-related physical activity items loaded onto one factor with an eigenvalue greater than one and factor loadings greater than 0.64 for two items and 0.40 for the remaining item. Participants rated how strongly they agreed with the following 3 statements: “It is safer to go outside and exercise in the neighborhood,” “I feel safer to go out and exercise in my community,” and “I have participated in more neighborhood physical activity.” Response options ranged from strongly agree (5) to strongly disagree (1). Scores ranged from 3 to 15 and higher scores corresponded with better perceptions. The scale showed good internal consistency (Cronbach's $\alpha = 0.81$).

2.3.3. Covariates

Participants self-reported their age, gender, highest level of education completed and the total annual household income for the previous year. We considered that distance from the HOPE VI site might affect participants' perceptions of neighborhood change and participation in physical activity. We examined distance (in miles) from HOPE VI by calculating distances between the HOPE VI development and each participant's address using publicly available mapping software.

2.4. Statistical analysis

We present descriptives for each of the variables. Statistics including t-tests and chi-squares examined whether there were significant differences in demographic characteristics between the retained sample participants and those lost to follow-up. We conducted paired t-tests and Analysis of Variance (ANOVA) ANOVAs to examine whether the changes in neighborhood-related variables significantly differed from baseline to six month follow-up and by distance from HOPE VI site. For the main analyses, we examined a series of block entry logistic regression models to examine whether the neighborhood measures and change scores influenced the odds of neighborhood-based physical activity. We excluded the individual-level socioeconomic block because it was not statistically significant and also excluded the HOPE VI Safety measure because it was highly correlated with HOPE VI Safety for Physical Activity. Because change scores are highly confounded with baseline levels, we included both baseline and change values in the logistic regression models. We set the probability criterion set at $\alpha < 0.05$ and we used SAS version 9.3 (SAS Institute Inc, Cary, NC) for all analyses.

3. Results

3.1. Concept map findings: surrounding residents' perceived expectations for HOPE VI

A total of 58 residents participated in the group concept mapping process (Table 1). The average age of the participants was 45

Table 1

Characteristics of participants who participated in the group concept mapping process ($N = 58$).

Characteristic	Mean \pm SD or n (%)
Age (years)	45.5 \pm 14.3
Gender (female)	41.0 (70.6)
Years in the Community	16.4 \pm 16.3
Home ownership	23.0 (39.7)
Education	
Less than high school	7.0 (12.1)
High school degree	11.0 (18.9)
Technical training/some college	21.0 (36.2)
Bachelor's degree or higher	16.0 (27.5)
Missing	3.0 (5.1)
Household income	
Less than \$5000	13.0 (22.4)
\$5000–\$10,999	9.0 (15.5)
\$11,000–\$13,999	7.0 (12.1)
\$14,000–\$22,999	9.0 (15.5)
\$23,000–\$28,999	4.0 (6.8)
\$29,000–\$37,999	5.0 (8.6)
\geq \$38,000	6.0 (10.3)
Missing	5.0 (6.8)
Employment	
Disabled	12.0 (20.7)
Employed	19.0 (32.7)
Retired	4.0 (8.0)
Unemployed	19.0 (32.8)
Missing	4.0 (6.9)

Note. SD = Standard deviation.

years and the participants were mostly women (71%). On average, participants lived in the community for 16 years. Almost 40% of participants reported home ownership. More than three-fourths of residents had completed at least high school and half of the participants reported an annual household income of less than \$14,000.

The group concept mapping results identified three clusters that referenced how the HOPE VI development might influence physical activity. There were no significant differences in the average relative importance across the clusters. Below, we describe subthemes and highly rated statements that emerged from these clusters.

3.1.1. Increase leisure physical activity

Residents sorted 23 statements into this cluster which referenced how HOPE VI is expected to increase neighborhood walking, jogging and other types of physical activities via changes to the built environment, community aesthetics, safety and social norms for physical activity. For example, resident statements indicated that the built environment modifications (i.e., expected walking and bike paths and parks) will provide “youth a place to participate in physical activity which takes them off of the street” and that the esthetic changes such as “the cleanliness and stability of HOPE VI would increase physical activity.” Resident statements also indicated that HOPE VI would change social norms because “there will be a ripple effect because if you see one person out, this will have a positive effect on motivating other people's physical activity” and “the community may increase the awareness of exercise.” Additional statements by residents highlighted the safety aspects of HOPE VI such that “if [HOPE VI] get a walking track where people can feel safe, it would make more people use it.”

3.1.2. Safe play areas

Residents sorted 6 statements into this cluster and the emergent subthemes related to the expected improvements in the safety of the physical activity resources and of the surrounding community. It was expected that these improvements in safety would increase physical activity for both children and adults. Additionally, one statement

highlighted the concern that “police should be aware that the physical activity is increasing in the neighborhood so that black males jogging won't be profiled.” The resident statements that directly referenced safety of physical activity resources included the statement “there are safe places to play for children (e.g., no broken glass at the park in Tuxedo, syringes, or needles).” Also, other statements referenced general community safety, “the new HOPE VI development is well-lit, can go walk and see who is in front/behind you,” and “feel safe letting kids go outside to be physically active.”

3.1.3. Generate health promoting resources

Residents sorted 21 statements into this cluster and subthemes mostly addressed the proposed built environment changes such as the walking tracks and bike trails, while other statements referenced built environment modifications that residents hoped would occur. Additionally, statements referenced the responsibility of adults to role model appropriate behaviors and activities. The statements in this cluster identified physical activity, general health and the need to provide more health clinics. The highest rated statement in this cluster referenced built environment modifications that would increase physical activity such that “with the proposed items such as swimming pools, walking tracks, and bike trails, people will become more physically active.” As well, another statement referenced general health, “the newness and cleanliness of the development should have a positive impact on health.”

Overall, several recurring themes emerged regarding the potential influences of HOPE VI on participation in physical activity.

These themes referenced built environment modifications that improve neighborhood walkability, aesthetics and increase access to physical activity resources. Also, improvements in the perceptions of the social environment (i.e., general community safety and safety for physical activity) emerged as an important pathway. We examined whether several of these mechanisms (i.e., changes in neighborhood walkability, aesthetics, disorder and HOPE VI-related community safety and safety for physical activity) increased the odds of neighborhood-based walking and jogging with a larger cohort of residents from baseline to six-months. We describe these quantitative results below.

3.2. Quantitative

A total of 184 residents completed the baseline survey. At six month follow-up, we retained 77% of the baseline sample ($N = 142$). However, participants were excluded due to missing responses for the baseline physical activity variable, reported Post Office Boxes as their mailing address or were missing data on one of the neighborhood change variables. These exclusions resulted in an analytic sample of $N = 120$. There were no significant differences in age, gender, education, income or participant reported baseline neighborhood aesthetics, walkability or disorder between those included in the analytic sample and those who were excluded due to attrition/missing data (p -values > 0.15). Baseline socio-demographic and neighborhood characteristics are presented in [Table 2](#). Participants averaged 45 years of age and approximately

Table 2
Baseline socio-demographic and neighborhood characteristics for quantitative phase ($N = 120$).

Characteristic	Mean \pm SD or n (%)
Age (years)	44.7 \pm 14.0
Gender (female)	58.0 (48.3)
Education	
Less than high school	17.0 (14.2)
High school degree	43.0 (35.8)
Technical training/some college	43.0 (35.8)
Bachelor's degree or higher	17.0 (14.2)
Employment	
Disabled	26.0 (21.7)
Employed	51.0 (42.5)
Retired	11.0 (9.2)
Unemployed	32.0 (26.7)
Income	
Less than \$5000	23.0 (19.2)
\$5000–10,999	23.0 (19.2)
\$11,000–13,999	8.0 (6.7)
\$14,000–\$22,999	20.0 (16.7)
\$23,000–28,999	7.0 (5.8)
\$29,000–37,999	15.0 (12.5)
\geq \$38,000	21.0 (17.5)
Not reported	3.0 (2.5)
Below US Poverty threshold ^a	91.0 (75.8)
Marital status	
Never married	41.0 (34.2)
Married or cohabiting	39.0 (32.5)
Divorced or separated	40.0 (33.3)
Years lived in community	23.6 \pm 18.8
Transportation	
Car	91.0 (75.8)
Bus	9.0 (7.5)
Walking	10.0 (8.3)
Not reported	10.0 (8.3)
Engaged in neighborhood physical activity (i.e., walking/jogging)	62.0 (51.7)
Perceived neighborhood disorder scale	24.7 \pm 6.3
NEWS-neighborhood aesthetics	2.5 \pm 0.5
NEWS-neighborhood walkability	2.5 \pm 0.5

Notes. SD = Standard deviation. NEWS = Neighborhood Environment Walkability Scale. US = United States.

^a Based on 2010 US Census Bureau Total reported annual household income adjusted for household size, including the number of related children <18 years of age.

48% were women. About 86% had completed a high school education. Almost 40% reported annual household incomes of less than \$11,000. Almost one-third of the sample was married or cohabiting, one-third had never married one-third was divorced or separated. Participants lived in the community for an average of 24 years. Regarding primary means of transportation, 76% of participants reported using a car while 7.5% reported using the bus while another 8.3% reported walking. Slightly more than half of participants engaged in neighborhood-based leisure time walking or jogging. Participants reported moderate levels of neighborhood disorder and slightly better than average levels of neighborhood walkability and aesthetics.

The neighborhood changes in physical activity, perceived built- and social-environments, the HOPE VI-related subscales and p-values are presented for the total sample and by distance from HOPE VI (see Table 3). Slightly more than one-third of respondents who were active at baseline maintained activity at six-months, 29% of residents were inactive at both time points, 19.2% were active at baseline only and 16.6% of respondents were active at six-month follow-up only. There were no statistically significant changes in perceived neighborhood disorder ($p = 0.39$), or walkability ($p = 0.30$) from baseline to follow-up. However, there was a significant decline in perceived neighborhood aesthetics ($p = 0.02$). Descriptive findings for the HOPE VI subscales indicated that on average, participants tended to agree that the neighborhood had increased in safety and that perceived safety for physical activity had increased since HOPE VI.

We also tested the hypothesis that residents who lived closest to HOPE VI would report more favorable changes in physical activity and neighborhood factors because they lived closest to the new development. However, when examined by distance from HOPE VI, there were no significant differences in the proportion of residents who changed their physical activity ($p = 0.19$), neighborhood aesthetics or walkability ($p = 0.84$ and 0.15 , respectively). However, residents who lived between 0.5 to less than 1 mile reported less disorder than residents who lived between 1 to less than 1.5 miles or 2.5 miles away or more ($p = 0.02$).

The logistic regression examining predictors of the odds of increased neighborhood-based leisure time walking/jogging between baseline and six-month follow-up are presented in Table 4.

In Model 1, baseline physical activity increased the odds of physical activity at six months by almost three-fold. In Model 2, age and gender were not statistically significant. However, baseline physical activity remained statistically significant. In Model 3, increased neighborhood walkability was associated with more than three-fold increased odds of physical activity. Baseline physical activity retained statistical significance. In Model 4, perceived HOPE VI-related safety for physical activity increased odds of physical activity by 19%. In this model, baseline physical activity and neighborhood walkability were no longer statistically significant.

4. Discussion

The overall objective of this study was to examine whether HOPE VI community revitalization influenced physical activity outcomes among residents surrounding a HOPE VI site. This mixed-methods study adds to the literature on neighborhood built and social contexts of physical activity in several key ways by: evaluating a natural experiment within a community undergoing HOPE VI transformation; conducting concept mapping with surrounding residents to identify potential mechanisms for HOPE VI effects on neighborhood-based physical activity; and testing these potential mechanisms quantitatively within a larger cohort of residents at baseline and six-month follow-up. The results from this study contribute to the literature on changing neighborhood contexts and physical activity and highlight that implementing neighborhood revitalization policies may increase participation in neighborhood-based physical activity.

The HOPE VI intervention facilitates multilevel systems changes consistent with a socioecological framework and with neighborhood features that promote physical activity. It is well established that in disadvantaged neighborhoods, physical activity promoting infrastructure is absent, underutilized or unsafe, that neighborhood walkability may be low and that social and physical disorders may discourage neighborhood-based physical activity (Blacksher and Lovasi, 2012; Nehme et al., in press; Wilson et al., 2014). These neighborhoods may lack collective efficacy whereby people lack strong social ties with their neighbors, thus reducing the likelihood that informal social controls will monitor and sanction any negative events that might influence physical activity (Burdette and Hill,

Table 3
Change scores for neighborhood physical activity, social- and built environment, and other HOPE VI related measures.

Measure	Total sample		Distance from Participants' home to the HOPE VI development (miles)						p
	N = 120	p	<0.5 (n = 8)	0.5–<1.0 (n = 41)	1–<1.5 (n = 25)	1.5–<2.0 (n = 22)	2–<2.5 (n = 13)	≥2.5 (n = 11)	
Neighborhood physical activity									
Active at baseline and follow-up	35.0		50.0	29.3	36.0	31.8	30.8	54.6	0.19
Inactive at baseline and follow-up	29.2		37.5	43.9	16.0	27.3	30.8	0.0	
Active at follow-up only	16.7		0.0	14.63	12.0	27.3	15.4	27.3	
Inactive at follow-up only	19.2		12.5	12.2	36.0	13.6	23.1	18.2	
Neighborhood disorder	0.4 ± 5.4	0.39	2.1 ± 4.4	−1.7 ± 4.9*	2.2 ± 5.1*	0.5 ± 5.0	−0.1 ± 5.8*	3.3 ± 6.3	0.02
Decrease in disorder	48.3		25.0	65.8	28.0	40.9	53.8	18.2	
No change in disorder	6.67		0.0	4.8	16.0	4.6	7.7	0.0	
Increase in disorder	45.0		75.0	29.23	56.0	54.6	38.5	81.82	
Neighborhood aesthetics	−0.1 ± 0.6	0.02	0.0 ± 0.3	−0.1 ± 0.5	−0.2 ± 0.7	−0.0 ± 0.5	−0.2 ± 0.8	−0.1 ± 0.6	0.84
Decrease in aesthetics	47.5		25.0	46.3	52.0	40.9	61.5	54.6	
No change in aesthetics	15.8		37.5	17.1	6.0	13.6	5.4	0.0	
Increase in aesthetics	36.67		37.5	36.6	32.0	45.4	23.1	45.4	
Neighborhood walkability	0.1 ± 0.6	0.30	−0.1 ± 0.3	−0.1 ± 0.7	0.3 ± 0.6	0.0 ± 0.6	0.1 ± 0.4	−0.1 ± 0.6	0.15
Decrease in walkability	38.3		50.0	48.8	20.0	45.4	30.8	27.3	
No change in walkability	16.67		25.0	14.6	12.0	9.1	23.1	36.4	
Increase in walkability	45.0		25.0	36.56	68.0	45.4	46.2	36.4	
HOPE VI neighborhood Safety Subscale	12.9 ± 3.7		13.8 ± 3.8	12.1 ± 3.7	13.4 ± 3.2	13.1 ± 3.8	11.9 ± 3.32	13.4 ± 4.7	0.81
HOPE VI perceived safety for physical activity subscale	9.8 ± 3.0		9.9 ± 3.5	9.6 ± 3.0	9.8 ± 3.3	10.0 ± 3.2	10.0 ± 2.9	10.1 ± 2.5	0.99

Note. Summary statistics are presented as Mean ± Standard Deviation (SD) or percentage (%). *Abbr.* HOPE VI = Housing Opportunities for People Everywhere.

*Significant difference in neighborhood disorder by distance from HOPE VI.

Table 4

Block entry logistic regression analysis of Housing Opportunities for People Everywhere (HOPE VI) variables as predictors of neighborhood-based physical activity at six month follow-up ($N = 120$).

Predictors	Logistic regression Models							
	Model 1	<i>p</i>	Model 2	<i>p</i>	Model 3 ^a	<i>p</i>	Model 4 ^a	<i>p</i>
Physical active at baseline	3.20 (1.51–6.75)	0.002	2.96 (1.37–6.41)	0.006	2.71 (1.13–6.52)	0.026	2.34 (0.94–5.79)	0.067
Gender (male)			2.15 (0.95–4.40)	0.067	2.08 (0.92–4.73)	0.080	1.75 (0.75–4.15)	0.197
Age (years)			1.01 (0.98–1.04)	0.497	1.01 (0.98–1.04)	0.603	1.01 (0.98–1.04)	0.433
Distance (miles) from HOPE VI development					1.21 (0.72–2.03)	0.464	1.21 (0.72–2.04)	0.475
Change in neighborhood disorder					0.99 (0.90–1.09)	0.855	1.01 (0.92–1.11)	0.901
Change in neighborhood aesthetics					0.88 (0.35–2.19)	0.782	0.82 (0.32–2.11)	0.679
Change in neighborhood walkability					3.12 (1.11–8.72)	0.030	2.71 (0.96–7.65)	0.060
HOPE VI perceived safety for physical activity							1.19 (1.02–1.39)	0.024

Note. Odds ratio (95% confidence interval) is presented for each model; significance level is set at $p < 0.05$. *Abbr.* HOPE = Housing Opportunities for People Everywhere.

^a Models 3 and 4 are adjusted for baseline neighborhood disorder, walkability and aesthetics.

2008; Sampson, 2003). Since most physical activity occurs within intrapersonal (i.e., family, friends and neighbors) and community contexts, behavior change may be facilitated by changing built and perceived social environments (Blacksher and Lovasi, 2012; Gustat et al., 2012). Multilevel intervention studies conclude that strategies based on mobilizing neighborhood social networks and social support as well as built environment modifications improve neighborhood based physical activity habits (Kinney et al., 2012; Wilson et al., 2014).

Results from the concept mapping portion of the study are consistent with the aforementioned roles of neighborhood effects on neighborhood-based physical activity. Resident statements suggest that while changes to the built environment are important for increasing physical activity, the social environment, particularly physical activity-related safety at recreational facilities, at parks and perceived safety for physical activity within the community, are additional influences on participation in neighborhood physical activity. These findings are supported by a qualitative study with residents in a pre-revitalized HOPE VI neighborhood (Marinescu et al., 2013). In this previous study, residents indicate lack of street lights and feeling unsafe in the community as barriers to physical activity (Marinescu et al., 2013). Cross-sectional and intervention studies with residents in disadvantaged communities also suggest that neighborhood perceptions influence participation in physical activity (Krieger et al., 2009; Wilson et al., 2014). Additionally, residents in the current study indicate that changing neighborhood social norms for physical activity might also influence physical activity behaviors. These relationships are supported by cross-sectional studies (Kinney et al., 2012) and results from the PATH intervention where neighborhood social marketing campaigns, social support for physical activity and changes to the neighborhood norms for physical activity increased participation (Wilson et al., 2014).

Empirical testing with a larger cohort of community residents provides additional support for the concept mapping results and the extant literature. The quantitative results indicate that residents perceive improvements in walkability and neighborhood safety for physical activity resulting from HOPE VI, and in turn, these improvements are associated with increased participation in neighborhood walking or jogging. These findings add to the body of evidence which supports associations between neighborhood walkability and physical activity (Kinney et al., 2012; Nehme et al., *in press*), but contrast with other non-significant study results (Durand et al., 2011). It should be noted however that the current study assesses walkability and physical activity at two time points, whereas the majority of studies with non-significant findings measure one time point. Research studies that include baseline and follow-up data from residents who relocate to new communities suggest that perceived improvements in neighborhood walkability

are associated with increased walking activity (Giles-Corti et al., 2013; Hirsch et al., 2014; Wells and Yang, 2008). However, many of these studies rely on self-reports of physical activity. Future research should include objectively measured physical activity to provide more insight into the complex relationships between changes in neighborhood walkability and perceived safety for physical activity on physical activity levels.

Although we hypothesized that changes in perceived neighborhood disorder would be associated with physical activity, we did not find any support for these associations. While qualitative statements from residents suggest that crime and drug related activity decreased, there were no significant associations with physical activity. This null result is similar to the finding of Giles-Corti et al. (2013) who found no evidence for relationships between changes in perceptions of neighborhood crime with physical activity among residents who relocated to new housing communities. Additionally, longitudinal and cross-sectional evidence (Kerr et al., 2015; Foster et al., 2012) and systematic reviews (Foster and Giles-Corti, 2008) also find limited support for the effects of perceived neighborhood disorder and violence on physical activity. This may indicate that perceived neighborhood disorder is too general a measure and/or individuals who are physically active in disadvantaged and disordered neighborhoods utilize strategies to reduce their risk of victimization. More specific measures of physical activity-related safety, such as the one developed in the current study as well as qualitative insights from physically active residents in these communities may provide better understanding of the relationships between neighborhood perceptions of disorder and physical activity outcomes.

Although there were no significant differences in reported changes in perceived neighborhood disorder or walkability from baseline to six-month follow-up, walkability significantly increased the odds of neighborhood-based physical activity. Also, perceived aesthetics significantly declined at six-month follow-up. At the time of baseline data collection, significant modifications to the neighborhood had already taken place. If we had been able to measure perceived aesthetics prior to any redevelopment of the original public housing site, significant improvements in aesthetics and associations with physical activity might have emerged. Similarly, walkability did not significantly change between baseline and follow-up; however, changes in walkability significantly influenced neighborhood-based physical activity. We hypothesize that the timing of data collection (i.e., after HOPE VI construction was in progress) may have influenced study findings. Despite the lack of significant changes in walkability, minor changes led to significant increases in physical activity, even after controlling for baseline levels of walkability.

Lastly, we expected that residents living less than 0.5 miles from the HOPE VI site would report the greatest improvements in

disorder, aesthetics, walkability and HOPE VI-related neighborhood safety and physical activity. However, this was not supported by the results. Perceived HOPE VI-related improvements demonstrated some spillover effects within the community. When categorized by distance, residents up to 2.5 miles from the HOPE VI site perceived improvements walkability, HOPE VI-related safety, and safety to participate in neighborhood-based physical activity and increased participation in neighborhood physical activity. These findings are supported by research suggesting that environmental policies to improve access to physical activity related-resources and green spaces significantly increase neighborhood-based physical activity (Giles-Corti et al., 2013). The available evidence from smart growth communities also indicate that this redesign approach increases residents' participation in neighborhood-based physical activity (Durand et al., 2011). These study findings suggest that multi-faceted approaches for community revitalization and redevelopment such as those evidenced with HOPE VI, are associated with significant increases in neighborhood-based physical activity.

4.1. Limitations

While this study presents support for community revitalization efforts on neighborhood-based physical activity, it does have some limitations. This study only included one community undergoing HOPE VI revitalization. As such, the current study findings are not generalizable. We were unable to conduct an RCT, which is considered the gold standard for intervention research, or include a control community. Instead, we capitalized on existing policy changes within a low-income community and conducted a natural experiment. This approach is gaining more support in research, particularly for its role in providing evidence for policy-related outcomes (Giles-Corti et al., 2013). Additionally, there was a low response rate to the randomized mailing for the quantitative portion of the study and thusly, we had to employ a multi-modal recruitment strategy which is a limitation to generalizability of study results. Also, the study sample size was small, almost one-quarter of the sample was lost to follow-up and the sample was further restricted due to missing data for some participants, which may have affected the study results. However, there were no significant differences in demographics between participants in the analytic sample and those who were excluded. We also relied upon a self-reported binary measure of physical activity which has not been established as a valid measure. Self-reported physical activity is subject to social desirability and response biases and demonstrates low correlations with accelerometer derived activity (Dyrstad et al., 2013). We also did not examine whether residents used the new walking paths, bike trails and parks within the new HOPE VI development. Instead, our main interest was to capture context specific (i.e., neighborhood and community) physical activity in absolute terms to determine whether environmental modifications resulted in changes in overall participation in physical activity. In future studies, we will incorporate objective measures such as accelerometry or observation methods such as SOPLAY to reduce biases associated with self-report (Dyrstad et al., 2013). While this study presents baseline and six-month changes in self-reported neighborhood-based physical activity, longitudinal studies are needed to better inform relationships linking policy efforts, community changes and physical activity related outcomes. Including more longitudinal studies will benefit urban planners, policy makers and public health practitioners to understand how multi-faceted approaches to change neighborhood built and social environments may promote neighborhood-based physical activity.

Despite some limitations, the findings provide evidence for how efforts like HOPE VI may stimulate neighborhood-based physical activity. Significant strengths to our work include the use of a

community engaged research approach to understand perceptions of residents and our mixed methods approach to test hypothesized mechanisms of action on physical activity change. This study also provides quantitative evidence that neighborhood physical activity increases in response to policy-level interventions that alter the built and social environments.

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