Neighborhood Infrastructure, Community Dynamics, Physical Activity, and Health Outcomes

A Report for KC-LISC on Four Kansas City Neighborhoods

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EXECUTIVE SUMMARY

1) *Introduction:* Aspects of the physical (e.g., available facilities) and social (e.g., peer support) environments directly and indirectly affect health behaviors and subsequently, the risk of developing chronic diseases. This necessitates a more focused examination of neighborhood redevelopment initiatives, which promote robust changes in the environment. The Kansas City Local Initiatives Support Corporation's (KC-LISC) NeighborhoodsNOW program utilizes a wide variety of infrastructure and community redevelopment strategies that could have significant impacts on health. The aim of this study was to develop and test a theoretically based, multidimensional health assessment model for evaluating the health impact of NeighborhoodsNOW.

2) Study Design: To accomplish this aim neighborhood- and individual-level information about the physical environment (e.g., park quality), social networks, physical activity behavior, and health (e.g., body mass index [BMI]) were assessed in two LISC neighborhoods and two comparison neighborhoods. The aspects of the physical and social environments selected for examination were closely linked with specific strategies for promoting neighborhood improvements outlined in the Quality of Life plans created for the LISC neighborhoods. Unique aspects of this study included the integration of physical and mental health with social and infrastructural information and the administration of a comprehensive survey and screening instrument door-to-door in the neighborhoods under study.

3) *Outcomes of Environmental Assessment:* Environmental audits revealed that walkability (e.g., good sidewalk conditions) was better in the LISC neighborhoods than in the comparison neighborhoods and that walkability was correlated with more people seen using sidewalks/streets for physical activity. Audits also showed that the average quality ratings of features and amenities in public open spaces were better in the LISC than in the comparison neighborhoods. The average number of physically active individuals seen in the LISC public open spaces was 132.5, compared with 32.0 in the public open spaces located in the comparison neighborhood.

4) *Outcomes of Survey and Health Screenings:* Survey data collected in the LISC and two comparison neighborhoods shows the complex dynamics of health and illness among this population. Namely, physical activity promoted positive health outcomes while sedentary activity promoted negative ones. Moreover, health care access had limited effects on important health considerations such as BMI and chronic disease. This suggests physical activity is critically important for health, perhaps even more important than access to a physician for some health outcomes. This means that community development agencies such as LISC have increasingly important roles to play since the data show physical activity is promoted when neighborhoods are more walkable and have greater aesthetic value. The data also show that physical activity is promoted when an individual has strong ties to others, because other people serve as a resource for accessing health care, dealing with problems, and even exercising itself.

5) *Conclusions and Recommendations:* LISC should continue with quality of life plans as these contain numerous strategies for neighborhood engagement that promote health. As this is done, it will also be important to continue to evaluate the health impacts and their trajectories across time. It would be additionally useful to expand these health impact assessments to other LISC neighborhoods and populations. In sum, it is important to continue to think about health promotion broadly, acknowledging the way that health and disease are nested in community infrastructure and neighborhood dynamics.

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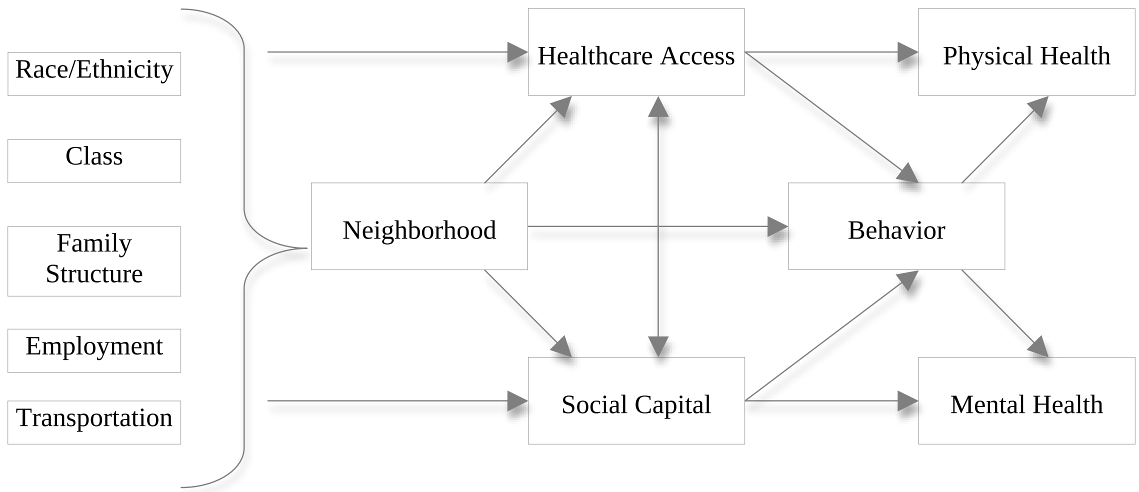
I. INTRODUCTION

Improving the physical and social conditions of a community can promote positive health behaviors among residents and subsequently improve their health. For example, residents with access to more physical activity facilities (e.g., playgrounds) are more likely to be physically active and less overweight and obese than individuals with less access to such amenities. The Kansas City Local Initiatives Support Corporation (KC-LISC) has launched a program called NeighborhoodsNOW for the purpose of helping residents of urban communities improve their quality of life. NeighborhoodsNOW focuses on creating positive changes in multiple aspects of the physical and social environments (improving green spaces, strengthening community services). As such, the program is well positioned to impact health behaviors and health status. Because the actions of NeighborhoodsNOW affect health through a unique network of pathways, assessing the health impacts of NeighborhoodsNOW requires a theoretically informed model populated by a corresponding variety of data that can illuminate their multifactorial effects on community dynamics and subsequent changes in health behaviors and outcomes. Lacking, however, is a comprehensive model of this nature and therefore no reliable or valid methods for evaluating the impact of NeighborhoodsNOW on health. *This study addressed this gap by developing and testing a theoretically based, multidimensional health assessment model for evaluating the health impact of NeighborhoodsNOW.* A key element of this study is to prove the feasibility of collecting individual and community level data that does not already exist, but is needed to populate the theoretical model described below.

This study concentrated on two neighborhoods participating in the NeighborhoodsNOW program and two neighborhoods that are demographically similar, but not in the NeighborhoodsNOW program or any other neighborhood development program. The inclusion of comparison neighborhoods allows for the collection of baseline comparative data that can be used to demonstrate the initial, positive health impacts of NeighborhoodsNOW and link specific neighborhood improvement strategies outlined in the Quality of Life plans devised as part of NeighborhoodsNOW with outcomes of interest (e.g., physical activity behavior) identified in our health assessment model.

Data collection for this project was guided by the theoretical model shown in Figure 1. Read from left to right, the model captures the relationships of core variables (those in the first column on the left) that set the social context in which the community improvement endeavors of NeighborhoodsNOW (the “Neighborhood” variable) are undertaken. It then illustrates the connection between the types of community improvements (the “Neighborhood” variable) and the kinds of subsequent environmental changes (“Health Care Access” and “Social Capital”) these improvements promote. These all affect “Health Behavior,” and ultimately a variety of physical and mental health outcomes (those in the column on the right side of the model).

Figure 1. Conceptual Model for KC-LISC Neighborhood Health Assessments.



KC-LISC Efforts Related to Physical Activity

Details regarding the Quality of Life plans for the two neighborhoods examined in this study were extracted from publications produced by KC-LISC. The framework for assessing environmental determinants of walking and cycling developed by Pikora et al, 2003 was used to identify strategies that could potentially affect physical activity and to group the strategies into six distinct environmental targets. Vague strategies (picnics, tours) that could not be confidently considered to affect physical activity were excluded. Furthermore, we did not include groundbreaking work such as conceptualizing, forming partnerships, and organizing. While these are very important for promoting environmental change the descriptions of these activities did not contain enough information to determine if they could have an effect on physical activity. If a groundbreaking activity did have enough information (e.g., obtain funding to renovate a park) it was included.

A summary of the information from the Quality of Life plans developed for the two LISC areas examined in this study is provided in Table 1. All six environmental target areas were supported by strategies. A total of 53 strategies were identified that exhibit some potential to positively affect physical activity, 28 in Scarritt and 25 in Douglass-Sumner. Most strategies were aimed at aesthetics and crime (19 and 13, respectively) and three were for creating exercise programs.

Overall, 55.6% of the strategies identified have been implemented according to the latest available Quality of Life plans. The highest percentage of strategies implemented related to aesthetics (79%) followed by destinations (75%). The lowest percentage of completion was for strategies targeting neighborhood walkability (20%).

Roadmap

In Section II of this report, we first describe the methods utilized to collect new data used to populate the model in Figure 1. The methods include randomized community audits,

Table 1. Quality of Life Plans Components Related to Physical Activity for all LISC Neighborhoods

Environmental Feature	Strategies Identified		Strategies Implemented		Percent Implemented
	Scarritt	Douglass-Sumner	Scarritt	Douglass-Sumner	Both Neighborhoods
Facilities/exercise structures	4	5	3	2	56%
Exercise program	1	2	2	-	66%
Destinations	3	1	2	1	75%
Crime	7	6	2	3	38%
Walkability	2	3	1	-	20%
Aesthetics	11	8	8	7	79%
Total	28	25	18	13	55.6% (avg)

descriptions of physical activity opportunities, resident questionnaires, and health screenings. Additionally, we compare the efficacy of two techniques for collecting individual data—centralized (i.e. health fairs and community events) and decentralized (door-to-door surveys). We conclude this section by describing successes and lessons learned during the data collection process. These are informative for the design and cost estimates of future health impact assessments of KC-LISC initiatives.

Provided in Section III of this report are the results of this study, including qualitative descriptions of physical activity opportunities, differences between LISC and comparison neighborhoods regarding community level indicators of physical activity and complementary environmental conditions, and individual level data. The latter is examined in terms of variables that predict health outcomes in the model, but also examined by each neighborhood to provide a differential description of health descriptors between LISC and comparison neighborhoods.

Interpretations of the study results are given in Section IV with particular attention being paid to the correspondence of findings with KC-LISC Quality of Life plans. This includes evaluation and recommendations for development and community organization strategies in these neighborhoods.

Presented in Section V are the conclusions based on study outcomes. This includes a review of strengths and weaknesses of the study, cost estimates for future studies, a discussion of methodological recommendations for future work, and possible avenues for obtaining funding for future research projects in this area.

II. METHODS

Data were collected for the key concepts in Figure 1 in order to provide baseline data on the infrastructure, dynamics, and health status of residents in the two LISC neighborhoods and evaluate impacts LISC initiatives were having on health behaviors and health outcomes. The former will be most useful for future evaluations once NeigborhoodsNOW initiatives are more fully developed and implemented. Concerning the latter, because NeighborhoodsNOW is at an early stage in terms of implementing its Quality of Life plans in the two study neighborhoods, detecting statistically significant deviations from the comparison neighborhoods may be difficult. Nonetheless, the comparison neighborhood data will allow future impact assessments to isolate the effects of neighborhood investments in target areas (e.g., NeighborhoodsNOW areas) from other influences such as a waxing or waning regional economy.

Measures

Audits

Residents are more likely to engage in physical activity if they have opportunities to do so in their own neighborhoods (Papas et al., 2007). Because the quality and conditions of streets, sidewalks, parks, along with crime and safety issues can affect residents willingness to engage in physical activity, a number of audit instruments were used to evaluate the conditions of an array of environmental features associated with numerous neighborhood behaviors settings (e.g., parks, streets) and physical activity occurring in these behavior settings. The audits used were as follows:

System for Observing Play and Physical Activities in Communities (SOPARC): This is a reliable and valid observation method for counting the number of people physically active in public open spaces (POS; McKenzie et al., 2006). For this study, a trained observer visited seven POS located in the four study areas a total of 12 different times per POS (morning, afternoon and evening x 4 different days). During a visit, the observer scanned the park and recorded the number of people engaged in physical activity in the park as well as their gender, race, and age.

Physical Activity Resource Audit (PARA): The PARA instrument is a reliable instrument used to determine the quantity and quality of features, amenities, and incivilities at various neighborhood locations (Lee et al., 2005). Trained auditors visited the seven POS where the SOPARC was conducted. While at the POS, they assigned ratings of good, fair, and poor to 13 features (e.g., playgrounds), 12 amenities (e.g., benches), and 15 incivilities (e.g., litter).

Objective Assessment of Physical Activity: A reliable observation method was used to assess the number of individuals being physically activity on neighborhood sidewalks/streets (Suminski et al., 2006). Trained observers walked 48, 300 ft. street segments in the four study neighborhoods at a pace of 1.66 feet/sec or 100 ft./min. Observations were made once in the morning (7-9 a.m.) and once in the afternoon (3-5 p.m.) in each segment. During a walk, observers systematically counted the number of people they saw performing various physical activities on the sidewalks/streets in the 300 ft. segment.

PIN3 Neighborhood Audit Instrument: The PIN3 is a 43-item, reliable instrument used to assess the walkability and bikeability of geographical areas (e.g., neighborhoods). For this study, trained auditors traversed the 48, 300 ft. street segments where the objective assessments of physical activity were performed. They assessed environmental features related to the arterial (places to walk/bike to), aesthetics (e.g. landscaped yards), physical incivilities (conditions of properties), and walkable neighborhood (presence of sidewalks/bike lanes). The data collected with this instrument is not biased by self-reporting, represents environmental features beyond existing census data, and is a combination of a number of items which may not be reasonably explored separately on their own.

Identification and Description of Physical Activity Resources

A number of established techniques were used to compile an exhaustive inventory of all places (besides POS and sidewalks/streets) in the study neighborhoods that could be used for physical activity. When places were identified, one or more techniques were used to obtain more information about the place and any opportunities existing there that related to physical activity (e.g., basketball league at a church).

Identification strategies included phonebook audits and Internet searches, followed by "windshield tours" of the neighborhoods both to check for previously unidentified physical activity opportunities and to confirm those found in the phonebook and online still existed. These strategies were successfully executed in all four study-neighborhoods.

Description strategies included contacting and interviewing individuals associated with the places identified. This was problematic particularly with privatized venues that were difficult to contact (see below for further discussion).

Survey Data

The survey administered to residents in each of the four study neighborhoods contained questions about age, gender, and race (using the two-item measure from the U.S. Census, see Appendix A). Additionally, the survey contained items that measured each respondent's socioeconomic status, including highest level of education completed, occupation (scored as a prestige rank; Nakao and Treas 1989, 1994), and two questions about their family structure of origin (previously identified in the literature as the best socioeconomic proxy of lifestyle behaviors). The latter included questions about who was the head of their household when they were growing up and this person's occupation.

Social Capital. Social capital refers to the ties one has to others in their community, and outside of it, that they can call on for help or support (see Cockerham, 2007; Fitzpatrick and LaGory, 2000; Lin 2001; Putnam, 2000). This is related to health because other people represent resources that we can marshal to address problems, such as getting to the doctor, a grocery store with healthy food options, a friend to jog with, etc (see Moore, Daniel, Paquet, Dube, and Gauvin, 2009). The more connections one has, and the more resources those connections represent, the more opportunities they have to improve their health and protect themselves against illness. These and other measures (see figure one below) are still being refined, particularly in regard to health (see Moore, Daniel, Paquet, Dube, and Gauvin, 2009).

We utilized three measures of social capital in this study. The first measure is derived from Moore et al. (2009) whose measure of network social capital was significantly correlated with obesity. This measure entails creating a list of 16 occupational categories with differing levels of prestige. Respondents are asked if they know anyone on a first name basis in each of the categories. From this data 3 social capital dimensions can be calculated: upper reachability, diversity, and range. The second measure used in this study is concerns trust in others andis derived from Putnam's classic work on social capital. Moore et al. (2009) did not find that it was related to obesity, but it may be related to other measures in our model. This was measured using two items: 1) "Most people can be trusted," and 2) Most people in my neighborhood can be trusted. Responses for both utilized a standard 6-point Likert scale ranging from "strongly disagree" to "strongly agree." The third measure used in this study attempted to measure community involvement. This was similarly measured with two questions, the first of which asked how many times a participant had worked on a community project in the last year, and the second asking how many times they had worked on a community project in their own neighborhood in the last year. (See Appendix A, items 8-14).

Health Care Access. Health Care access was measured with a series of questions evaluating where a participant was most likely to seek care (primary doctor, health clinic, or hospital), the ease with which they could access care (measured by how easily they can get to and from the doctor), the financial impact illness might have on them ("I worry that if I get sick I won't be able to pay my bills") and whether they can easily get dental care (an indication of good access to health care generally). Most of these items were measured using a 6-point Likert scale with response options ranging from "strongly disagree" to "strongly agree." (See Appendix A, items 15-20).

Stress. Stress was measures using the short-form version of Cohen's Self-perceived Stress Scale. Items such as, "In the last month, how often have you felt that you were unable to control the important things in your life?" are rated on a 5-point scale ranging from "never" to "very often." This scale shows high levels of internal reliability and correlates in expected directions with other variables, including health behaviors and substance use, which suggests external validity appropriate to our study (Cohen, 1988).

Stage of Change for Physical Activity: A single question was used to assess current stage of change for physical activity. Interviewees were asked to select one of five statements describing their current physical activity behavior and intentions concerning physical activity initiation within the next six months. The statements have been termed precontemplation, contemplation, preparation, action, and maintenance.

The International Physical Activity Questionnaire (IPAQ): The IPAQ was used to assess participation during the past seven days in household and yard work activities, occupational activity, self-powered transport, leisure-time physical activities, and sedentary activities. Total minutes of walking, moderate intensity activities, vigorous intensity activities, and sedentary activities engaged in during the previous week were derived from the IPAQ. The 31-item, self-administered IPAQ has been shown to be both a reliable (Spearman's p = 0.8) and valid (Spearman's p =0.33) instrument for obtaining detailed assessments of physical activity in 18-65 year old men and women.

Health Data

Standing height was assessed by a trained member of the research team using a stadiometer (at the health fairs) or steel measuring tape (during the door-to-door survey). Weight was measured on a portable digital scale that was calibrated daily. Body mass index (BMI) was calculated using Quetelet's index (weight in kilograms/meters2). A portable blood pressure measuring device was used to assess systolic and diastolic blood pressure and pulse in beats per min.

Analysis

Audit data were analyzed by creating summary measures for park quality, number of people physically active at the POS, the walkability and bikeability of sidewalks and streets, and the number of people physically active on these sidewalks and streets. Descriptive data for these were compared directly because the small number of communities under study mitigated the utility of significance testing. However, for the survey data, difference of means tests and predictive linear models were evaluated testing the relationships theorized in the above model. Mainly, this entailed regressing variables on those proposed to predict variance in them, moving from right to left across the theoretical model. A summary figure of empirically observed relationships is provided below.

III. RESULTS

Identification and Description of Potential Physical Activity Resources

During this portion of the study, 15 private neighborhood entities that could potentially support physical activity were identified in Scarritt and Douglass-Sumner. In the comparison neighborhoods, 13 private neighborhood entities were located that could potentially support physical activity.

The LISC neighborhoods had 11 physical activity programs offered a total of 20 hours/week at no cost to participants. Seven programs were for youth and five were for adults. Respondents to our inquiries estimated that on average 449 people/week attended the programs. In the comparison neighborhoods there were six physical activity programs offered a total of 24.5 hours/week at no cost to participants. Six programs were for youth and two were for adults. Respondents estimated that on average 57 people/week attended the programs.

Audits - Public Open Spaces

The SOPARC audit measures the number of people in POS and their characteristics and the PARA instrument measures the quality of those open spaces. We applied these to POS in the four target neighborhoods. The analyses revealed a number of interesting findings (see Table 1). The average quality ratings of features and amenities were better in the LISC neighborhoods (Scarritt and Douglass-Sumner) than in the comparison neighborhoods. The severity of incivilities was relatively higher in the LISC neighborhoods; however, this was likely due to the much higher use of the POS in the LISC neighborhoods (higher use = more severe incivilities such as more litter or graffiti). The average number of physically active individuals seen in the LISC POS was 132.5, compared with 32.0 in the POS located in the comparison neighborhood. The average quality of amenities was nearly significantly positively correlated with the number of people physically active in the POS (p=0.07).

Table 2. POS Audits.

Qualities	Neighborhood (LISC vs. Comparison)	Mean	Std. Deviation	Std. Error Mean
Features[1]	Comparison	.9975	.11667	.08250
	LISC	1.2200	.15556	.11000
Ammenities[1]	Comparison	1.1900	.97581	.69000
	LISC	1.8150	1.67584	1.18500
Incivilities[1]	Comparison	1.2000	.77782	.55000
	LISC	1.5000	.09899	.07000
Total # people obs.	Comparison	32.0000	29.69848	21.00000
	LISC	132.5000	176.06959	124.50000

[1]Ratings are on a scale of 1 to 3.

Audits - Sidewalks and Streets

The "objective assessment" measure is akin to the SOPARC in that it is a systematic method for determining the number of people using streets and sidewalks for physical activity (see Table 2). Similarly, the PIN3 mirrors the PARA in that it provides a systematic assessment of the quality of the sidewalks, streets, and surrounding spaces (housing quality, signage, street lights, etc.).

Table 3. Sidewalk and Street Segment Audits

	LISC vs. Comparison	N	Mean	Std. Deviation	Std. Error Mean
Physical Activity	Comparison	26	.6538	1.01754	.19956
	LISC	22	.6364	.95346	.20328
Arterial Score	Comparison	26	2.6154	1.23538	.24228
	LISC	22	2.7273	1.20245	.25636
Incivilities Score	Comparison	26	4.9615	1.84349	.36154
	LISC	22	5.8182	1.50036	.31988
Decorations Score	Comparison	26	2.1923	.80096	.15708
	LISC	22	1.7273	.93513	.19937
Walkability Score	Comparison	26	2.3846	1.09825	.21538
	LISC	22	2.9545	.78542	.16745

LISC neighborhoods had a slightly greater arterial score and a significantly higher walkability score (2.95 compared to 2.38) than the comparison neighborhoods. Conversely, relatively more incivilities and fewer aesthetically pleasing sights were observed in the LISC neighborhoods, though the differences were not statistically significant. The total number of people seen engaged in physical activity across the multiple observations of sidewalks/streets was roughly the same for LISC and comparisons neighborhoods. The number of people seen was significantly and positively correlated with the walkability and aesthetic scores.

Survey and Health Data

Descriptive Statistics

The descriptive data from these neighborhoods gives useful characterization to the health and health behaviors of residents, along with baseline data for evaluation of future efforts.

Sample Composition and Description. Slightly over half of the sample was female (52.1% and 54.4% in the comparison and LISC neighborhoods, respectively), 16.1% completed the survey in Spanish (14.1% in the comparison and 17.5% in LISC neighborhoods), 36.6% of respondents in the comparison verse 26.2% in LISC neighborhoods had less than a high school education, and 47.4% of the LISC neighborhoods sample were minorities compared with 64.4% in the sample from the comparison neighborhoods. Body mass index was 29.5 and blood pressure was 124/81 mmHg in the LISC neighborhoods. In the comparison neighborhoods BMI was 28.6 and blood pressure was 133/82 mmHg.

Physical Activity. The physical activity measures suggest both slightly more physical activity, and also sedentary behavior in the LISC neighborhoods. While seemingly a contradiction, this is likely due to greater variation in both measures among the LISC neighborhoods. That is, there is a greater diversity of physical activity behaviors in the LISC neighborhoods. Specifically, residents in LISC neighborhoods reported 1726 minutes of physical activity in the past week relative to the residents in the comparison communities who reported 1597 minutes of physical activity in the past week. For minutes spent sitting in the past week, residents of the LISC neighborhoods reported 305 minutes sitting compared to 295 minutes sitting in the past week for the residents of the comparison neighborhoods. Thus, while significance tests are not viable, residents of the LISC neighborhoods appear to exercise 129 more minutes, but have only 10 more minutes of sedentary behavior.

Physical activity guidelines from the CDC call for 75 minutes or more of vigorous physical activity or 150 minutes or more of moderate physical activity per week. Table 4 shows the percentage of residents in the LISC versus comparison neighborhoods who report meeting these recommendations. As shown, 36.9% of residents in the two LISC neighborhoods get 75 minutes or more of vigorous activity per week, and 70.9% report 150 minutes or more of moderate physical activity per week, compared to 32.4% vigorous and 71.8% moderate activity in the comparison neighborhoods. Additionally, as shown in Table 4, 37% of residents in the LISC neighborhoods and 39% in the comparison neighborhoods report being in the maintenance phase of the “Stage of Change” measure, meaning that they have exercised regularly for six months or more. On the other hand, 5.4% more individuals in the comparison neighborhoods (19.4%) than in the LISC neighborhoods (14.0%) reported being in the “precontemplation” stage, meaning that they were not even thinking about exercising.

Table 4. Comparison of Residents Meeting Guidelines and Stage of Change

Measure	**LISC Neighborhoods**	**Comparison Neighborhoods**	**Percent Difference**
≥ 75 minutes of vigorous activity per week	36.9%	32.4%	+4.5%
≥150 minutes of moderate activity per week	70.9%	71.8%	-0.9%
Stage of Change – Maintenance	37.0%	39.0%	-2.0%
Stage of Change – Pre-contemplation	14.0%	19.4%	+5.4%

Statistical Analyses

As shown in the model above (Figure 1), we posited a number of sets of relationships to try to capture the complex and layered relationships between neighborhood infrastructure, community dynamics, and health outcomes. While this research was exploratory in nature, the data show a number of statistically significant relationships that demonstrate the current and potential impacts of LISC redevelopment and community engagement efforts on health. A summary of these findings is provided in Figure 2.

Physical Health Outcomes. In terms of predicting physical health outcomes, both health care access and physical activity behaviors were related. Minutes spent sitting per week positively predicted BMI ($ß=.202$; $p<.05$). Conversely, combined physical activity minutes per week (walking, moderate, and vigorous) negatively predicted BMI ($ß=-.335$; $p<.001$). Similarly, days per week that one exercised negatively predicted BMI ($ß=-.298$; $p<.01$). Finally, meeting CDC guidelines for physical activity negatively predicted BMI ($ß=-.335$; $p<.001$). Health care access was not related to BMI.

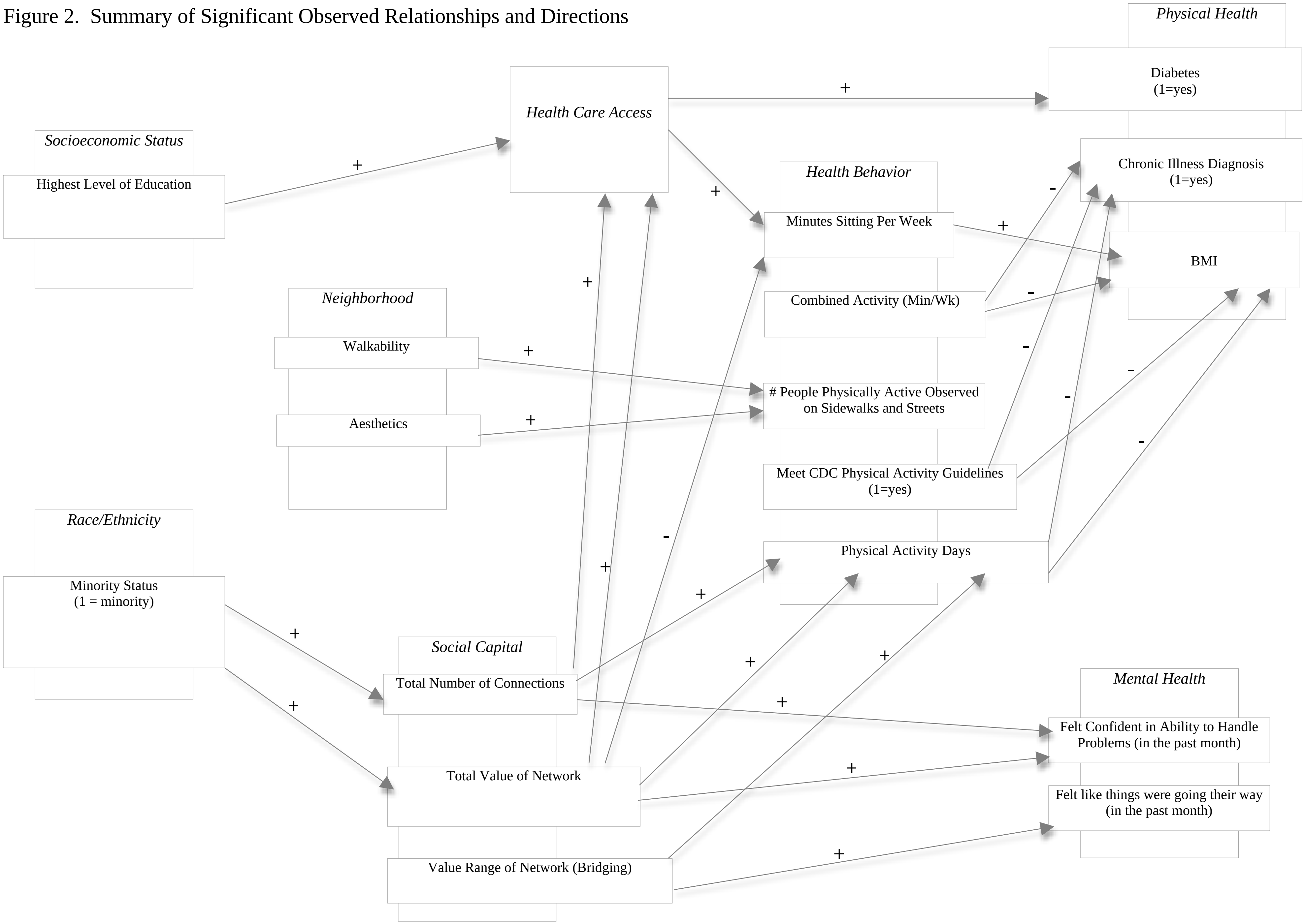
While health care access did not predict whether a respondent had been diagnosed with a chronic disease (hyperglycemia, high cholesterol, diabetes, heart disease, or high blood pressure), combined physical activity minutes per week was negatively predictive of chronic disease in the respondents ($ß=-.234$; $p<.05$), and days of physical activity per week was nearly significant ($ß=-.192$; $p=.08$). Meeting CDC recommended guidelines also was negatively predictive of having a chronic condition ($ß=-.246$; $p<.05$). The difference in these measures may be attributed to the fact that some chronic conditions require limiting the number of minutes at a time one is physically active. Health care access did positively predict the likelihood of a respondent having diabetes ($ß=.234$; $p<.05$).

Mental Health Outcomes. Neither the social capital measures nor the physical activity measures held any predictive value for the overall stress variable. This may be due to the fact that variation in this measure is more sensitive to acute stimuli, while social capital and physical activity may affect chronic stress. However, the total value of one's network connections was nearly significantly positively predictive of whether a respondent rated themselves as highly confident in their ability to handle problems ($ß=.198$; $p=.09$). Total number of network connections was also nearly predictive of respondents' score on this question ($ß=.131$; $p<.09$). Finally, having greater bridging social capital (the range of values in one's network) was positively predictive of a respondent reporting the extent to which they felt like things had been "going their way" in the past month ($ß=.162$; $p<.05$).

Physical Activity Behavior. We theorized that environmental quality, social capital and health care access would be positively predictive of physical activity. Environmental quality and its association with physical activity is reported above in the relationship between environmental conditions and number of people using POS and sidewalks/streets for physical activity. Additionally, the descriptive statistics above indicate slightly greater physical activity in the LISC neighborhoods relative to the comparison neighborhoods.

Here again, health care access did not predict physical activity whether it was measured as total days active or combined physical activity minutes per week. However, the total number of social capital connections, the total value of one's network, and bridging

Figure 2. Summary of Significant Observed Relationships and Directions



social capital (the range of values in one's network) were positively predictive of physical activity days (total social capital connections: ß=.205; p<.01; total social capital value: ß=.200, p<.05; bridging social capital: ß=.172, p<.05). These relationships held even when controlling for age (which also significantly negatively predicted physical activity days; ß=-.297; p<.001).

Health care access was significantly positively predictive of sedentary behavior (measured as minutes spent sitting per week; ß=.228; p<.01). This likely reflects the fact that less healthy people, particularly those with diagnosed conditions, get more medical care and are limited from physical activity. For social capital, the total value of one's network was nearly significantly negatively related to sedentary behavior (ß=-.134; p=.09). This relationship might be significant in a larger sample, and suggests that the more people one knows and interacts with, the less time they spend in a sedentary state.

Finally, total value of one's network was nearly significantly positively predictive of whether a respondent met CDC physical activity guidelines (ß=.142; p=.08) while health care access was not.

Health Care Access. We theorized that neighborhood condition, along with socioeconomic variables and social capital would positively predict health care access. There were no differences in health care access between the LISC and the comparison neighborhoods. However, education positively predicted health care access (ß=.241; p<.01) as did the total value of one's network (ß=.159; p<.05), while total number of network connections was nearly significantly positively related (ß=.149; p=.052). The relationships between social capital and access to health care held, even while controlling for education and vice versa.

Social Capital. Neighborhood conditions, socioeconomic variables, and minority status were all theorized to be predictive of social capital. There were no differences between LISC and the comparison neighborhoods on total value of one's network, total number of connections, or the range of one's connections. Being a minority was positively predictive of both total number of connections (ß=.244; p<.01) and total value of one's network (ß=.227; p<.05). Similarly, highest level of education attained was positively predictive of both total number of connections (ß=.319; p<.01) and total value of one's network (ß=.329; p<.001). This is interesting because education, insofar as a it is a proxy for class, typically is disproportionately lower among minorities. Where minority is related to social capital in the same direction as education, it may be reflective of the fact that these neighborhoods, which are "majority minority" communities, constitute "ethnic enclaves." That is, it appears to be white residents in these areas who are more socially isolated than minorities. An analysis of variance shows that minorities in this sample had significantly greater total number of connections (9.28 versus 7.24; F=5.37; p<.05) and a greater total network value (399.21 versus 316.89; F=4.48; p<.05).

IV. SUMMARY AND INTERPRETATION

The Quality of Life plans developed for the LISC neighborhoods were reviewed to identify strategies created and implemented to promote positive environmental changes. The audits we conducted on POS and sidewalks/streets were selected in order to capture changes in these behavior settings that may have resulted from the implementation of Quality of Life plan strategies. This approach proved successful. For example, we found that walkability was better in the LISC neighborhoods than in the comparison neighborhoods, most likely because walkability was specifically targeted by five strategies in the Quality of Life plans. In addition, the quality of features and amenities in POS was relatively higher in the LISC neighborhoods. Here too, the Quality of Life plans contained several strategies targeting POS (obtain money for parks, install playground equipment).

What also is clear from this data is that the relationship between neighborhood infrastructure, community dynamics and health outcomes is complex and multidimensional. This means it is increasingly important to evaluate the multiple pathways through which changes in the environment or the social relationships of a community affect health behavior and health outcomes.

Additionally, the data shows that the most promising frontiers for health promotion no longer are restricted to traditional arenas (e.g. clinical medicine), but rather are embedded in the social frameworks of communities. In the results above, access to health care was only predictive of a more discrete illness like diabetes, but did not predict variation in an array of other key health outcomes like BMI or having any number of chronic conditions. These were predicted by physical activity, suggesting that lifestyle behaviors are significantly more important than acute care in the contemporary landscape of health and illness. This makes promotion of physical activity of paramount importance and initiatives like NeighborhoodsNOW are poised to make a significant improvement in that regard.

Initial effects of KC-LISC's engagement with the community may be only beginning to manifest in the data. For example, walkability score was higher in the LISC neighborhoods and positively correlated with the number of people seen being physically active on sidewalks/streets. However, we did not observe a difference in the number of people seen between the LISC and comparison neighborhoods. One interpretation is that baseline levels of people using sidewalks/streets in the LISC neighborhoods were relatively low and our evaluations are occurring at a time when they have risen in response to NeighborhoodsNOW to a level equal to the comparison neighborhoods. Alternatively, LISC efforts to improve walkability and aesthetics may have not yet manifested as greater use of sidewalks/streets for physical activity but, given more time, will result in a significant increase in the number of people using sidewalks/streets for physical activity. In other words, due to a lag time between improved walkability and aesthetics and resulting physical activity, we are not able to detect differences between LISC and comparison neighborhoods at this point in time. The main message is that improvements to the walkability and aesthetics dimensions of the environment are paying off and will continue to improve physical activity and ultimately health in these neighborhoods.

The future promise of KC-LISC's programs for health promotion is evident from the individual level data in this study, which shows a relationships between community dynamics, behavior and health outcomes. For one, multiple stress measures were significantly improved when individuals had larger and more socioeconomically integrated social networks. Similarly, physical activity predicted more positive results on both BMI and having been diagnosed with a chronic disease. In turn, having larger and more socioeconomically integrated social networks positively predicted multiple physical activity measures. When KC-LISC works with communities toward improving residential and public spaces, getting residents to work together, and making neighborhoods safer, they help establish communities where people are more likely to be physically active. They also are more likely to know and rely on their neighbors, which also promotes physical activity. Thus, by working on the social relationships and the physical infrastructure a strong two-tiered approach is created that, as suggested by the data of this study, is likely to have more impact than focusing on either dimension alone.

Finally, where the data show that minorities report greater social capital (which, again, is predictive of physical activity), it is important to be aware of the accompanying social dynamics. Studies suggest that community investment in "ethnic enclaves" can be tremendously effective because of the strong social ties in those communities between the residents (Wilson and Martin, 1982). At the same time, the strong bonding social capital in these neighborhoods can come at the expense of bridging social capital, that is connections to important outside resources (Portes, 1994). Additionally, it is important to keep in mind the potential for increasing social isolation of older residents, as areas become "majority minority" communities. Special efforts to integrate newer and older residents may prove especially necessary to build strong social ties in a neighborhood.

V. SUCCESSFUL ADAPTATIONS AND LESSONS LEARNED

This project was designed to collect some baseline health and health-related data in LISC target neighborhoods, but was also fundamentally about proving the feasibility of collecting data on the concepts in Figure 1. As such, we tested several approaches and learned valuable lessons along the way that will inform future large-scale research efforts in this area.

Survey and Health Data Collection

Perhaps the most critical lesson learned concerned the strengths and limitations for the data collection protocol. The initial thought was to hold and promote health fairs at community organizations in each neighborhood that would draw participants in for health screenings and data collection. While the initial attempt was relatively successful because we were able to attach our protocol to an established neighborhood event (the annual "Chalkwalk" in Scarritt yielded 24 participants over the 8-hour day), subsequent attempts to utilize these centralized venues for data collection were tepid. Two subsequent health fairs in Douglass-Sumner and Sheffield, both strategically attached to larger community events, yielded only 8 and 7 full participants across 4-hour periods, respectively. While more people attended and were provided with health screenings, which to be sure were valuable as service elements of this project, it became clear that recruiting an analytically sufficient number of participants from each neighborhood would require a different, more efficient approach. Additionally, the screening process caused a bottleneck in the system that would have been problematic especially if we had drawn more people. Five- to seven-minute wait times and a number of failed cartridge readings made using the Cholestec machine infeasible for this project. Finally, we found that the quality of collaboration from local partners was uneven, even when we utilized local community organizers. While local institutions reported a willingness to help, incompatible timetables along with variation in support, particularly with recruitment efforts proved to be a difficult obstacle.

We then adjusted the protocol to undertake a decentralized data collection plan, whereby we sent teams of surveyors door-to-door in each target neighborhood. Blocks were selected at random to correspond to the block segments we had previously audited, though our coverage eventually extended the overwhelming majority of each area. To gather the corresponding physical health data, the two primary investigators brought a tape measure, and battery-operated scale and blood pressure cuff, and circled the areas that the survey data collectors were covering. When a participant taking the survey also consented to have the physical health information collected, survey data collectors would notify the primary investigators who would arrive, collect the physical health data and provide a copy of that data and brief consult to the participant, along with additional information about additional follow-up screening services. Another copy of the physical health information was immediately attached its respective survey. This process proved efficient as the primary investigators could administer the physical health portion of the process more quickly than the surveyors could administer the questionnaire. It also alleviated the survey data collectors from having to carry large amounts of equipment, and allowed for an additional layer of safety and quality control because the primary investigators were constantly rotating to observe different survey data collectors.

The decentralized data collection process proved far more efficient. While collecting data at health fairs had netted a total of 46 surveys in 16 hours, the door-to-door process netted 128 in a comparable 16 hours (11.75 hours of active data collection, 4.25 hours of travel and coordination time). While the health fair model utilized 4 to 6 data collectors, the latter utilized between 3 and 5 data collection teams, usually of 2 paired individuals. Across all of the neighborhoods, data collectors returned 1.49 surveys per hour per team. However, we believe improved training would result in a better initial presentation, and increase the rate of return in future studies. The neighborhood specific results for the door-to-door data collection method are shown in Table 5.

Table 5. Door-to-Door Data Collection Method Efficiency Data

Neighborhood	**# Surveys[1]**	**Time Spent (hrs)**	**Teams Per Session**		**Average # Surveys (per unit per hour)**
			Day 1	**Day 2**	
Scarritt	43	3	4	5	1.59
Douglass-Sumner	22	2.75	3	3	1.33
Sheffield	31	3	4	4	1.29
Quindaro	31	3	3	3	1.72

[1] Includes door-to-door surveys only, not those collected at health fairs.

More importantly, the data from the door-to-door surveys is likely more representative of the residents of the neighborhood. For one, qualifying participants for the study by showing them a map of the neighborhood boundaries is not as reliable as approaching residents at homes that the researcher knows is within the target area. Additionally, the data show significantly different averages for both sedentary activity and occupational prestige. For the former, respondents of the door-to-door surveys reported sitting an average of 330.81 minutes per week compared to respondents from the centralized health fairs who reported sitting for an average of 216.82 minutes per week ($F=8.41$; $p<.01$). For the latter, respondents from the door-to-door survey had a mean occupational prestige score of 32.85 compared to those from the health fairs who had a mean of 44.20 ($F=4.58$; $p<.05$). This suggests that more active and more middle class individuals are likely to attend a health fair in the neighborhood compared to more sedentary, lower class individuals. Where the former are more likely to be healthier, the centralized data collection method introduces problematic selectivity into the sample.

While we did not track response rate (consents to declinations minus no-answers), the observations of the primary investigators and the reports of the surveyors suggest that approximately 65-76% of people who answered the door agreed to do at least the survey portion, and 44% percent of those agreed to do the full physical health screening. This success was due in part to the successful initial presentation developed by one of our data collectors. Rather than beginning with a question about taking a survey, she first noted that she was a medical student working with a non-profit that was trying to improve the conditions of the neighborhood. Then she noted that we were studying the effects those conditions have on the health of the residents. Only then would she ask if they were willing to do a survey. By putting that information up front, she let people know that there was nothing for sale and that the intentions of the data collection were to benefit the neighborhood. This approach was very well received and, by the end of the study, it had been disseminated to other data collectors.

Another possible data collection approach utilizes telephone survey methodology. Although easy to administer and cost effective, telephone surveys have several limitations. Telephone coverage varies by demographics with coverage being lower for persons with low incomes, persons with less than 12 years of education, persons in poor health and heads of households under 25 years of age. Residents with these characteristics comprise substantial proportions of the populations in the study areas, but because of this systematic bias they would be underrepresented if phone surveys were used. During door-to-door surveys when contact is made the completion rate for initiated surveys is nearly 100%. Only 83% of initiated telephone surveys are completed when the interviewer reaches an eligible respondent. Another major advantage of the door-to-door method is the elimination of "dead-end" selections, such as non-working telephone numbers, businesses, and residences outside the sample area. "Dead-end" selections account for 43% of randomly sampled telephone numbers using the phone survey method. Additionally, during door-to-door surveys, as opposed to phone surveys, the interviewer can visually verify important information (e.g., address) and provide the interviewee with visual cues for questions that may be difficult to comprehend.

Thus, based on our experience in collecting data in these neighborhoods, we can unequivocally say future studies would benefit from undertaking this decentralized approach. However, better training and coordination of the survey data collectors would improve both the response rate and the consistency of the data. In particular, we paid some data collectors by the hour, resulting in a high attrition rate where they would work some days and then not show up for others. Future studies would benefit from establishing a system where pay was contingent on completion of a certain percentage of the data collection periods. Additionally, while we spent about an hour training data collectors to administer the survey, future research would benefit from implementing a longer and more thorough training process, including supervised practice sessions for administering the survey.

Finally, future research would benefit from insuring that there is at least one bilingual survey data collector in each team when collecting in neighborhoods with significant prevalence of Hispanic residents. While some of our surveyors were bilingual, we did not have enough bilingual team members to have one in each dyad. We compensated for this by moving bilingual data collectors to households when a need arose, but this was not ideal.

Issues with the Description and Identification Component

One part of this study concerned the identification and description of any physical activity opportunities in each neighborhood. For this, we began with Internet searches and then proceeded to conduct windshield tours of each neighborhood in order to map local organizations and institutions that could potentially serve as a physical activity resource. This included schools and churches that might have fields and playgrounds or offer exercise classes open to the community.

The identification aspect of this component of the project was relatively successful. A number of potential physical activity opportunities were identified in each neighborhood. However, collecting descriptive information about actual physical activity opportunities at these various venues proved more difficult. In many cases it was difficult to get in contact with representatives from the organizations. Often when we were able to talk to those individuals, they did not feel comfortable speaking to us without the approval of superiors in the organization (this was particularly difficult at schools and large churches). Combined, this resulted in a limited amount of data on the number and kinds of physical activity opportunities and resources in each neighborhood. At the same time, difficulties obtaining this information speak in part to its limited dissemination in the community, which may mitigate the extent to which residents capitalize on programs, even where they do exist.

Future research utilizing this component in the study design would benefit from several alternative strategies. For one, it is important to go to each organization and institution, developing contacts in more personal ways, and speaking with multiple members to get a more comprehensive picture of any physical activity opportunities they offer. However, this means identifying opportunities to make that sort of personal contact, which still may prove difficult for organizations that are not staffed full time. This suggests that this sort of element for a project needs an extended timeline, such that this process begins well in advance of other project components. We would tentatively recommend a six- to eight-month period for identifying and describing physical activity opportunities in communities like those engaged in this study. This extended timeline also is necessary to capture waxing and waning activity patterns, such as seasonal activity, community programs that are tethered in some way to the academic calendar, etc.

VI. CONCLUSION AND FUTURE CONSIDERATIONS

We acknowledge the importance of proper nutrition for improving and maintaining good health. Therefore, future plans call for testing the feasibility of obtaining neighborhood- and individual-level data on diet and nutrition policies, environment, and behavior. At the neighborhood level we could assess publicly funded food programs that follow dietary guidelines, nutritional labeling requirements at restaurants, stores and snack bars, presence of food pyramid charts in learning environments, number of fast food restaurants per capita, location of farmer's markets, proportion of shelf-space in grocery stores devoted to low-fat foods, and/or bar code sales data. At the individual level we could measure caloric and nutrient intake using various reliable and valid methods (self-report questionnaires [24-hour dietary recall], dietary records/logs).

Plans for future assessments also include evaluations of additional neighborhood-level indicators of health such as the prevalence and incidence rates for chronic diseases. Potential sources of data on disease rates are public health departments and hospitals.

In order maximize the integrity of data, we would want to optimize the quality of the data collection processes. To accomplish this, we will develop an ongoing surveillance system to document and monitor neighborhood efforts to promote physical activity, alterations in the environment, and improve health outcomes. Neighborhood residents and stakeholders would be recruited to become trained data collectors. They would periodically measure neighborhood- and individual-level outcomes related to our health assessment model (Figure 1) and relay the data to researchers in the Office of Community Health Research at KCUMB. There, the data would be analyzed, interpreted and described in a yearly report that would be provided to KC-LISC.

Future Funding

Grant Opportunities

Robert Wood Johnson Foundation, Health Impact Project: Advancing Smarter Policies for Healthier Communities. Funding to encourage the use of health impact assessments (HIA) to help decision-makers identify the potential health effects of proposed policies, projects, and programs, and make recommendations that enhance their health benefits while minimizing their adverse effects and any associated costs.

National Institutes of Health (NIH), Time-Sensitive Obesity Policy and Program Evaluation PAR-12-257. Examine the effect of imminent policy or programs intended to improve dietary intake or activity levels such as:

- Infrastructure Initiatives such as the introduction of new aspects of the built environment such as retailers offering healthier food options in underserved areas;
- Introduction of active transportation options such as the implementation of bike lanes in urban areas, multi-use trails, or subsidies for public transit on activity of citizens; and community-level changes, e.g., upgrades of sidewalks, modification of transportation pathways to facilitate more walking or bicycle riding, implementation of multi-use trails, or traffic calming measures.

Cost Estimates

Based on the data return rate for the door-to-door surveys, we can estimate future costs for data collection of a larger project which implements the lessons learned from this initial study. Namely, better-trained, bilingual survey data collectors could improve the data collection process with only a small cost increase. Based on the rate of return for two-person survey teams per hour, and estimating a pay range for better trained, bilingual data collectors of $18-$25 per hour per data collector, and adding in 200 dollars for supplies and incidentals, we can estimate a cost of $2600 - $3550 *per 100 surveys @ 1.49 surveys completed/h.* With a larger sample, statistical power increases.[1]

Cost estimates based on a $15/hour pay rate also were derived for identifying/describing physical activity opportunities, conducting audits of POS and sidewalks/streets. They are as follows:

> PIN3 (sidewalk/street and surrounding area conditions): The average time needed to audit environmental conditions of a 100 ft segment of roadway was 3 min, 30 sec. It would cost $1.63 to audit one, 100 ft segment.
>
> Observations of physical activity on sidewalks/streets: An observation period of one min is needed to assess 100 linear ft of roadway and each 100 ft segment of roadway should be assessed on two different occasions (e.g., morning and evening). Given these parameters assessing a single 100 ft segment would cost $0.50.
>
> PARA: An average of 20 min/POS was needed to assess their quality. The costs to assess one POS would be $5.00.
>
> SOPARC: This method requires a 5 min scan of an area to be conducted on 12 separate occasions. The cost to assess one area would be $15.00 (assuming area requires only one scan per occasion).
>
> Identifying/describing opportunities: On average it takes 12 min to identify one physical activity opportunity and 15 min to describe it in detail. The cost for one opportunity would be $6.75.

Sample Cost Estimate. Here we provide an example cost estimate for a neighborhood with 35,250 linear feet of roadway, 1400 residents, two POS each requiring two scans, and 10 private entities that could offer a physical activity opportunity. These parameters are the average values found for the four neighborhoods examined in the present study. If 10% of the roadway linear footage and 10% of the residents are the selected sample sizes then 36 road segment and 140 resident surveys would be assessed. The total cost for assessing this neighborhood would be:

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[1] This can be compared to the cost of surveys administered by telephone, estimated to cost $45.97 per survey, which would cost $4,597 for 100 surveys, but would not include health screenings (calculated from data from *Marketing Research, 8th Ed).*

- Resident surveys and health screens - 93 h/140 surveys @ $40/survey team/hr + $200 supplies = $3920
- Identification/description - 10 opportunities x $6.75/opportunity = $67.50
- POS audits - Two open spaces requiring two scans each @ $15/scan = $60 plus $10 for two PARA assessments = $70.00
- Sidewalks/streets - PIN3 for 36 road segments @ $1.63/segment = $58.68 plus $36.00 for two observations of each segment @ $0.50/segment = $94.68

- Indirect rate: @ 51% = 2,138 (includes administrative cost, latent resources, etc.)

- *Grand Total = $6,330.00*

Final Summary

KC-LISC should continue to work with neighborhoods to develop and implement Quality of Life plans. Because the implementation of these plans occurs over time and our theory that some strategies take time to influence physical activity, we also suggest utilizing prospective study designs and including follow-up assessments. This approach also would allow for cause-effect relationships to be examined.

It would also be advisable to expand the scope of data collection and strategy evaluation to include other neighborhoods, both those engaged by KC-LISC and comparison neighborhoods. This would enable better assessment of key variables.

Better align some of the Quality of Life plan strategies with physical activity promotion. This is particularly true for strategies targeting businesses. For example, strategies could focus on recruiting businesses that are related to physical activity such as athletic equipment stores or fitness clubs (e.g. karate or yoga). This also would provide peripheral support for other changes that affect physical activity (e.g. building walking trails).

Finally, what is most important is for LISC and other neighborhood development organization to continue to think about health promotion broadly, acknowledging the way that health and disease are nested in community infrastructures and neighborhood dynamics. That is, promoting healthy, functional neighborhoods is part and parcel to helping people live healthier lives.

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