Individual social capital and physical activity in Riley County, KS

by

David Pluta

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College of Human Ecology

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Approved by:

Major Professor
Dr. Brandon Irwin

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Abstract

BACKGROUND: Resource-deficient social networks can have detrimental health effects on individuals. In part, this may result from limited engagement in health-related behaviors such as physical activity (PA). PA can lower one's risk for a variety of chronic diseases and promoting this behavior is a public health priority. Understanding the relationship between network-owned resources and PA behavior can help policymakers and health advocates develop comprehensive programs to promote health among those who are disadvantaged. Measurements of resources available through an individual's social network have previously been referred to as social capital (SC). This study set out to explore the relationship between SC and PA by testing the following hypotheses: (1) Individuals with low household income will report low levels of both SC and PA participation, (2) SC has a positive relationship with PA participation, (3) Individuals who engage in leisure-time PA with others will report higher levels of SC than those who do it alone, (4) Social support for PA mediates the relationship between SC and PA.

METHODS: Data were obtained from residents of Riley County, KS (n=828) who completed a survey. One-way analyses of variance (ANOVA) were used to examine differences in SC (bonding, bridging, total) and PA (moderate, vigorous, total, leisure-time) between different income groups. Relationships between SC and PA variables were examined using Pearson product-moment correlations, while independent sample t-tests were used to identify differences in SC between those who did or did not meet recommended PA guidelines. ANOVAs were also used to identify differences in SC among those who primarily engage in leisure-time PA by themselves, with a partner, or with a group. Finally, the Sobel test was used to examine the mediating effect of social support for PA in all significant linear relationships between SC and PA variables.

RESULTS: Social capital was highest among high-income groups (p <.05). Leisure-time PA was lowest in the poorest income group (p <.05). Weak linear relationships were identified between bonding SC and leisure-time PA [$r(786) = 0.09$, $p = 0.01$], as well as between total SC and leisure time PA [$r(775) = 0.08$, $p = 0.02$]. Individuals who met PA guidelines reported higher levels of SC than those who did not (bridging and total: p <.001; bonding: p = <.01). No

differences in SC were found between individuals who primarily engaged in leisure-time PA by themselves, with a partner, or with a group. The Sobel test found that social support for PA fully mediated the relationships between leisure-time PA and both bonding SC ($z = 5.61$, $p < .001$) and total SC ($z = 6.01$, $p = < .001$).

CONCLUSIONS: Social capital has a positive relationship with leisure-time physical activity and influences this behavior through provisions of behavior-targeted social support. Further examination should be afforded to the relationship between social capital, income, and leisure-time physical activity. While physical activity promotion efforts which target social capital may achieve marginal improvements in physical activity levels at the population level, they are unlikely to result in significant improvements at the individual level.

Keywords: social capital, social networks, social support, physical activity

Table of Contents

List of Figures

List of Tables

Dedication

To my parents, grandmother, and closest friends—thank you. This would not have been possible without your unwavering support.

Chapter 1 - Introduction

Social mechanisms exert a strong influence on health-related behaviors (Bandura, 1998; Israel & Rounds, 1987). This has vast public health ramifications, as lifestyle-related diseases such as obesity have been shown to spread throughout social networks (Christakis & Fowler, 2007). Fortunately, positive health behaviors also exhibit this ability to spread, which suggests that health promotion efforts can take advantage of this phenomenon (Higgs, 2015; Powell et al., 2015).

An important health related-behavior which has been promoted widely through various means is physical activity (Bornstein, Pate & Pratt, 2009; Bors et al., 2009). Engaging in regular physical activity can reduce ones' risk for a multitude of chronic conditions including cardiovascular disease, various cancers, and type-2 diabetes (Physical Activity Guidelines Advisory Committee [PAGAC], 2018). Most potential health benefits can be achieved by performing at least 150 minutes of moderate intensity aerobic physical activity, or 75 minutes of vigorous aerobic physical activity per week (US Department of Health and Human Services [USDHHS], 2008). However, any amount of physical activity is preferable to none and even bouts that are shorter than ten minutes can provide health benefits (PAGAC, 2018).

A resource-deficient social environment generally has a negative impact on adherence to health-related behaviors (Berkman, Kawachi, & Glymour, 2014). However, unique dimensions of the social environment have been shown to influence physical activity behavior to varying degrees (McNeill, Kreuter, & Subramanian, 2006; Seefeldt, Malina, & Clark, 2002). Social capital has been viewed as one of these dimensions of the social environment.

Some debate exists over the exact definition of social capital (Szreter & Woolcock, 2004; Lin, 1999; Putnam, 1995). A primary point of contention is whether social capital is

inherently a group or individual level attribute—whether its presence facilitates social interaction or whether it describes accessible resources within a network (Kawachi, Subramanian, & Kim, 2008). Public health researchers continue to operationalize and measure social capital in various ways (Villalonga-Olives, & Kawachi, 2015a). Trust, reciprocity, social participation, and network density are among the most common proxy measures which have been utilized (Villalonga-Olives, & Kawachi, 2015b). This lack of consistency limits the potential for generalizing the findings of studies and has led some critics to even suggest that the term has become meaningless (Kawachi et al., 2008).

Despite some criticism, social capital remains a compelling area of research in public health due to the vast influence that social mechanisms are known to have on health and behaviors. As a construct, social capital is meant to capture an important aspect of social environments which may play a role in shaping health inequities (Berkman, Kawachi, & Glymour, 2014). Additional research in this area may continue to provide important insights to policymakers and health advocates.

Viewing social capital as accessible resources within a network is uniquely compelling due to the flexibility it provides in allowing both individual and group-level analyses (Lin, 1999). Yet, some have argued that health researchers have been dismissive of this conceptualization and that studies examining it have been limited in number (Moore, Shiell, Hawe, & Haines, 2005). To the author's best knowledge, only one study has examined the relationship between what was explicitly referred to as "network" social capital and physical activity behavior (Legh-Jones & Moore, 2012). This study is also notable among individual-level analyses given that many others have operationalized individual social capital in a manner that has been criticized for its susceptibility to confounding effects (Kawachi et al., 2008).

For these reasons, this study set out to fill what were perceived as gaps in the literature. Specifically, the study was meant to accomplish two goals: (1) develop a detailed description of the relationship between network social capital and physical activity at the individual level, (2) identify whether the influence of network social capital on physical activity extends beyond provisions of social support for physical activity.

Four hypotheses were tested to achieve these goals. First, it was examined whether differences in social capital and physical activity participation exist between various income groups. Lower income groups were hypothesized to report lower levels of both social capital and physical activity than higher income groups.

Second, it was hypothesized that social capital would exhibit a positive relationship with physical activity. A strong positive correlation was hypothesized. Individuals who met recommended physical activity guidelines (USDHHS, 2008) were also expected to report higher levels of social capital compared to those who did not meet the guidelines.

The third hypothesis in this study was related to leisure-time physical activity habits. Those who primarily engaged in leisure-time physical activity with a partner or group were hypothesized to report higher levels of social capital than those who typically did physical activity alone.

Fourth, this study sought to explore a mechanism through which social capital may influence physical activity participation. It was hypothesized that social support—which is specifically oriented towards physical activity—would at least partially mediate the relationship between social capital and physical activity participation.

Chapter 2 - Literature Review

Defining Social Capital

While examinations of the social environment and its influence on health have a long history—stretching back to 1897, when Durkheim linked low levels of social integration with greater suicide rates (Durkheim, 1951)—advocates of "social capital" argue that this construct represents a new line of research due to the additional focus on group-level effects (Kawachi, Kim, Coutts, & Subramanian, 2004). Broadly defined, social capital refers to resources within networks which can influence or be utilized by members of those networks. While a variety of specific conceptualizations have previously been outlined by researchers outside of public health (Lin, 1999; Putnam, 1995; Coleman, 1988; Bourdieu, 1986), Kawachi (2006) identifies the two prevailing views that have been utilized within public health.

The first of these has been described as the "communitarian" or "social cohesion" school (Kawachi, 2006; Moore, Shiell, Hawe, & Haines, 2005). This view conceptualizes social capital as community or group attributes—such as trust, social control, and social norms—which can impact all members of that group (Kawachi et al., 2008). Even someone who is loosely connected to a group can ultimately be affected by the prevailing nature of that group. Szreter and Woolcock (2004) lucidly describe this as the infrastructure of social relations—if social interactions are viewed as electricity, social capital is the power grid which allows the electricity to flow. Different groups or communities may facilitate social interaction to varying degrees. Those whose underlying "infrastructure" facilitates it to a greater degree are considered more socially cohesive. An analysis by Moore et al. (2005) found that this is the view of social capital favored by health scholars.

The other view of social capital is called the "network" theory. In this view, social capital describes both the tangible and abstract resources that are available to an individual through their social relationships (Lin, 1999). Szreter and Woolcock (2004) describe this as the content of social interactions—information, services, favors—or the electricity which flows through a power grid. The resources available to an individual are a result of both the structure of their social environment and the individual's history of interacting with others in that environment. In fact, one of the best predictors of receiving social support is having previously given it yourself (Plickert, Cote, & Wellman, 2007). While the social cohesion school of social capital views it as an inherently group level attribute, the network theory conceptualizes social capital as both an individual and a group level attribute (Kawachi et al., 2008). The group level measure is an aggregation of individually owned social capital within a network. Networks with different average levels of social capital may influence their individual members in varying ways.

To summarize, the distinction between these two views of social capital is that the social cohesion school is interested in how the nature of a group impacts the exchange of resources while the network theory is concerned with the specific resources that can be accessed through and because of social processes (Lin, 1999; Putnam, 1995). However, the resources available to an individual or a community are inevitably influenced by the nature of the social environment within the population being studied. The social environment within a population can also be shaped over time by the social exchanges which occur between individual members. Therefore, these two conceptualizations are inherently intertwined, which contributes to the debate and results in methodological challenges. Subsequent use of the term "social capital" in this thesis will refer to the network theory (i.e., the specific resources that can be accessed through and because of social processes), unless otherwise specified.

Social Capital and Behavior

Social capital is thought to influence individuals' behaviors through mechanisms which include stress-buffering, social standing, and social support (Kawachi et al., 2008). Stress-buffering is a psychological effect through which the negative psychological impact of stressors is limited (Dean & Lin, 1977). Access to resources may provide a steady stress buffering effect, better equipping individuals to handle stressors in their everyday lives (Wheaton, 1985). This may result in a greater adoption of new behaviors and the maintenance of habits which may previously have appeared unfeasible.

Social standing may provide an individual with unique social pressures (Portes, 1998). For example, someone who is known to have access to a lot of resources in their network may feel pressure to provide support to others. This may be done at the expense of time which could otherwise have been spent on more personally-focused activities. Someone without a lot of resources may also feel pressure to spend time and effort pursuing them. This may be done at the expense of activities which are not deemed priorities.

Social support is a more tangible mechanism through which social capital may influence behavior. Social support is a broad term which traditionally refers to the content of an individual's social interactions which provide benefits (Turner & Turner, 2013). This content can be divided into three categories: emotional, instrumental, and informational support (Thoits, 2011). Emotional support can take the form of encouragement or expressions of caring. Instrumental support refers to tangible assistance such as lending money or doing an activity together with someone. Informational support is the sharing of advice or otherwise educational content.

The structure and composition of an individual's social network can play a role in shaping behavior because different types of relationships tend to render different types of social support. A key distinction can be drawn between "bonding" and "bridging" social capital (Gitell & Vidal, 1998). The former arises from close relationships that create networks with members who are alike in some important aspect of their social identity—such as family, age, ethnicity, or social class. These close relationships tend to be a source of emotional and instrumental support (Wellman & Wortley, 1990). Bridging social capital is found in networks that link individuals from different social identity groups and facilitates the spread of new ideas and information (Granovetter, 1983).

At the group level, social capital is thought to influence health-related behaviors in three ways: facilitating the spread of health information, promoting healthy behavioral norms, and maintaining social control over deviant behaviors (Kawachi, Kennedy, & Glass, 1999). Communities with more social capital are also said to be more cohesive and are often better at organizing around issues and providing access to health promoting resources (Sampson, Raudenbush, & Earls, 1997). In addition, socially cohesive communities provide their members with greater levels of psychosocial support, which seems to provide a protective health effect even to socially isolated individuals within those communities (Seeman et al., 1993).

Clearly, the behavioral influence of social capital may differ when examining it at the individual level versus the group level. This influence may also be dependent on contextual factors. For example, some evidence suggests that social capital may have a greater positive health effect on individuals with lower socioeconomic status (Uphoff, Pickett, Cabieses, Small, & Wright, 2013). Those with lower socioeconomic status may reap greater benefits from the stress-buffering effect of social capital, as such populations tend to experience greater levels of

psychological distress (Whelan, 1992). Those with lower socioeconomic status may also benefit to a greater degree from social support which promotes engagement in health-promoting behaviors. While socially disadvantaged groups tend to be less physically active (Trost, Owen, Bauman, Sallis, & Brown, 2002; Taylor, Baranowski, & Young, 1998), social support for physical activity positively influences activity levels among such groups, potentially mitigating certain factors which contribute to inactivity (Eyler et al., 1999).

Social Capital and Physical Activity

Studies have shown mostly positive associations between various conceptualizations of social capital and physical activity at both the individual and group levels (Nieminen et al., 2013; Ueshima et al., 2010; Kim, Subramanian, Gortmaker, & Kawachi, 2006; Greiner, Li, Kawachi, Hunt, & Ahluwalia, 2004). However, these studies have generally relied on proxy measures for social capital which are more in line with the social cohesion view of social capital (Legh-Jones & Moore, 2012). Few studies have examined the relationship between the network view of individual social capital and physical activity (Legh-Jones & Moore, 2012; Mummery, Lauder, Schofield, & Caperchione, 2008).

Mummery and colleagues (2008) found a significant negative association between physical inactivity and an operationalization which resembled the network view of social capital. Social capital was measured with a nine-item instrument which contained questions related to perceived social support and social interaction habits. Responses were aggregated to create a single variable. However, the questions focused on a person's immediate social network, which may have more thoroughly assessed bonding capital than bridging capital (Mummery et al., 2008).

Legh-Jones and Moore (2012) found a significant negative relationship between network diversity and physical inactivity. However, the findings of their study were limited because network diversity was the only measure of network social capital (Legh-Jones & Moore, 2012). While network diversity is arguably a fair assessment of bridging social capital, it may not reflect an individual's bonding social capital.

Legh-Jones and Moore (2012) also analyzed the relationship between two proxy measures which have been used in other studies examining individual social capital: generalized trust and social participation. Social participation had a significant negative association with physical inactivity, whereas generalized trust had no significant association. This reflects the findings of other individual level studies which have operationalized social capital as social participation (Nieminen et al., 2013; Lindstrom, Moghaddassi, & Merlo, 2003; Greiner et al., 2004; Lindstrom, Hanson, & Ostergren, 2001).

However, findings related to generalized trust have been inconsistent. Two studies found no association with physical activity (Marlier et al., 2015; Nieminen, 2013). Lindstrom (2011) only found a relationship between those who had low generalized trust and low levels of physical activity. Yet, a study by Kim, Jeong, Park, and Kang (2017) indicated that higher generalized trust increased the odds of being physically active.

A global measure of generalized trust likely captures a different phenomenon compared to one's perceptions about the immediate community. Trust in one's community has previously been shown to have a positive association with physical activity (Ueshima et al., 2010; Greiner et al., 2004). However, the validity of using any measure of trust to assess individual social capital in the context of public health has been questioned.

Within the network view of social capital, trust may contribute to the accumulation of social capital or it may result from owning social capital. Trust itself is not transferable between individuals and therefore is not a considered a true form of capital (Lin, 1999). In the social cohesion view, social capital is inherently a group level attribute (Kawachi et al., 2008). Trust is clearly a resource which facilitates social interaction between members of a community. Aggregating individual perceptions of trust may certainly provide a good reflection of that community. However, at the individual level, trust is a personality trait which also has a direct physiological connection to health—such personality traits may influence an individual's health and behavior in a manner which is independent of any social processes (Kawachi et al., 2008).

Similar issues also exist with the practice of using social participation as a measure of individual social capital. Social participation is not a resource, but rather an action which can either lead to the accumulation of resources (Guillen, Coromina, & Saris, 2011) or arise from the presence of accessible resources (Ponce, Rosas, & Lorca, 2014). In the aggregate, social participation may reasonably reflect the social infrastructure of a community (Leyden, 2003). However, personality traits can directly impact an individual's social participation habits (Penner, 2002) and thereby confound individual level analyses which equate social participation to social capital.

Group-level examinations of social capital and physical activity are somewhat less controversial, but the wide range of proxy measures which have been utilized for social capital still limits the generalizability of findings (Samuel, Commodore-Mensah, & Dennison Himmelfarb, 2014; Kawachi et al., 2008). Group-level studies have almost exclusively utilized the social cohesion approach to social capital and have generally found positive associations with

physical activity (Marlier et al., 2015; Ball et al., 2010; Kim et al., 2006; Fisher, Li, Michael, & Cleveland, 2004).

A Swedish study is among the exceptions. Lindstrom and colleagues (2003) found no association between social capital and physical activity. This discrepancy may be explained by differences in economic egalitarianism between Sweden and the United States. Countries with lower levels of socioeconomic inequalities tend to exhibit lower levels of between-area variances in health (Islam, Merlo, Kawachi, Lindstrom, & Gerdtham, 2006).

Since socioeconomic status appears to play a role in how social capital impacts physical activity participation, this study provided additional context to the relationship between individual social capital and physical activity by examining differences in the two variables between income groups. A detailed description of the overall relationship between social capital and physical activity was then obtained by measuring both the correlation between the variables and examining differences in social capital between individuals who were and were not meeting recommended physical activity guidelines.

Additional insight regarding leisure-time physical activity habits was provided by testing for differences in social capital among those who generally did leisure-time physical activity by themselves, with a partner, or with a group. Finally, analyzing the mediation effects of social support for physical activity shed light on a possible mechanism behind the relationship between social capital and physical activity participation. In sum, this study provides a more thorough examination of social capital and physical activity than any which has been completed to date.

Chapter 3 - Methods

Data Collection

A survey of Riley County, KS residents was conducted between March 21st and May 18th of 2018. Individuals were eligible to participate in the survey if they spent more than six months of the year living in Riley County. Data were collected primarily through the online Qualtrics platform (Provo, UT). Paper surveys were provided to the Manhattan Senior Service Center after the first two weeks of data collection and resulted in additional responses from individuals aged 65+. Respondents were compensated by being entered into a drawing for one of seven pre-paid gift cards, including one $100, two $50, and four $25 cards.

Participants were recruited through announcements in an online university newsletter (K-State Today), a listing on the USD 383 Community Information webpage, social media posts, Craigslist, and promotional flyers. K-State Today announcements were made at random intervals throughout the period of data collection. A listing on the USD 383 Community Information webpage was made at the start of the data collection period. Social media posts were periodically made on a variety of Facebook groups catering to Riley County residents and were subsequently shared by individuals. An advertisement was listed on Craigslist at the start of the data collection period. Printed promotional flyers with a QR code and an abbreviated URL for the survey were sent out to a random sample of 600 residential addresses inside the county, but outside the city of Manhattan. These addresses were obtained by purchasing a mailing list from an online vendor (LeadsPlease.com).

Variables

Social Capital

Social capital was assessed with the Personal Social Capital Scale (Chen, Stanton, Gong, Fang, & Li, 2009). The instrument was slightly modified to clarify statements which could be confusing to an American audience. Since Chinese and English language versions of the Personal Social Capital Scale were developed simultaneously, the original wording choices were likely meant to facilitate translation and may have sacrificed on clarity. A pilot test of the Chinese version deemed the instrument to have adequate construct validity and high reliability ($\alpha > 0.8$) (Chen et al., 2009).

Bonding and bridging social capital were assessed in separate sections of the instrument. Both sections had five questions, each with several sub-items. The numerical values associated with the Likert scale response for each sub-item were added together and averaged for each question. The average values for the questions in each section were then added together to obtain separate scores for bonding and bridging social capital. The final scores for bonding and bridging social capital were subsequently added together to create a total social capital variable.

The first question in both the bonding and bridging sections asked respondents to rate the size of those respective networks. The bonding section asked participants to rate the number of people they have in groups such as “immediate family” or “friends.” The bridging section asked participants to rate the number of two different types of organizations that exist in their community—government/political/economic/social justice groups and cultural/recreational/leisure groups. Five response categories were available for each sub-item, ranging from “a few” (1) to “a lot” (5).

The next three questions in both sections of the instrument were answered by rating the number of people or organizations who met various criteria. The categories of people and organizations were the same as in the first question. The rating was done using another five-point Likert scale with response options ranging from “none” (1) to “all” (5).

The second questions assessed the respondent’s social interaction habits. The bonding section asked, “With how many of the people in each of the following categories do you keep a regular contact with?” The bridging section framed the question as “How many groups and organizations from each of these categories do you participate in activities for?” The next questions were related to trust. In the bonding section, participants answered “Among the people in the following six categories, how many can you trust?” The bridging section asked, “Of the groups and organizations in each of the two categories, how many represent your rights and interests?” The fourth set of questions measured perceived support. The bonding question asked respondents “Among the people in each of the following six categories, how many will definitely help you upon your request?” In the bridging section, participants were asked to rate “Of the groups and organizations in each of the two categories, how many will definitely help you upon your request?”

The final question in both the bonding and bridging sections was meant to gauge the socio-economic assets present within the individual’s network. The same response scale was used as in the three previous questions—"none” (1) to “all” (5). For the bonding question, respondents were asked to consider the all of people they know and report how many of them possess six different types of assets, including “certain political power” and “wealth or ownership of a business.” In the bridging section, participants considered all of the community

groups that they are aware of and assessed how many of them possess assets such as “significant power for decision making” and “solid financial backing.”

Physical Activity

Physical activity was measured with items adopted from the short form International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003). This is a recall instrument which asks participants to report the physical activity they completed over the past week. Both reliability and validity of the various forms of the IPAQ are similar to that of other self-report questionnaires (Craig et al., 2003). Reliability is adequate, with Spearman’s rho clustering about 0.8, while criterion validity has a median rho of about 0.30 (Craig et al., 2003).

First, participants reported the number of days on which they engaged in vigorous activity. Next, they provided an estimate—in minutes—for the total time they usually spent on vigorous activity on one of those days. Only bouts of at least ten minutes in duration were considered for this estimate. Participants then provided the same information about their moderate physical activity. Examples of both vigorous and moderate physical activities were provided in the questionnaire.

Estimates for weekly physical activity were obtained by multiplying the duration of activity on a typical day by the reported days per week. To determine whether an individual met the recommendation of at least 150 minutes of moderate activity per week—or an equivalent combination of moderate and vigorous activity (USDHHS, 2008)—their weekly vigorous activity was multiplied by two and added to their weekly moderate activity.

Respondents were also asked to estimate what percentage of their total physical activity occurred in each of the four physical activity domains—workplace, travel, at home, and during leisure-time. The sum of each individual’s moderate and vigorous physical activity was

multiplied by this leisure-time percentage to obtain an estimate for time spent on leisure-time physical activity. The final physical activity variable was obtained from participants who reported engaging in any amount of leisure-time physical activity. These participants were asked to report whether they typically did this alone, with a partner, or with a group.

Social Support

Received social support for physical activity was assessed with a three-item questionnaire that was developed for this study. The instrument contained three items which inquired about three types of social support (Thoits, 2011). The wording of the items was similar to a scale developed by Sallis, Grossman, Pinski, Patterson, and Nader (1987). Ratings were given using a five-point Likert scale with answer options ranging from "never" (1) to "very often" (5). The same rating scale was used for all three items. A cumulative social support variable was subsequently created by adding the numerical values of each individual's Likert scale ratings for the three items.

The first item assessed emotional support. Respondents were asked to rate how often the people they know gave them encouragement to be physically active. The second item assessed instrumental support. Participants were asked to rate how often the people they know went "out of their way" to help them be physically active. Three examples of this type of support were listed: exercising together, giving reminders, and providing awards. The third item was a measure of informational support. Respondents assessed how often information about physical activity was shared or discussed with them.

Data Analysis

SAS 9.4 (Cary, NC) was utilized for data analysis. Descriptive statistics were calculated for all demographic groups. One-way analyses of variance (ANOVA) were conducted to test for

differences in all social capital (bonding, bridging, total) and physical activity (moderate, vigorous, total, and leisure-time) variables between different income groups. Pearson product-moment correlations were calculated to identify any linear relationships between social capital and physical activity variables, while independent sample t-tests were carried out to identify potential differences in social capital between those who met physical activity guidelines and those who did not. One-way ANOVAs were also conducted to identify any differences in social capital among those who typically engage in leisure-time PA by themselves, with a partner, or with a group. Finally, the Sobel test was used to examine the mediating effect of social support for physical activity in significant linear relationships which were found between social capital and physical activity variables.

Chapter 4 - Results

Sample Characteristics

A total of 1170 survey responses were recorded—1149 online and 21 on paper. Response data were analyzed if they met two conditions: 1) if all subscale items were rated for at least one of the bonding or bridging social capital sections; and 2) if average duration and average days per week were provided for either moderate or vigorous physical activity behavior. The resulting sample contained data for 828 participants. Participant demographics are listed in Table 1. Respondents were primarily white (83.6%) and female (75%). Almost all (94.5%) had at least some college education and over half (55.4%) were students at the time of data collection.

Table 1: Sample demographics

Age (n=823)					
18-24	**25-34**	**35-44**	**45-54**	**55-64**	**65+**
42.2% *(n=347)*	20.3% *(n=167)*	12.3% *(n=101)*	10.0% *(n=82)*	11.3% *(n=93)*	4.0% *(n=33)*

Gender (n=820)			
Male	**Female**	**Other**	**Prefer not to respond**
24.2% *(n=198)*	75% *(n=615)*	0.4% *(n=3)*	0.5% *(n=4)*

Race/Origin (n=821)								
White	**Hispanic, Latino, or Spanish origin**	**Black or African American**	**Asian**	**American Indian or Alaska Native**	**Native Hawaiian or Other Pacific Islander**	**Some other race/origin**	**Mixed race/origin**	**Prefer not to respond**
83.6% *(n=686)*	3.8% *(n=31)*	2.0% *(n=16)*	4.0% *(n=33)*	0.2% *(n=2)*	0.1% *(n=1)*	0.9% *(n=7)*	4.4% *(n=36)*	1.1% *(n=9)*

Education (n=823)					
Some high school, no degree	**High school/GED**	**Some college, no degree**	**Associate's degree (2-year degree)**	**Bachelor's degree (4-year degree)**	**Graduate or professional degree (Master's, PhD, JD, MD, etc.)**
0.1% *(n=1)*	5.4% *(n=44)*	34.1% *(n=281)*	5.4% *(n=44)*	28.3% *(n=233)*	26.7% *(n=220)*

Household Income (n=806)				
Less than $10,000	**$10,000-$24,999**	**$25,000-$49,999**	**$50,000-$99,999**	**Over $100,000**
12.0% *(n=97)*	13.2% *(n=106)*	23.0% *(n=185)*	31.1% *(n=251)*	20.7% *(n=167)*
Current Student (n=823)				
Yes		**No**		
55.4% *(n=456)*		44.6% *(n=367)*		

Hypothesis Testing

H1: Individuals with lower household income will report lower levels of both social capital and physical activity participation.

One-way ANOVAs revealed a significant effect between household income groups and all measures of social capital [bonding: $F(4,763) = 14.02$, $p < .001$; bridging: $F(4,790) = 7.90$, $p < .001$; total: $F(4,752) = 13.01$, $p < .001$]. Tukey's post hoc test was used to identify significant ($p < .05$) differences among groups. As shown in Table 2, with respect to bonding social capital, the "over $100,000" group had a higher mean than all other income groups. The "$50,000-$99,999" group also had a higher mean than the "$10,000-$24,999" group. For bridging social capital, the "over $100,000" group had a higher mean than all other income groups. For total social capital, group differences reflected the hierarchy seen in bonding social capital.

One-way ANOVAs also revealed a significant effect between household income groups and engagement in leisure-time physical activity ($F(4,801) = 2.46$, $p = 0.04$). Tukey's post hoc test found that the "$10,000-$24,999" income group reported significantly higher engagement in leisure-time physical activity than the "less than $10,000" income group ($p < .05$).

In summary, individuals from the highest income households had the highest levels in all measures of social capital. The second highest income group also had higher levels of bonding

and total social capital than the second to lowest income group. With regard to leisure-time physical activity, individuals from the lowest household income group spent less time on leisure-time physical activity than the next highest income group. These findings support hypothesis 1.

Table 2: Social capital and physical activity among household income groups

Household Income	% *(N)*	Social Capital			Physical Activity			
		Bonding	Bridging	Total	Moderate	Vigorous	Total	Leisure
Less than $10,000	12.0% (97)	15.1[a] (2.5)	12.8[a] (2.7)	27.9[a] (4.4)	112.3 (136.4)	124.4 (180.5)	236.7 (266.3)	82.6[a] (141.0)
$10,000-$24,999	13.2% (106)	14.7[bc] (2.5)	12.7[b] (3.1)	27.5[bc] (4.8)	236.8 (514.1)	165.3 (313.0)	402.2 (647.7)	153.6[a] (277.5)
$25,000-$49,999	23.0% (185)	15.1[d] (2.4)	12.8[c] (3.1)	27.9[d] (4.7)	203.7 (375.1)	130.0 (166.4)	333.7 (448.4)	110.7 (147.5)
$50,000-$99,999	31.1% (251)	15.6[be] (2.3)	13.4[d] (2.6)	29.0[be] (4.2)	165.5 (267.3)	131.9 (191.7)	297.5 (396.1)	123.3 (181.6)
Over $100,000	20.7% (167)	16.5[acde] (1.8)	14.2[abcd] (2.6)	30.7[acde] (3.6)	156.8 (278.0)	133.6 (155.8)	290.4 (346.8)	102.3 (128.6)
***F*-Value**		14.02***	7.90***	13.01***	2.36	0.73	2.22	2.46*

Notes:

- Mean (standard deviation)
- Bonding & Bridging Social Capital range = 5 (lowest social capital) - 25 (highest social capital)
- Total Social Capital range = 10 (lowest social capital) – 50 (highest social capital)
- Physical activity reported as minutes/week
- [a-f] Tukey's test: Mean values in the same column followed by the same superscript were significant at $p < .05$
- *F*-value: Results of ANOVA significant at *p <.05, **p <.01, ***p <.001

H2: Social capital has a positive relationship with physical activity participation.

Correlation data are listed in Table 3. Two significant relationships were identified between social capital and physical activity variables. A weak positive correlation was found between bonding social capital and leisure-time physical activity, $r(786) = 0.09$, $p = 0.01$. A similar relationship was found between total social capital and leisure-time physical activity, $r(775) = 0.08$, $p = 0.02$.

Table 3: Correlations between social capital and physical activity variables

	Moderate Physical Activity	Vigorous Physical Activity	Total Physical Activity	Leisure-Time Physical Activity
Bonding Social Capital	***0.05*** *p*=0.14 n=788	***0.02*** *p*=0.61 n=788	***0.05*** *p*=0.17 n=788	***0.09*** *p*=0.01 * n=788
Bridging Social Capital	***0.01*** *p*=0.77 n=817	***0.04*** *p*=0.29 n=817	***0.02*** *p*=0.48 n=817	***0.05*** *p*=0.14 n=817
Total Social Capital	***0.03*** *p*=0.39 n=777	***0.03*** *p*=0.34 n=777	***0.04*** *p*=0.27 n=777	***0.08*** *p*=0.02 * n=777

Note: Significance at *p <.05

Results from t-tests are provided in Table 4. Individuals who met physical activity guidelines reported significantly higher levels of social capital than those who did not. This was true for all measures of social capital. For bonding social capital, the difference between those who met guidelines (M = 15.7, SD = 2.2) and those who did not (M = 15.1, SD = 2.6) was significant at the $p < 0.01$ level [$t(786) = -2.95$, $p < 0.01$]. Differences in bridging [$t(815) = -5.05$, $p < 0.001$] and total social capital [$t(775) = -4.68$, $p < 0.001$] among these groups were both significant at $p < 0.001$. Together with the significant correlations, the results of these t-tests provide evidence for a small but positive relationship between some measures of social capital and physical activity. Thus, hypothesis 2 was supported.

Table 4: T-tests for social capital and meeting/not meeting physical activity guidelines

Bonding Social Capital							
	%	**n**	**Mean**	**SD**	**DF**	**t**	**Pr > t**
No	29.8%	235	15.1	2.6	786	-2.95	<0.01**
Yes	70.2%	553	15.7	2.2			
Bridging Social Capital							
	%	**n**	**Mean**	**SD**	**DF**	**t**	**Pr > t**
No	30.5%	249	12.5	3.1	815	-5.05	<0.001***
Yes	69.5%	568	13.6	2.7			
Total Social Capital							
	%	**n**	**Mean**	**SD**	**DF**	**t**	**Pr > t**
No	29.9%	232	27.6	4.9	775	-4.68	<0.001***
Yes	70.1%	545	29.3	4.2			

Note: Significance at **p < .01, ***p < .001

H3: Individuals who typically engage in leisure-time physical activity with a partner or group will report higher levels of social capital than those who do this individually.

One-way ANOVAs were used to identify whether significant differences exist in social capital between individuals who have different levels of companionship during their leisure-time physical activity. Data are listed in Table 5. No significant differences were found for any measure of social capital [bonding: $F(2,655) = 1.31$, $p = 0.27$; bridging: $F(2,678) = 1.89$, $p = 0.15$; total: $F(2,645) = 2.19$, $p = 0.11$]. Therefore, hypothesis 3 was not supported.

Table 5: ANOVA between social capital and leisure-time physical activity companionship

Companionship During Leisure-Time Physical Activity	%	Bonding Social Capital *M (SD)*	Bridging Social Capital *M (SD)*	Total Social Capital *M (SD)*
By myself	61.7% (*n*=426)	15.6 (2.2)	13.3 (2.8)	29.0 (4.3)
With a partner	24.3% (*n*=168)	16.0 (2.3)	13.7 (2.8)	29.6 (4.3)
With a group	14.0% (*n*=97)	15.8 (2.0)	13.8 (2.4)	29.8 (3.6)
F-value Pr > F		1.31 *p*=0.27	1.89 *p*=0.15	2.19 *p*=0.11

Notes:

- Bonding & Bridging Social Capital range = 5 (lowest social capital) - 25 (highest social capital)
- Total Social Capital range = 10 (lowest social capital) – 50 (highest social capital)

H4: Social support for physical activity mediates the relationship between social capital and physical activity.

Two significant, positive linear relationships were found between social capital and physical activity variables in this study. One was between bonding social capital and leisure-time physical activity [$r(786) = 0.09$, $p = 0.01$]. The other was between total social capital and leisure-time physical activity [$r(775) = 0.08$, $p = 0.02$]. The mediating effect of social support for physical activity was examined in these two relationships.

Figure 1 illustrates the first mediation model that was analyzed. In step one of the mediation analysis, the linear regression between bonding social capital and leisure-time physical activity was shown to be significant [$b = 7.03$, $t(787) = 2.62$, $p = 0.01$]. Step two revealed that the linear regression between bonding social capital and social support for physical activity was also significant [$b = 0.38$, $t(784) = 8.75$, $p = <.001$]. Step three showed that when controlling for bonding social capital, social support remained a significant predictor in a multiple linear

regression for leisure-time physical [b = 41.28, t(784) = 6.45, p = <.001]. However, step four revealed that the opposite was not true. When controlling for social support for physical activity, bonding social capital was no longer a significant predictor in the multiple linear regression for leisure-time physical activity [b = 1.75, t(784) = 0.64, p = 0.52]. A Sobel test for this mediation effect was significant (z = 5.61, p <.001). Therefore, social support for physical activity appeared to fully mediate the relationship between bonding social capital and leisure-time physical activity.

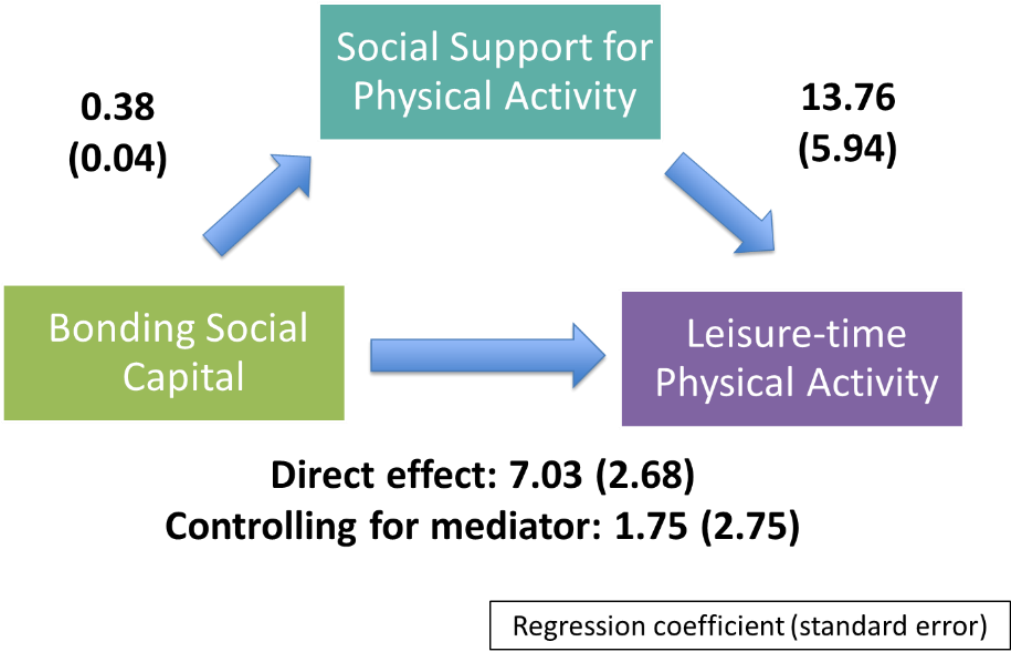

Figure 1: *Mediation model for the relationship between bonding social capital and leisure-time physical activity*

Figure 2 illustrates the second mediation model that was analyzed. The same process was was followed as for the first model. Step one showed that the linear regression between total social capital and leisure-time physical activity was significant [b = 3.29, t(775) = 2.33, p = 0.02]. The second step showed that the linear regression between total social capital and social

support for physical activity was also significant [b = 0.24, t(772) = 10.49, p = <.001]. Step three revealed that social support for physical activity remained a significant predictor in a multiple linear regression model for leisure-time physical activity when total social capital was controlled for [b = 14.58, t(771) = 6.62, p = <.001]. In step four, it was found that when social support for physical activity was controlled for, total social capital was no longer a significant predictor in a multiple linear regression model for leisure-time physical activity [b = -0.13, t(771) = -0.09, p = 0.93]. A Sobel test was conducted and found that this fully mediating effect was significant (z = 6.01, p = <.001). Since both mediation analyses found that social support for physical activity fully mediated the relationship between measures of social capital and leisure-time physical activity, hypothesis 4 was supported.

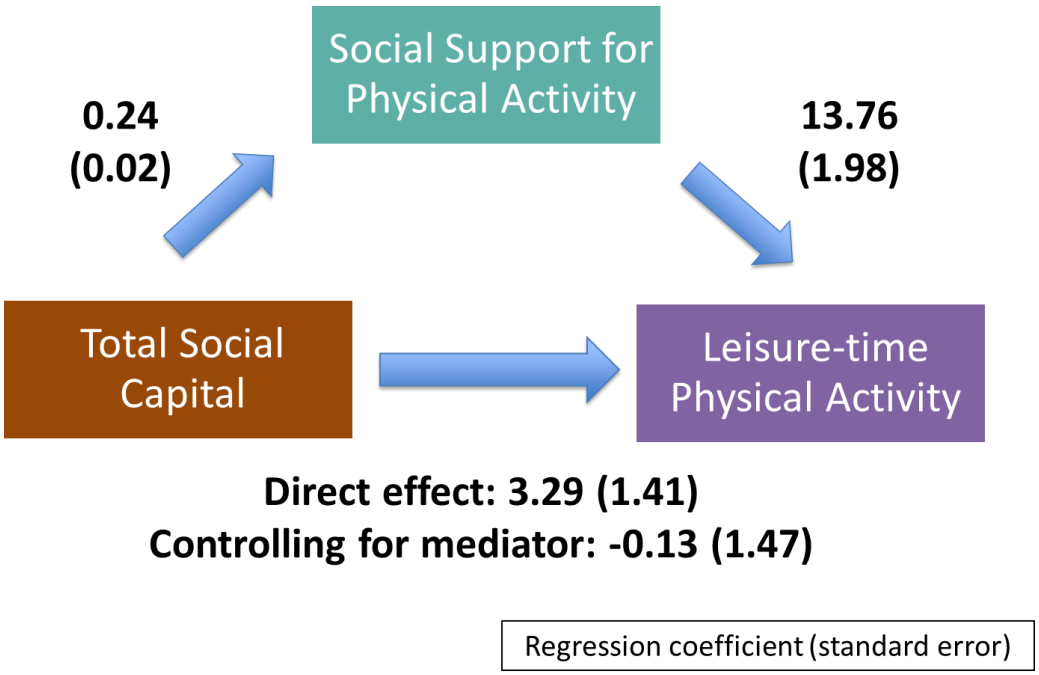

Figure 2: *Mediation model for the relationship between total social capital and leisure-time physical activity*

Chapter 5 - Discussion

The purpose of this study was to examine individual social capital and its relationship with physical activity participation. The primary goals were to describe this relationship and test whether social support for physical activity is a mechanism through which social capital contributes to this health-related behavior. Social capital was defined as the tangible and non-tangible resources available to an individual through their social connections. Physical activity was operationalized as moderate to vigorous intensity activities which occur in bouts of at least ten minutes. Specific findings are discussed below, in accordance with the hypotheses outlined at the beginning of the study.

Low Income Groups

Social capital is generally understood to be lacking among disadvantaged groups (Carlson & Chamberlain, 2004) and poverty may be a factor which places a foundational constraint on the acquisition of social capital (Sun, Rehnberg, & Meng, 2009). Low income has also previously been linked with lower levels of physical activity (Trost et al., 2002; Taylor et al., 1998). This knowledge informed the hypothesis that individuals with lower household income would report lower levels of both social capital and physical activity participation.

The data examined in this study support this hypothesis. The highest income group had the highest levels in all the social capital measures and the second highest income group also had higher levels of bonding and total social capital than one of the lower income groups. In physical activity, the lowest income group reported lower levels of leisure-time physical activity than the second lowest income group. While these findings support the hypothesis, they do not provide clarity on whether social capital may play a role in shaping physical activity participation among individuals with low income. It is only clear that significant differences exist on the extremes.

The wealthiest individuals have the highest levels of social capital and the poorest individuals appear have the lowest level of leisure-time physical activity.

In fact, other studies have shown that having network connections with lower income—or working-class—individuals has a negative association with self-reported health (Verhaeghe & Tampubolon, 2012). This suggests that even if lower income individuals have access to certain kinds of social capital, it may not necessarily have a positive impact on their engagement in health-related behaviors. Some social networks may actually facilitate the spread of unhealthy norms and behaviors which contribute to major public health issues such as obesity (Christakis & Fowler, 2007). Further research is needed to examine the connections between social capital, income, and physical activity.

Social Capital and Physical Activity Level

A positive correlation was expected between social capital and physical activity levels, and individuals who met physical activity guidelines were expected to report higher levels of social capital than those who did not meet guidelines. Research on social capital and physical activity to date has generally supported the idea that a positive relationship exists between the variables, despite inconsistent operationalizations of social capital. For example, two studies which operationalized social capital as network-based resources found that individuals with higher levels of social capital were less likely to be physically inactive (Legh-Jones & Moore, 2012; Mummery et al., 2008).

However, individuals who were considered physically active in these studies were not necessarily meeting USDHHS (2008) guidelines. The threshold in the Legh-Jones and Moore (2012) study was slightly below the recommended minimum, while individuals who reported any physical activity were considered active by Mummery and colleagues (2008). The present

study was the first to test for differences in social capital between those who were meeting the physical activity guidelines and those who were not. This also appears to be the first study to test for a correlation between social capital and physical activity.

Individuals who met physical activity guidelines were found to have significantly higher levels of bonding, bridging, and total social capital than those who did not. However, despite having statistical significance, the differences were small. It is unclear whether such small differences are discernable or whether they can be expected to have any impact on whether an individual meets physical activity guidelines.

A statistically significant positive correlation was identified between bonding social capital and leisure-time physical activity. A similar relationship was also found between total social capital and leisure-time physical activity. These findings provide some additional evidence linking social capital and physical activity. However, these are very weak correlations. They raise questions about the utility of viewing social capital as a determinant of physical activity behavior.

There are a few reasons why social capital may be limited in this respect. As a variable, social capital may be too broad to display a strong relationship with a specific behavior like physical activity. By definition, all of the social support available to a person is meant to be captured with a measurement of social capital. However, the circumstances which determine whether social support is received and whether it impacts a person can be nuanced. For example, support from family members can have a different effect on physical activity behavior than support from friends (Mendonca, Cheng, Melo, & de Farias Junior, 2014). A measure of bonding social capital would mix these types of support together. An individual with a lot of support from

family, but no support from friends, would be said to have the same amount of bonding social capital as someone who has no support from family, but a lot of support from friends.

As mentioned previously, social capital is under no restriction to confer objectively positive effects. Some of the participants in this study may indeed have received support which led to them engage in physical activity. However, others may have received support which accomplished nothing or even discouraged physical activity (Christakis & Fowler, 2007). Contextual factors may play a key role in shaping the behavioral effects of social capital. These can even include something like an individual's ratio of bonding to bridging social capital. Low bridging social capital and high bonding social capital can limit a person's exposure to new ideas and make that person especially susceptible to adopting whatever behaviors are prevalent in their close social network (Villalonga-Olives & Kawachi, 2017).

In general, social capital can be said to have a positive relationship with physical activity. However, future examinations of this relationship would benefit from a greater consideration of contextual factors within an individual's social network. These may include social norms or attitudes about physical activity. For instance, it would be helpful to know that an individual has high bonding social capital but that their close personal network does not value physical activity. Stronger relationships between social capital and physical activity may also be revealed by pursuing more specific assessments of social capital than bonding or bridging. For example, it may be useful to distinguish between the resources that are accessible through family or friends.

Social Capital and Leisure-Time Physical Activity Companionship

It was expected that those who engaged in leisure-time physical activity with either a partner or a group would report higher levels of social capital than those who typically did this alone. This was a compelling research question due to the potentially bi-directional nature of this

relationship. Those with higher levels of social capital could reasonably be expected to have more opportunities to participate in physical activities with others. Physical activity with others could also be an opportunity to develop social relationships and build social capital. No other studies have explored this specific hypothesis to date.

Unexpectedly, this study found no significant differences in social capital between individuals who typically engaged in leisure-time physical activity alone, with a partner, or with a group. This suggests that for this sample, social capital does not play a role in people's decisions to engage in physical activities with others. It also suggests that the social interactions which occur in the context of performing physical activity do not contribute to the building of social capital.

These conclusions are somewhat surprising because social capital has often been operationalized as social participation, which has shown a positive relationship with physical activity (Nieminen et al., 2013; Lindstrom et al., 2003; Greiner et al., 2004; Lindstrom et al., 2001). The implication from these studies is that socially active individuals tend to be more physically active. However, it is reasonable to believe that some individuals who are otherwise very socially active may still prefer to do leisure-time physical activity on their own. They may find it easier to focus on their workout or relax while not feeling an obligation to interact with others.

Admittedly, these conclusions make more sense in the context of the findings from a workplace intervention which set out to build social capital through group exercise (Andersen et al., 2015). Social capital was built among individuals who exercised together, but this appears to have been achieved at the expense of social capital from other areas of the participants' social networks (Andersen et al., 2015). Such an effect could explain why the present study found no

significant differences between those who engage in leisure-time physical activity alone or with others. Any social capital that was built in the context of leisure-time activity could have been cancelled out by a loss of social capital from other areas of people's social networks.

Social Capital and Social Support for Physical Activity

As defined in this study, social capital is, in part, a measure of available social support (Chen et al., 2009; Lin, 1999). For this reason, received social support for physical activity was expected to at least partially mediate the relationship between social capital and physical activity participation. Social support was actually shown to fully mediate the relationship between bonding social capital and leisure-time physical activity, as well as the relationship between total social capital and leisure-time physical activity. The full mediation effects were surprising because social capital is believed to have multiple mechanisms through which it can influence behavior at the individual level. In addition to social support, these are also said to include psychosocial mechanisms such as stress buffering and social standing (Kawachi et al., 2008).

The findings of this study challenge the idea that simply having social capital promotes physical activity in an abstract psychosocial manner. Social capital appears to have a more direct impact on physical activity behavior. It seems that certain network-owned resources must be utilized or shared through provisions of social support for physical activity. The two significant linear relationships which were found suggest that these specific resources are best captured with the measures of bonding social capital and total social capital.

Few studies have examined bonding and bridging social capital separately in the context of physical activity, although both types of social capital have previously been linked with lower odds of physical inactivity (Ueshima et al., 2010). The discrepancy in this study—with bridging social capital having no linear relationship with any measure of physical activity—may result

from the unique way in which bridging social capital is assessed with the Personal Social Capital Scale (Chen et al., 2009). The instrument leverages community organizations to assess respondents' more heterogeneous social connections, whereas other studies have more directly inquired about demographic differences among social connections (Legh-Jones & Moore, 2012; Ueshima, 2010).

Study Strengths & Limitations

A key strength of this study was that it utilized a validated, multi-item instrument to obtain measures of social capital (Chen et al., 2009). In contrast, much of the research on social capital and physical activity has relied on proxy measures with a limited number of items that were taken from general, population-level studies (Nieminen et al., 2013; Lindstrom, 2011; Ueshima et al., 2010; Greiner et al., 2004; Lindstrom et al., 2001.) It has also been common for other studies examining this relationship to distinguish only between individuals who were and were not active (Mummery et al., 2008; Kim et al., 2006; Lindstrom et al., 2003). This study went more in-depth, testing for a linear relationship between the variables, examining social capital based on whether individuals met physical activity guidelines, examining differences based on whether leisure-time physical activity was done alone or with others, and testing for the significance of a mediating variable.

However, this study is not without limitations. The cross-sectional design of this study precludes judgements related to causation between variables. In addition, since data were only collected in Riley County, KS, the findings of this study may not generalize to a wider population. Collecting data on the internet may have also yielded a sample which is disproportionally active online. Disproportionate online activity levels could impact both social

capital (Naseri, 2017) and physical activity levels (Boone, Gordon-Larsen, Adair, & Popkin, 2007).

The participant sample in this study underrepresented certain demographic groups, including men and Black/African-Americans. Examining social capital and physical activity among racial/ethnic groups could have provided additional insights on how social capital may impact physical activity behavior among socioeconomically disadvantaged groups. However, this analysis was not conducted due to the small sample of non-white respondents. This participant sample also over-represented college students. Since younger individuals tend to be more active (Sallis, 2000), this may have skewed the physical activity data and affected the relationships that were found in this study.

Conclusion

In behavioral research, measuring social capital can provide a way to quantify the capacity that an individual's social network has for influencing them. A higher capacity for influence may result in greater levels of received influence. Indeed, this study found that bonding and total social capital both had significant correlations with leisure-time physical activity. Those who met physical activity guidelines reported higher levels in all measures of social capital. It was also shown that provisions of social support for physical activity fully mediated the significant relationships between social capital and leisure-time physical activity. In summary, social capital had a generally positive relationship with leisure-time activity and influenced this behavior through provisions of behavior-targeted social support.

However, these findings are also clear in that social capital offers no guarantee of physical activity promotion. The correlations found between leisure-time physical activity and both bonding and total social capital are very weak. Differences in social capital between those

who met physical activity guidelines and those who did not were small as well. Social factors which promote physical activity may be more nuanced than that which is captured with a general assessment of social capital. Physical activity promotion efforts which target social capital may achieve marginal improvements in physical activity levels at the population level, but they seem unlikely to result in significant improvements at the individual level.

Future research should explore the relationship between social capital and physical activity among socioeconomically disadvantaged groups. Social capital may have a disproportionate effect on promoting physical activity among such groups. Future studies should also examine specific network characteristics which may promote physical activity and how interventions may build this specific type of social capital for individuals.

Chapter 6 - References

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