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Suicide is the second leading cause of death among adolescents and rates have increased in recent years. Research has demonstrated that social capital is related to better health and mental well-being and can reduce suicide risk. However, little research has examined social capital in adolescent populations and the inconsistency in social capital measurement, particularly structural social capital, has made parsing out the independent effects of different social capital components on suicide elusive.

This dissertation explores how different components of social capital independently predict suicidal thoughts and behaviors among high school students and examine how changes in social capital predict changes in suicidal thoughts and behaviors over time. Social network analysis measures are used to measure structural social capital. To examine the relationships between social capital and adolescent suicidal thoughts and behaviors, data from the *Sources of Strength* intervention is used that include adolescent perceptions of their social environment, attitudes and experiences with suicide, and friendship nominations to create school friendship networks. Multilevel models examine the associations between individual and group level cognitive and structural social capital and the within-person and between-person effects of social capital on suicidal thoughts and behaviors.

The results from the dissertation indicate that some components of social capital are independently associated with decreases in adolescent suicidal thoughts and behaviors. However, social capital may be risky at times when students exceed their typical levels of social capital. The results indicate components of social capital make independent contributions to

adolescent risk for suicidal thoughts and behaviors and further exploration of the pathways that

connect social capital and adolescent suicide are needed.

AN EXAMINATION OF THE RELATIONSHIP BETWEEN SOCIAL CAPITAL AND

ADOLESCENT SUICIDAL THOUGHTS AND BEHAVIORS

by

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DEDICATION

To Kaitlyn.

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CHAPTER I: INTRODUCTION

Statement of the Problem

Suicide is the 10th leading cause of death in the United States and the second leading cause of death among high school students (Hedegaard, Curtin, & Warner, 2020). Suicide rates among 15-19 year-olds have increased nearly 40% from 7.53 cases per 100,000 in 2010 to 10.57 cases per 100,000 in 2020 (Centers for Disease Control and Prevention, 2022).The increased rates of suicide appear to be affecting all parts of the United States with 90% of counties reporting at least a 20% increase. Rural counties are disproportionately affected by higher suicide rates with rates for girls at 5.1 per 100,000 in large urban areas compared to 8.2 in rural areas and rates for boys at 18.3 per 100,000 in large urban areas compared to 31.0 in rural areas (Hedegaard et al., 2020). The largest increase in suicide rates is among Native Americans, who also have higher rates of suicide than Non-Hispanic Whites (Curtin & Hedegarrd, 2019).

These climbing rates of suicide have coincided with rises in several known suicidal risk factors, such as anxiety and depression (Calati et al., 2019), firearm access (Hemenway, Kennedy, Kawachi, & Putnam, 2001a), substance misuse (Jordan, Blackburn, Jarlais, & Hagan, 2017), social isolation (Cacioppo & Cacioppo, 2014), and a lack of social integration (Tsai, Lucas, Sania, Kim, & Kawachi, 2014). Recent trends in certain social phenomenon may explain the rising rates of suicide among adolescents as there is a well-established association between social relationships and suicide at the individual (Borowsky, Ireland, & Resnick, 2001; Tsai, Lucas, & Kawachi, 2015a) and community levels (Baller & Richardson, 2002; Barkan & Houle, 2013; Durkheim, 1951). High school seniors in 2017 had 26% less in-person social interaction than seniors in 2010 and spent nearly 2 hours less a week socializing in-person with friends compared to 2010 seniors (Twenge, Spitzberg, & Campbell, 2019). Although these trends can

partly be explained by increases in social media usage (Anderson & Jiang, 2018), they also coincide with recent trends in how teens perceive their relationships. Feelings of loneliness is becoming increasingly prevalent in teens, particularly in the last few years. After a decline in perceptions of loneliness among teens from 1991 to 2012 (Clark, Loxton, & Tobin, 2014), high school seniors in 2017 are 50% more likely to feel lonely than high school seniors in 2012 (Twenge et al., 2019). Feelings of loneliness increased during the COVID-19 pandemic with one study finding 61% of young people feeling lonely in October 2020 (Weissbourd, Batanova, Lovison, & Torres, 2021). Increased loneliness has coincided with an increase in suicide attempts, as emergency room visits for suicide attempts among adolescents increased by 39% from 2019 to 2021 (Yard et al., 2021). Teens are also more likely to feel lonely than adults or the elderly (Pollack, 2018). The current study will test the relationship between social relationships (specifically, social capital) and suicidal thoughts and behaviors (STB) among adolescents.

Social Capital

Social relationships are strong determinates of health outcomes, including suicide (Berkman, Syme, & Berkman, 1979; Holt-Lunstad, Smith, & Layton, 2010; Luke & Harris, 2007; Miller, Esposito-Smythers, & Leichtweis, 2015; Thoits, 2011). Social capital, a concept that has undergone a wide evolution (Bourdieu, 1986; Coleman, 1988; Portes, 1998; Putnam, 1995) can be broadly defined as the value that exists within social relationships. More specifically, social capital is "the connections among individuals' social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2000).

Social capital is both an individual and group level construct that contains both cognitive and structural dimensions. Individual level measures include the resources that individuals can access through their social relationships (e.g., knowledge, social support), their perceptions of

trust and reciprocity, and participation in formal groups such as volunteer organizations. Group

level measures examine aggregate levels of individual measures and shared norms. The

dimensions of social capital differentiate between how people feel about their relationships

(cognitive social capital) and how people interact (structural social capital). Cognitive measures

of social capital focus on perceptions of trust, reciprocity and social cohesion, whereas structural

measures capture the activities of individuals and communities through participation in formal

organizations, as well as the social network position of individuals and network structure of

groups. Together, these make four distinct social capital components (individual cognitive;

individual structural; group cognitive; group structural). Measurement examples of social capital

components are given in Table 1.

Table 1. The Components of Social Capital

	Individual	Group
Cognitive	Perceptions of : • Trust • Reciprocity • Group Cohesion • Belonging • Social Support	• Aggregate levels of individual perceptions • Shared norms
Structural	• Formal Group Membership (i.e. voluntary civic organizations, church) • Social Interaction • Degree (number of relationships in a network) • Betweenness (how often an individual acts as a link between two non-connected individuals in a network) • Transitivity (how often a person's friends are friends with each other) • Coreness (the degree to which a person is connected to others who are well connected)	• Formal group membership rates. • Civic involvement, i.e., voting rates. • Network Density (the proportion of actual relationships to possible relationships). • Transitivity ratio (the proportion of triangular relationships in which all three individuals are connected) • Reciprocity ratio (the proportion of relationships that are bidirectional).

Studies have found mixed results about the link between social capital and health. For example, higher levels of social capital are generally positively associated with health (Choi et al., 2014; Leyden, 2003; K. A. Lochner, Kawachi, Brennan, & Buka, 2003; Rodgers, Valuev,

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Hswen, & Subramanian, 2019), however social capital can also have a negative effect on health, especially for marginalized populations (Villalonga-Olives & Kawachi, 2017). These results can partly be attributed to the examination of social capital as singularly an individual or group-level measure, aggregating individual level measures to create group level measures that can lead to ecologic fallacies, and failing to differentiate between cognitive and structural dimensions of social capital. Little research has examined the independent effects of cognitive and structural social capital on health at both the individual and group levels. This study will test whether cognitive and structural measures of social capital at both the individual and group level are linked to adolescent STBs.

Prior research has attempted to examine the structural features of social capital through measures such as participation in voluntary organizations, yet formal group participation is a problematic measure because it could be as much an outcome of social capital as it is a measure of social capital. These measures do little to capture the structure of social networks, as individuals in groups can interact in formal (e.g. community organizations, churches) and informal (i.e. vacationing with friends) settings. Therefore, social network analysis may be a better way to test some structural components of social capital. Social network analysis is a theoretical perspective used to understand relationships among, within, and between people and groups and how they affect behaviors (Wasserman & Faust, 1994; Valente, 2010). Ichiro Kawachi has called for more network analysis of social capital, stating "more refined tests…would be made possible by incorporating explicit measures of social capital…exemplified by network-based concepts." (Ichiro Kawachi, Subramanian, & Kim, 2008).

Study Aims

The primary aims of this study are to test whether different components of social capital are associated with adolescent STBs and to examine how changes in social capital predict changes in STBs. The study is guided by these research questions:

1. Is there a relationship between social capital and STBs?

    a. To what extent are (a) cognitive social capital and (b) structural social capital independently associated with (a) suicide ideation and (b) suicide attempts?

    b. Does group level structural capital moderate the relationship between individual structural level social capital and suicide ideation?

    c. Does group level cognitive social capital moderate the relationship between individual structural level social capital and suicide ideation?

2. Do *changes* in social capital predict *changes* in suicidal ideation and suicide attempts over time, after controlling for typical levels of social capital (i.e., between-person effects)?

Overview of Methodology

Social Network Analysis (SNA)

This study uses social network analysis to answer the research questions. SNA requires information about relational linkages that are used to create network structures of relationships. These networks are most often composed of who knows whom, or are based on certain relationship characteristics, such as who shares information with whom or who is friends with whom. For this study, the networks are created by students naming their closest friends at school.

Social network analysis will allow for identifying both individual and network level effects like network structures and individual positions within those structures, which are vital

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for fully understanding the effects of social capital on STBs. At the individual level, certain network characteristics are important for understanding structural social capital. Their number of ties, known as degree, and directionality of their relationships, whether they are reciprocal or unidirectional, capture structural social capital at the individual level. Each student also has a specific position in the network. Some students will be more centrally located whereas some will be on the periphery or isolated from the network completely. Centrality measures, such as coreness, which measures how connected someone is to others who are well connected, and betweenness, which measures how often someone connects others who are disconnected in a network capture individual structural social capital and isolates would be considered low in structural social capital. At the network level, characteristics such as density (how much each student is connected to everyone else in the network), reciprocal relationship ratio (the percentage of ties that are bidirectional) and transitivity relationship ratio (how often two of a student's connections are also connected to each other) capture structural social capital at the group level.

This study will use a series of multi-level models, as social capital is best understood as a multi-level concept. To understand the independent effects of the various levels and components of social capital, each component's relationship with STBs will be analyzed independently, and then the study will test a final model, testing all components of social capital to identify the change in effect for social capital components after controlling for other components. This study will also use a series of time-varying models to examine (1) the between person effects of social capital by testing whether a student's typical social capital is associated with their STBs and (2) the within person effects to test whether deviations from a person's typical social capital predict changes in STBs.

Significance of the Study

Although there have been several efforts to reduce suicide and a goal was set to reduce suicide by 10% by 2020, suicide rates have continued to climb for several years (Hedegaard, Curtin, & Warner, 2018). Social factors contributing to suicide, including social networks and social capital, have been understudied in comparison with individual and psychological factors (Fazel & Runeson, 2020). Franklin and colleagues found that research on suicidal risk factors over the last 50 years has only produced limited explanatory power in identifying causes of suicide over time (Franklin et al., 2016). Therefore, there is a critical need to identify factors that contribute to increasing rates of suicide that could lead to a reexamination of the current clinical, political, and educational efforts that have been implemented to reduce suicide.

This study will contribute to building a framework for understanding the relationship between social capital and STBs among adolescents. Although prior research has found that increased social capital is related to better health and lower STBs, most research has been done on adult populations. Further, the lack of consistent measurement, particularly for structural social capital, has made it difficult to create a theoretically grounded framework for studying social capital in adolescents. This study will test whether social capital is associated with STBs among adolescents and the analytic process can be used as a framework for identifying the relationship between social capital and other adolescent health outcomes. Future research can expand on the use of social network analysis for understanding adolescent social capital and examine how social networks may fit into other traditional measures of structural social capital in adolescents, such as participation in school groups/activities, participation in youth organizations, and connections to family and the broader community.

This study will also provide a framework for future social capital research that examines social capital as a multi-dimensional, multi-level concept to more specifically identify the components of social capital that most directly impact STBs. Much of the research on social capital and suicide does not examine all components of social capital and the results across studies are often mixed with components sometimes having no association or associated with higher rates of STBs. This study will provide a clearer understanding of the relationship between social capital and STBs by testing the relationship with a specific social capital component and STBs after controlling for all other social capital components. The results from this study can provide a better understanding of the protective effect of social capital and which components may provide the strongest protective effect, or which social capital components may be potentially risky after controlling for other components.

This study can also be used to inform practitioners in developing interventions to address STBs. Interventions that only address the individual level or psychiatric factors have been shown to have little impact in addressing STBs (Krysinska et al., 2016). Interventions that address individual risk factors as well as the social environment are needed. The study can provide some empirical underpinning for interventions that promote social capital in individuals and groups and inform which specific components of social capital should be addressed for reducing suicide.

Finally, a longitudinal study can demonstrate how changes in social capital may predict changes in STBs over time and which social capital characteristics have the strongest effect on suicide over time. As suicide risk increases with age throughout adolescence (Centers for Disease Control, 2022), it is important to know how changing social patterns like changing social capital may protect or put an individual at a greater risk of suicide. Practitioners can use this

knowledge to determine when adolescents may be at increased risk for suicide and account for

the changing social patterns adolescents will experience in this life stage.

Organization of the Dissertation

Chapter 2 reviews prior research on the association between social capital and STBs.

Chapter 3 details the methodologies for the study. Chapters 4 will test which social capital

components are most strongly associated with suicide ideation and suicide attempts (research

question 1). Chapter 5 will test whether changes in social capital are associated with changes in

suicide ideation (research question 2). Chapter 6 will synthesize the results of the study and

discuss the implications this study has for understanding how social capital influences suicide.

CHAPTER II: LITERATURE REVIEW

Social Capital Definitions

Social capital measures the value that exists within relationships. Most public health research have used Putnam's definition that social capital is "the connections among individuals' social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2000). Although most research only examines social capital at either the individual or group level, many researchers argue that social capital is both an individual and collective (or group) property (I. Kawachi, 2004; Lin, 2001). For example, Lin (2001) argued that social relations could be beneficial (or detrimental) to both the individual and the group, so examining individual and group levels of social capital exclusively can be problematic.

Others have argued that social capital is also a multidimensional concept (Kawachi, 2004; Poortinga, 2006; Szreter, 2004). In Putnam's (2000) definition, there is a sense of feeling and belief that resides in the norms, expectations, and trust that make up social capital. This 'cognitive' dimension of social capital is measured as levels of trust (Congdon, 2012; I Kawachi, Kennedy, Lochner, & Prothrow-Stith, 1997), a sense of belonging or cohesion (Letki, 2008; Stahlman et al., 2016) and expectations of reciprocity (J. Y. Kim, Yoon, Kim, & Kim, 2017a; K. A. Lochner et al., 2003). In addition, the networks that make up social capital imply some level of action among individuals and groups. This 'structural' dimension of social capital is made up of the actual relationships and networks that exist among individuals and groups. Often structural social capital is measured through participation in community organizations (Han & Lee, 2013; Poortinga, 2006), religious participation (Fitzpatrick & Spialek, 2020; Rasic, Kisely, & Langille, 2011), and volunteering (Daniel Kim, Subramanian, Gortmaker, & Kawachi, 2006; Smith & Kawachi, 2014a). These measures of structural social capital capture relationships in

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formal group settings (i.e. civic organizations), but not informal interactions (i.e. friends getting coffee). Although some research have measured structural social capital through more relational constructs, such as number of friends (An & Lee, 2019; Yu & Chen, 2020), quality of relationships (Kasen & Chen, 2020), and frequency of contact (Peng, Yang, & Rockett, 2019), few have use social network structure to examine group level structural social capital.

Theoretical Foundations

It is likely that social capital influences suicide risk through similar pathways as it influences health more broadly. For individuals, a high social capital environment can reduce stressors and promote behaviors that reduce negative health outcomes. Individuals with higher social capital will also have higher levels of social support and access to resources that can promote health. Conversely, low social capital in individuals and communities can create hostile environments that may harm health. These relationships may be particularly important for the association between mental health and suicide. Nearly 95% of those who commit suicide suffer from some form of mental disorder (Cavanagh, Carson, Sharpe, & Lawrie, 2003). If social capital can serve as a buffer to reduce stress, anxiety, and other mental illnesses, then higher levels of social capital may reduce suicide by lowering these risk factors for mental health.

Within social networks, individuals engaged in their social network may have additional social resources to rely on to reduce STBs. Individuals experiencing stressful life events, such as a fractured relationship or an economic disruption, may depend on their ties for social support, and have a lower risk for suicide through their perceived norms that discourage suicide (Joiner, 2005). At the group level, cohesive groups may promote social interactions that individuals will feel obligated to participate in. The norms set by the group may establish values that deter

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suicide and give members of the group meaning and purpose, both of which may reduce the risk of considering suicide (Joiner, 2005).

The mechanisms through which social capital can influence suicide align well with several social theories on suicide. According to the Interpersonal Theory of Suicide (Joiner, 2005; Van Orden et al., 2010), suicidal ideation results from two interpersonal constructs: thwarted belongingness (made up of perceptions of loneliness and a lack of reciprocal caring relationships) and perceived burdensomeness (i.e., someone's perceptions of their worth to their social connections). Sustained feelings of thwarted belongingness and perceived burdensomeness can lead to hopelessness that situations will never improve, and thus increase the risk for suicide. The two latent constructs that make up thwarted belongingness (loneliness; lack of relationships) fit well into social capital theory. Loneliness is a measure of one's perceived lack of social connection which directly measures individual level cognitive social capital. The presence, or lack of, reciprocal relationships also directly measures structural social capital as it requires relationships to be built on norms of reciprocity. A person who feels the strains of social relationships based on their network position or who perceives relationships as one-sided may have a high perceived burdensomeness.

The Interpersonal Theory of Suicide and Klonsky and May's (2015) three-step theory of suicide account for the transition from suicidal ideation to a suicide attempt. Most individuals that consider suicide will never attempt suicide (Van Orden et al., 2010), so these theories account for the different mechanisms that put one at risk for suicidal ideation as opposed to a suicide attempt. According to the three-step theory, strong social connections provide social support that reduce the risks that someone who is considering suicide actually attempts suicide. These strong social connections could be assessed through social capital, as relationships built on

trust can provide social support. At the group level, high social capital may protect individuals

from suicide attempts by diffusing healthy norms and informally controlling the suicidal

behavior of those considering suicide. At the same time, the Interpersonal Theory of Suicide

posits that individuals move from ideation to an attempt through acquiring the capability of

committing suicide. This may be possible if an individual perceives their network approves of

suicidal behavior.

Finally, Whitlock, Wyman and Moore (2014) discuss the closely related construct of

'connectedness' and STBs, noting that few studies have identified how connectedness may

protect against STBs among adolescents. Much like social capital, connectedness is made up of

subjective and structural components that lead to intrapersonal thoughts and feelings, collective

action, and positive norms. The authors suggest connectedness can result in a reduced risk of

STBs when the connections and responses are positive. They call for more studies examining

how various social contexts, such as within schools and peer groups, influence the relationship

between connectedness and STBs. Network structure of a peer group and the general

perceptions of a social environment are measures of social capital themselves and can be

examined for their relationship with STBs of adolescents.

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Social Capital Components

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Each social capital component is distinctly related to health and STBs. This section

describes the relationships between each of the four distinct social capital components and health

and STBs more specifically.

Individual Cognitive Social Capital

Individual cognitive social capital captures how much an individual perceives their

relationships as trusting and helpful. People who have trusting, reciprocal relationships have

strong emotional support, which can help to reduce their stress and anxiety, and potentially improve their physiological and psychological health (McKenzie & Harpham, 2006). Feeling tied to others also produces a sense of belonging and meaning, which has a profound effect on well-being (Roffey, 2013). Perceived norms about expected behaviors—both healthy and deviant behaviors—can also affect people's health as they regulate their behavior to fit group norms. Reciprocity norms may also reduce anxiety and stress as individual's perceive their networks as helpful and symbiotic as opposed to a network where people only look out for themselves, creating a stressful, competitive environment (McKenzie & Harpham, 2006).

Relationship with general health.

Studies examining social capital and health more broadly suggest that individual cognitive social capital may be related to STBs. Two reviews examining associations between social capital and mental health (Ehsan & De Silva, 2015; De Silva, McKenzie, Harpham, & Huttly, 2005) found that individual cognitive social capital was most consistently associated with mental health compared to other social capital measures. In a review of social capital and physical health, individual cognitive social capital was strongly associated with better health outcomes, particularly self-rated health (Daniel Kim, Subramanian, & Kawachi, 2008). These reviews indicate that higher levels of cognitive social capital may protect against STBs, as poor mental health is a risk factor for suicide and those in poor overall health are also more likely to commit suicide (F. Whitlock, 1986).

Relationship with suicide.

Individual cognitive social capital is a consistent protective factor against STBs although it may be differentially related to suicidal ideation and suicide attempts. Interpersonal trust has one of the most consistent protective effects on suicidal ideation and suicide attempts (Langille,

Asbridge, Kisely, & Rasic, 2012; Noguchi et al., 2017; Wu et al., 2018), as does social and emotional support (Lindström & Rosvall, 2015). Results for reciprocity and sense of belonging/closeness are mixed. One study found that perceptions of reciprocity are associated with lower suicidal thoughts (Bae, 2019), and one found no relationship with reciprocity after controlling for other measures of cognitive social capital (J. Y. Kim et al., 2017a). Some research found sense of belonging has a protective effect against suicide (Adams et al., 2017; Congdon, 2012b); however, one study found no association between perceptions of cohesion and suicidal thoughts (Stahlman et al., 2016). In regards to suicide attempts, although higher levels of trust and norms of reciprocity are often associated with fewer suicide attempts (Langille et al., 2012; Rasic et al., 2011), some research has found that trust only affects suicidal ideation but not suicide attempts (J. Y. Kim et al., 2017a). Bae (2019) found that perceptions of reciprocity mediates the relationship between suicidal ideation and a suicide attempt, lending evidence that social capital may protect those thinking about suicide from attempting suicide.

Individual Structural Social Capital

Individual structural social capital captures an individual's position and participation in a network, both of which can affect health. Lin (2001) suggests that social network structure facilitates the flow of information, exerting influence, building social credentials and reinforcing identity, recognition, and worth, which can all impact health. For example, networks can facilitate or hinder the spread of health information, influence health-related behaviors, establish positive or negative norms about health and instill a sense of purpose and belonging. Berkman and Glass (2000) propose that network structure also influences health through social engagement and access to resources and goods. In addition to emotional social support, networks can provide individuals with access to instrumental support, such as assistance with

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needs. Someone who is more centrally located in a network may have more ties to rely on for support and may receive information and assistance more readily than those with fewer ties. Having ties that cut across networks may give an individual access to resources that are not available to those who only associate with those in their immediate network (Granovetter, 1973). Engagement with others in the network through shared activities, or shared values, can also influence health through providing purpose and meaning to an individual's life. Finally, having connections to trusted individuals may also influence health by providing role models for behavior (Eriksson, 2011). Again, this may cut both ways in that a person may engage in healthy or unhealthy behaviors depending on the behaviors they may model.

Relationship with general health.

Research shows that structural social capital generally has a positive association with health although the relationship is generally weaker than the relationship between cognitive social capital and health and some studies find no association or a negative relationship with health. Three literature reviews found that individual structural social capital is generally positively associated with physical health (D. Kim, Subramanian, & Kawachi, 2008), mental health (de Silva et al., 2005) and health-related behaviors (Lindstrom, 2008). The most common measure of structural social capital from these reviews is participation in voluntary or civic associations or participation in social activities. Some studies have found structural social capital has no effect on health outcomes, such as depression and overall well-being (Fujiwara & Kawachi, 2008; Yip et al., 2007) and a literature review examining individual structural social capital and common mental disorders found three studies in low income countries where structural social capital increases the risk of mental disorders (Ehsan & De Silva, 2015). Among adolescents, Takakura (2015) found that participation in school-based extracurricular activities

was associated with a decrease in smoking and drinking behaviors, but participation in youth activities outside of school increased smoking and drinking behaviors.

Importantly, the measurement of individual structural social capital makes it difficult to fully evaluate the relationship between this dimension of social capital and health. Most studies use social or civic participation as a measure of structural social capital, rather than measures of network structure. By contrast, network measures may better capture structural social capital's relationship with health. For example, several studies have found that degree, (i.e., number of friends in a network), is positively related with overall wellness, BMI, and physical activity (de la Haye, Robins, Mohr, & Wilson, 2010; S. Lin, Faust, Robles-Granda, Kajdanowicz, & Chawla, 2019; O'Malley, Arbesman, Steiger, Fowler, & Christakis, 2012; Prochnow, Delgado, Patterson, & Meyer, 2020; Sawka et al., 2014) .

Relationship with suicide.

Most studies have found that individual structural social capital has a protective effect against STBs, although this is not universal, and studies do not always differentiate between structural and cognitive components. Participation in social events is often found to be protective against suicidal ideation after controlling for measures of cognitive social capital (Fitzpatrick, Irwin, LaGory, & Ritchey, 2007; Stahlman et al., 2016; Wu et al., 2018). Some studies capturing individual structural social capital find social capital reduces suicide, but do not differentiate between cognitive and structural social capital components, making conclusions about the independent effects of structural social capital difficult (Bae, 2019; Hori et al., 2019; Yu & Chen, 2020). In one of the few studies examining social capital in adolescents, Langille and colleagues (2012) found no association between structural social capital among adolescents,

measured as participation in school organizations, and suicide ideation or attempts after controlling for cognitive social capital measures.

Although not explicitly labeling the measure as structural social capital, several studies using social network analysis to predict STBs found significant results using measures that could accurately measure structural social capital. Isolation from peers (Bearman & Moody, 2004b; Wyman et al., 2019) and less dense networks (Janet Kuramoto, Wilcox, & Latkin, 2013; Philip, Ford, Henry, Rasmus, & Allen, 2016) are related to higher rates of suicidal ideation or suicide attempts while transitivity, the measure of how connected your friends are to each other, is also related to lower suicidal ideation and attempts (Bearman & Moody, 2004b; Wyman et al., 2019). Coreness, a social network measure that analyzes how central a member is in their overall network, appears to have some varying results with suicide with one study finding higher coreness associated with lower suicidality (Wyman et al., 2019), and one finding that higher coreness is a risk factor for suicidality (Fulginiti, Rice, Hsu, Rhoades, & Winetrobe, 2016).

Group Level Cognitive Social Capital

Group level cognitive social capital captures the general feelings of trust, cohesion and reciprocity within a group. Kawachi et. al argues that levels of trust aggregated to the group level measures a collective property that facilitates collective action (Kawachi et al., 2008). Social environments that are built on trust may support health-enhancing behaviors (Campbell & Jovchelovitch, 2000) and can make diffusion of information, such as health information or information about access to services, more efficient (Rogers, 1962). Groups characterized by reciprocal norms function more cohesively as members engage in actions to help the group and may regulate healthy, or deviant, behaviors through informal social control (Sampson, Raudenbush, Earls, & Earls, 1997). While the same could be said about normative deviant

behaviors, groups high in cognitive social capital through mutual trust are more likely to support healthy behaviors as the group is concerned about the well-being of its members (Campbell & Jovchelovitch, 2000).

Relationship with general health.

Group level cognitive social capital appears to be protective against several health outcomes. Higher self-rated health and overall well-being (Hamano et al., 2010; Hibino et al., 2012; Kawachi, Kennedy, & Glass, 2011; Zhang & Jiang, 2019), greater physical activity (Broyles, Mowen, Theall, Gustat, & Rung, 2011), less smoking (Henderson, Ecob, Wight, & Abraham, 2008), and less illicit drug use (Åslund & Nilsson, 2013) were found to be associated with higher levels of group level cognitive social capital. Despite the risk of social interaction on infectious diseases, higher group cognitive social capital is also associated with lower rates of infectious disease, like STIs (Holtgrave & Crosby, 2003; Owusu-Edusei, McClendon-Weary, Bull, Gift, & Aral, 2020; Semaan, Sternberg, Zaidi, & Aral, 2007) and COVID-19 (Bartscher, Seitz, Siegloch, Slotwinski, & Wehrhöfer, 2021; Borgonovi, Andrieu, & Subramanian, 2021; Murayama, Nakamoto, & Tabuchi, 2021) as areas with higher levels of interpersonal trust and reciprocal norms had higher rates of condom use and were more likely to adhere to social distancing and mask wearing guidelines.

Relationship with Suicide.

Several ecologic studies demonstrate a protective effect for group level cognitive social capital and suicide rates (Desai, Dausey, & Rosenheck, 2005, 2008; Hemenway, Kennedy, Kawachi, & Putnam, 2001; Kelly, Davoren, Mhaoláin, Breen, & Casey, 2009; Kunst, van Hooijdonk, Droomers, & Mackenbach, 2013; Smith & Kawachi, 2014) and mortality more generally (Hutchinson et al., 2009; I Kawachi et al., 1997; K. A. Lochner et al., 2003). Reeves

and colleagues (2015) found that group level cognitive social capital moderates the relationship between unemployment and suicide, lending evidence that social capital may serve as a buffer between economic uncertainty and suicide. A common measure among these studies uses the General Social Survey (GSS) to measure group level cognitive social capital, the same metric used by Robert Putnam in *Bowling Alone* (2000). This survey measures perceptions of trust and reciprocity that are then aggregated to the group level. One study did find that group level cognitive social capital measured as aggregate trust, was associated with an increase in suicide rates in eastern European countries but had no relationship with suicide rates for Western European countries (Huisman & Oldehinkel, 2009).

Group Level Structural Social Capital

The final dimension, group level structural social capital, may influence health through the social influence of behaviors, the diffusion of health information, and collective action that can influence access to health services (I Kawachi & Berkman, 2000). Social interactions with others may establish healthy "role models" in which members of the group try to emulate and may trigger the diffusion of health information and healthy norms (Rogers, 1962). High structural social capital may make collective action of the group more attainable. This collective action could be used to support the health of a group, through advocating for access to resources to the group and higher levels of public investment (Eriksson, 2011). Finally, structural social capital may influence health through promoting collective efficacy: the willingness of members to intervene on behalf of the public good (Sampson et al., 1997). A cohesive group may actively intervene to control health behaviors, as opposed to informal social control which operates through establishing perceptions of healthy norms.

Relationship with general health.

Several studies demonstrate group level structural social capital is generally associated with better overall health (Choi et al., 2014; Ehsan & De Silva, 2015; Kawachi et al., 2011), mortality (I Kawachi et al., 1997), BMI (Mackenbach et al., 2016), and self-rated health (Mansyur, Amick, Harrist, & Franzini, 2008). Among adolescents, higher group level structural social capital is associated with lower rates of violence (Galea, Karpati, & Kennedy, 2002), teen pregnancy (Crosby & Holtgrave, 2006), alcohol and drug use (Weitzman & Kawachi, 2000; Wen, 2017; Winstanley et al., 2008) and emotional distress (Vilhjalmsdottir, Gardarsdottir, Bernburg, & Sigfusdottir, 2016). Most commonly, these studies measure structural social capital through participation rates in voluntary, community, or school organizations.

Few studies examine the effects of whole network structure on health using social network analysis. A recent literature review on studies using social network analysis to examine the health of college students only found four studies that used a whole network approach (Patterson & Goodson, 2019) and these studies used whole network approaches to examine individual positional measures rather than how the overall network structure may influence health. Many studies examining whole network structures within schools examine the association between network structure and adolescent health outcomes such as substance use, but few of these studies examine how whole network structure features of social capital, such as density and reciprocal proportions, may influence healthy behaviors (Henneberger, Mushonga, & Preston, 2020).

Relationship with suicide.

Results from ecologic studies examining the effects of group level structural social capital and suicide rates varied more than group level cognitive social capital. Many studies find

group level structural social capital is related to lower rates of STBs (Desai et al., 2005; Hemenway et al., 2001b; Huisman & Oldehinkel, 2009; Smith & Kawachi, 2014; Steelesmith et al., 2019; Sundquist et al., 2014); however, unlike group level cognitive social capital, several studies find no association (Kunst et al., 2013; Nakamura et al., 2019; Okamoto, Kawakami, Kido, & Sakurai, 2013). Like the measures for individual structural social capital, measures vary drastically, making comparisons across studies difficult. Some measures include marriage rates and renting percentage (Kunst et al., 2013), number of civic group facilities (Steelesmith et al., 2019b), voting rates (Sundquist et al., 2014), and most commonly participation rates in volunteer organizations (Desai et al., 2005; Nakamura et al., 2019; Okamoto et al., 2013; Smith & Kawachi, 2014a).

Few studies have examined the effects of group level network measures on suicide that could be measures of group level structural social capital. Bearman and Moody (2004) found that higher school level density was related with lower levels of suicidal ideation in girls and lower levels of suicide attempts in boys. Wyman and colleagues (2019) found in univariable models, higher average network transitivity, a measure of how often two friends of an individual are also friends, and higher average friend nominations was related with lower levels of suicide attempts and density, transitivity, and average coreness were related with lower rates of suicidal ideation. Higher levels of out-degree centralization, a measure examining how much friend nominations are concentrated around a few individuals, was related with higher rates of suicide attempts.

Social Capital and Health in a Multilevel Context

Social capital is both an individual and a group-level construct. For example, individuals that have lower levels of cognitive social capital through lower levels of trust and lower

perceived norms of reciprocity may feel a heightened sense of exclusion if they are part of a particularly cohesive group. It is also possible an individual with lower levels of individual social capital may benefit from residing within a group that has higher social capital. The group may use their social capital to advocate for some healthy action that all members of the group may benefit from, even those that are not directly participating. An individual that is residing in a fractured group low in social capital may experience increased stress if they feel they are meeting too many demands of others in the group, even if the individual has higher levels of individual social capital.

A recent review on multilevel studies of social capital and health revealed that while social capital seems to have a positive effect on health, the results were far from conclusive (Murayama, Fujiwara, & Kawachi, 2012). The authors found that different dimensions of social capital may operate differently to affect health, and that social capital could be beneficial for one population while being detrimental for another (Mitchell & LaGory, 2002a; Ziersch, 2004). Other studies have shown that socially isolated individuals who have low individual structural social capital, may still benefit from being in a group with high levels of group level social capital (Seeman et al., 1993). Similar results were found in a review examining social capital and mental disorders where only three studies simultaneously controlled for individual and group level social capital (Ehsan & De Silva, 2015). Although one study found all components were associated with better mental health (Hamano et al., 2010), one study found group level social capital measures have no association with mental health after accounting for individual measures (Han & Lee, 2013) and one found that structural social capital was associated with increased odds of mental disorder (De Silva, Huttly, Harpham, & Kenward, 2007). These results

demonstrate a need for more prospective, multilevel studies on social capital and health outcomes and demonstrate the complexity with studying the effects of social capital on STBs.

Multilevel Studies of Social Capital and Suicide

The multilevel studies that examine social capital and suicide find that different social components have varying relationships on STBs. Although only a few multilevel studies have been conducted, these studies find that at least some components have a protective effect against STBs. Individual cognitive social capital was found to be protective in several multilevel studies (Han & Lee, 2013; Noguchi et al., 2017; Peng et al., 2019; Yamamura, 2015), while group level cognitive social capital was protective in some studies (Peng et al., 2019; Yamamura, 2015) but had no association in others (Han & Lee, 2013b; Noguchi et al., 2017). Group level structural social capital was associated with a reduction of suicidal ideation in one study (Noguchi et al., 2017), but an increase in another (Peng et al., 2019). These mixed conclusions could be due to the a few reasons. One, some studies did not account for all social capital components (Noguchi et al., 2017; Yamamura, 2015). Two, these studies examined different populations such as Japanese adults (Yamamura, 2015), Korean adults (Han & Lee, 2013), elderly adults (Noguchi et al., 2017), and Chinese college students (Peng et al., 2019). Finally, although these studies all examined cognitive social capital through perceptions of trust, the ones measuring structural social capital varied from participation in voluntary organizations and political participation (Peng et al., 2019) and participation in university and religious organizations (Han & Lee, 2013).

Gaps

There are several gaps in the understanding of the relationship between social capital and STBs. First, in general, higher rates of social capital are associated with lower rates of suicidal ideation and suicide rates, but some studies (Huisman & Oldehinkel, 2009; Kunst et al., 2013;

Noguchi et al., 2017; Peng et al., 2019) found contradictory results. Some of these studies looked at specific populations, such as homeless youth (Fitzpatrick, Irwin, Lagory, & Ritchey, 2007), men who have sex with men (Stahlman et al., 2016), and college students (Peng et al., 2019) and the contradicting results may be due to varying effects of social capital among different populations. Some contradictory results may be due to the lack of consistent social capital measurement across studies and the various dimensions and levels of social capital that are or are not accounted for (Portes, 1998; Portes & Vickstrom, 2011; Villalonga-Olives & Kawachi, 2017). Based on the limited number of multilevel studies, it appears that social capital may operate differently when examined at both the individual and group level, and that some dimensions of social capital become less relevant after controlling for all social capital dimensions. More information is needed on how group level contexts may affect individual levels of social capital. Individuals with lower levels of social capital (e.g., those who are isolated) may experience STBs differently in high social capital contexts (e.g., densely connected networks) compared to low social capital contexts (Bearman & Moody, 2004). Therefore, more information is needed to capture the multi-level, multi-dimensional nature of social capital and the relationship between these facets of social capital and suicide.

Second, more research is needed about the link between social capital and suicide among American adolescents. A systematic review that examined multi-level studies (Murayama et al., 2012) found only two studies conducted on adults in the United States and a review examining research on social capital and mortality only found three studies conducted in the United States (Choi et al., 2014). The research on social capital and suicide appears to follow a similar trend, with several studies, particularly multilevel studies, being conducted in Asia and Europe. Social capital and health seem to have different results depending on the context, with stronger

relationships being observed in the United States and Europe than in Canada and Australia and stronger relationships in less egalitarian countries, such as the United States (Islam, Merlo, Kawachi, Lindström, & Gerdtham, 2006). Most of this research focuses on adult populations or on how group level social capital may affect children and adolescents without accounting for the social capital possessed by children and adolescents themselves (Morgan & Haglund, 2009). Adolescents differ from adults in the social spaces they occupy, but their social spaces such as schools are rarely included in social capital research (Vieno, Perkins, Smith, & Santinello, 2005).

Third, few studies have examined if changes in social capital result in changes in STBs. Nearly all studies examining the association between social capital and STBs are cross-sectional. It is possible there could be a reciprocal relationship between social capital and STBs. More information is needed on how social capital is related to STBs over time, and if sustained or changing levels of social capital are associated with changing levels of STBs.

Lastly, it is problematic that social capital has been operationalized differently across studies (Portes, 1998; Portes & Vickstrom, 2011; Stone, 2001), especially for structural social capital. Although there is more consistency on measuring cognitive social capital as perceptions of trust and reciprocity, structural social capital has been measured as relationships, participation, networks, and roles. Using social network analysis could illuminate some structural social capital measures that are useful for studying social capital by creating the social network of a bounded environment, such as a school, and identifying adolescents' positions within networks to account for both group and individual level structural social capital. Some studies demonstrate the potential for examining social capital and suicide from a network perspective, but those studies do not capture the cognitive dimension or examine social capital as a multilevel concept.

This study will build on two previous studies of adolescents that have demonstrated the relationship between social network structures and STBs. Bearman and Moody (2004) found that features of overall network structure have some effect on suicide, specifically the density of a school network, an adolescent's isolation from the school network, and the level of transitivity among an adolescent's friends. All these measures capture structural social capital as they identify the structure of relational linkages in a network, an adolescent's access to social relationships, and the level of cohesiveness among an adolescent's immediate relationships. Although the study did capture an element of cognitive social capital by measuring an adolescent's attachment to school, it did not examine attachment to school in the aggregate which could have captured group level cognitive social capital, and it only examined social networks at the individual level without accounting for the natural nesting of adolescents within their school network. Wyman et al (2019) examined several social network measures that could capture structural social capital and their relationship with suicide. At the school level, they examined the percentage of isolates in a network, the mean number of friendships, the mean coreness of a school, the in and out-degree centralization, network density, and network transitivity, all potential measures of group level structural social capital. At the individual level, they measured isolation, degree, and coreness, all potential measures of individual structural social capital. Building on these past findings, the current study will add perceptions of the school social environment to measure cognitive social capital to test whether both dimensions and levels of social capital are related to STBs and whether these relationships change over time.

Conclusion

Relationships between social capital and health are well researched, but less is known on the relationships between specific dimensions and levels of social capital and its effects on

health, particularly STBs. Many researchers have noted the multilevel nature of social capital, but there is still a dearth of research that examines social capital in a multilevel context. Multilevel studies could aid in understanding how social capital at both the individual and group level affect health outcomes, including STBs. The studies in the review also lacked agreement on social capital indicators and make it difficult to compare the results across studies. There is a need for more robust indicators of social capital, particularly structural social capital. Despite social capital being characterized through social network structure, very few studies have examined social capital using social network analysis. Based on this literature review, there are no studies that examine both cognitive and structural social capital at individual and group levels using social network analysis and its relationship with STBs. More studies using this framework are needed to identify how all components of social capital are related to STBs.

CHAPTER III: METHODS

The goals of this study are to test (1) whether individual and group (school) level cognitive and structural measures of social capital predict STBs during adolescence and (2) whether changes in structural social capital are related to changes in STBs over time. The specific research questions of this study are:

1. Is there a relationship between social capital and suicidal thoughts and behaviors?

    a. To what extent are (a) cognitive social capital and (b) structural social capital independently associated with (a) suicide ideation and (b) suicide attempts?

    b. Does group level structural capital moderate the relationship between individual structural level social capital and suicide ideation?

    c. Does group level cognitive social capital moderate the relationship between individual cognitive level social capital and suicide ideation?

My hypotheses are that all components of social capital will have a negative relationship with suicidal ideation and suicide attempts in bivariate analyses. Individual cognitive social capital measures will have the strongest relationship on both suicide ideation and suicide attempts. In the full model that includes all components, I hypothesize that individual cognitive social capital and individual structural social capital will be associated with lower suicide ideation and suicide attempts, but group level components will not be associated with either. For the cross-level interactions, my hypothesis is that the results will trend towards students with a lower individual structural social capital having increased risk of suicide ideation if they are nested in a higher structural social capital network and students with lower individual cognitive social capital will have an increased risk of suicidal ideation and suicide attempts if they are nested in schools with high levels of group cognitive social capital.

2. Do *changes* in social capital predict *changes* in suicidal ideation and suicide attempts over

time, after controlling for typical levels of social capital (i.e., between-person effects)?

My hypotheses are that (1) when individual cognitive social capital is higher than usual, suicide ideation will be lower and there will be a lower likelihood of a suicide attempt and (2) when individual structural social capital is higher than usual, suicide ideation will be lower and there will be a lower likelihood of a suicide attempt. I also hypothesis that when group level cognitive and structural social capital are higher than usual, suicide ideation will be lower and there will be lower likelihood of a suicide attempt.

Participants and Procedures

Data were collected from 40 high schools (20 intervention; 20 waitlist control) in predominantly rural towns in New York and North Dakota as part of an evaluation of the *Sources of Strength* intervention. *Sources of Strength* is a peer-driven suicide prevention program that trains peer-leaders how to develop healthy bonds and identify resources to manage adversity (Wyman et al., 2010a). These peer leaders disseminate this information through their school-wide social networks with the aim of modifying norms around coping and help-seeking behaviors and improving the quality and frequency of youth-adult relationships. Researchers from the University of Rochester administered web-based questionnaires to all 9th-12th graders at a school during their class time. To create school-wide friendship networks, all students in grades 9-12 were invited to participate in the study. Data were collected from four cohorts (2010-2013) and were collected in four waves every six months. Participation rates ranged from 93.8% to 38.9% for the first wave of data.

Measures

Individual-level Measures of Social Capital

Cognitive Social Capital

School integration was the average of four items that measured students' perceptions of their school social environment: At my school, I "feel close to other students," "have many friends," "am socially accepted," and "often hang out with other students" (1=Strongly Disagree to 4=Strongly Agree; $\alpha=0.853$). Scores for students missing more than one item were set as missing, removing 50 students from the analysis.

Structural Social Capital

Students were asked to name up to seven of their closest friends at school and these nominations were used to create school level networks. Based on the friendship nominations, three individual-level measures of structural social capital were created: *In-degree* is the number of friendship nominations received. *Out-degree* is the number of friendship nominations given. *Betweenness* measures how often an individual acts as a bridge on the shortest path between any two individuals in a network (Freeman, 1978). Higher betweenness scores indicates a higher likelihood of connections across clusters within networks, and theoretically higher access to social resources. In this study, betweenness and is based on outdegree.

Group-level Measures of Social Capital

Cognitive Social Capital

The *mean school integration* was calculated by computing the average school integration score across all students at the school.

Structural Social Capital

Effective density is the number of connections in a network compared to the total number of connections possible, which was seven times the network size (i.e., number of students at the school at a given wave) as students were only able to nominate seven friends. *Network Transitivity* is the measure of triangular closure within the network. This closure occurs when two of a student's friends are also friends with each other. Network transitivity captures the proportion of triad relations that are closed compared to all triad relationships. Higher transitivity indicates higher levels of social capital. In this study it is based on outdegree. *Reciprocity* is the proportion of all ties that are bidirectional. Students that name each other as a friend are considered reciprocal ties. A preliminary correlation analysis revealed a strong correlation across all potential group level structural social capital measures ($r = .897$ to $.910$). To avoid collinearity effects of these predictor variables, only *reciprocity* was used to measure group level structural social capital.

Suicidal Thoughts and Behaviors

Suicide ideation was measured by the item, "In the past 12 months, did you ever seriously consider attempting suicide?" ($0 = $ "No"; $1 = $ "Yes"). *Suicide attempts* were measured by the item "During the past 12 months, how many times did you actually attempt suicide?" (0 times, 1 time, 2-3 times, 4-5 times and 6 or more times). The responses were dichotomized into $1 = $ "Attempted suicide at least one time in the past 12 months" and $0 = $ "Did not attempt suicide in the past 12 months."

Since the questionnaire was administered more frequently than every 12 months, a new measure for suicide ideation and suicide attempts will be used to answer question 2. Students who respond "no" during a wave and then respond "yes" to the wave immediately following will

be considered to have a new suicide ideation. For example, if a student responded "No" at wave 1, but "yes" at time 2, this would be considered a *new suicide ideation*. Responses were coded as 1 = "new ideation" and 0 = "No new ideation." Students with a higher response value to the item, "During the past 12 months, how many times did you actually attempt suicide?" during the wave immediately following the previous wave were considered to have a new suicide attempt. For example, if a student responded that they attempted suicide 1 time at wave 1 and 2-3 times at wave 2, this would be considered a *new suicide attempt*. Responses were coded as 1 = "new suicide attempt" and 0 = "No new suicide attempt."

Control Variables

Students responded whether they were "1 = Male" or "2 = Female" for their *gender*. To compute a measure for *Race/Ethnicity,* the items "What is your race?" and "Are you Hispanic or Latino" were used. Students responded whether they were "White," "Black or African American," "Native American," "Asian," or "other" for their race. Students that responded "yes" to the item "Are you Hispanic or Latino" and "other" for their race were considered "Hispanic or Latino." Students were considered either "Non-Hispanic White," or "Non-White" for their *Race/Ethnicity.* Students responded whether they were in "0 = 9th grade," "1 = 10th grade," "2 = 11th grade," or "3 = 12th grade" for their *grade.* For Question 2, 0.5 was added to their grade measure at waves 2 and 4. *School Size* was measured by the number of students that were administered a questionnaire and divided by 100.

<div align="center">

Analytic Plan

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The first research question will be addressed using data from the baseline survey at 38 of the 40 schools. Two schools did not invite the entire school to participate in the study and yielded results that are insufficient for constructing network data and are excluded from the

analysis. Students with missing data on any predictor variables or the outcome variable will be excluded from the analysis. The second research question will be addressed using data only from control schools with network data to control for intervention effects over time, leaving a total of 18 schools for the analysis. The demographic characteristics of the samples are described in table 3.

Table 2. Sample Demographics for Studies 1 and 2

Variable	Study 1 N =10,082	Study 2 N=5,262
Schools	38	18
Grade		
9	2667 (26.5)	-
10	2605 (25.8)	-
11	2451 (24.3)	-
12	2359 (23.4)	-
Gender		
Male	5030 (49.9)	2580 (50.7)
Female	5052 (50.1)	2682 (49.3)
Race/Ethnicity		
White	7948 (78.8)	4578 (86.5)
Black	599 (5.9)	121 (2.3)
Native American	446 (4.4)	213 (4.0)
Hispanic/Latino	654 (6.5)	216 (4.1)
Other	435 (4.3)	164 (3.1)

Question 1

Research Question 1 tests whether individual and group level cognitive and structural social capital are associated with STBs. A preliminary correlation analysis shows that there are moderately significant relationships between measures of cognitive and structural social capital, (r = .293 to .323) suggesting that they could have independent effects on STBs. Multi-level logistic regression models will test for the effects of each social capital component on suicide ideation and a final model examining all social capital components simultaneously will be created. Model 1 will only include demographic control variables to establish a null model. Model 2 includes the individual cognitive measure of social capital as well as all demographic control variables. Model 3 will examine individual structural measures of social capital. Model 4 will examine group level cognitive social capital and model 5 will examine group level structural social capital. A final model (model 6) will examine all social capital components simultaneously with control variables and their association with suicide ideation. These steps will be repeated to examine associations with suicide attempts among those who had seriously considered suicide. Finally, four cross-level interaction models will examine if there is a significant interaction between individual and group cognitive social capital measures and between individual (indegree) and group structural (reciprocity) measures in predicting suicide ideation and suicide attempts. Indegree is determined by how often others in the network view an individual as a friend and is not determined by the perceptions of the individual. Therefore, it more clearly distinguishes itself from cognitive social capital and will be used as the structural social capital measure in the cross-level interaction model. Because of potential intervention effects, only data from the baseline (pre-intervention) survey will be used in the analysis. To test

for potential collinearity effects, a VIF analysis will be conducted. A VIF above 10 will indicate

a collinear variable and it will be removed from the analysis and the models will be re-run.

Question 2

Research Question 2 tests whether *changes* in social capital are related to *changes* in

STBs. Indegree as structural social capital and the individual cognitive social capital will be used

to predict suicide ideation and suicide attempts. Because of the small sample of schools (18), low

power to detect significant changes across schools and the large amount of memory required to

run time-varying 3 level models, this study will only examine changes in individual social

capital. Time-varying 2-level models will be used, with data from each wave nested within

students. To control for the typical (between-person) level of individual social capital a student

has, each social capital measure will be averaged across the 4 waves. Group-mean centering will

then be used to compute within-person measures of social capital. Specifically, at each wave,

students' individual social capital measure for that wave will be subtracted from their typical

individual social capital measure. To examine how social capital predicts changes in suicide

ideation and suicide attempts over time, the within-person social capital from the previous wave

will be used to predict suicide ideation and suicide attempts at the present wave.

Three models will be created for each social capital component to predict changes in

suicide ideation over time. In model 1, only control variables will be included to establish a null

model. In model 2, control variables (gender, race/ethnicity, and depression) and between-

person social capital will be included. In the final model, control variables, between-person

social capital and within-person social capital will be included. These steps will be repeated to

predict suicide attempts.

CHAPTER IV: THE RELATIONSHIP BETWEEN SOCIAL CAPITAL COMPONENTS AND

ADOLESCENT SUICIDAL THOUGHTS AND BEHAVIORS: A MULTILEVEL ANALYSIS

Introduction

Suicide is the 10th leading cause of death among Americans and the 2nd leading cause of

death among high-school aged (14 to 19) adolescents (Hedegaard et al., 2020). Since 2010,

suicide rates among adolescents have increased nearly 40%, with suicide mortality among 15-19

year-olds reaching 10.57 deaths per 100,000 in 2019 (Centers for Disease Control and

Prevention [CDC], 2022). In addition, many more students are at-risk of suicide, with nearly

19% of students seriously considering suicide in the past year, 16% making a suicide plan, and

9% attempting suicide (CDC, 2022). These trends have coincided with increases in several

known suicide risk factors in adolescents such as common mental disorders (Calati et al., 2019),

feelings of hopelessness (CDC, 2022), feelings of loneliness (Twenge et al., 2019) and social

isolation (Cacioppo & Cacioppo, 2014).

Social forces, such as social integration and connectedness, are strongly linked to suicide

(Durkheim, 1897; Faris & Dunham, 1939), yet most suicide research has focused on identifying

individual psychiatric predictors (e.g. depression, history of suicide attempts) of suicide (Cha et

al., 2018; Fazel & Runeson, 2020; Gould et al., 2005; Nock, Ramirez, & Rankin, 2019). Social

capital, or "the connections among individuals' social networks and the norms of reciprocity and

trustworthiness that arise from them" (Putnam, 2000) may be an important predictor of suicidal

thoughts and behaviors in adolescents.

Social capital both reduces the risk of suicidal thoughts and behaviors (J. Y. Kim et al.,

2017a; Kunst et al., 2013; Langille et al., 2012; Smith & Kawachi, 2014a; Yu & Chen, 2020) as

well as reduces the risk of overall mortality and adverse mental health outcomes (Ehsan & De Silva, 2015; I Kawachi et al., 1997; K. A. Lochner et al., 2003; Silva et al., 2005). Social capital can protect against suicide by providing social, emotional, and instrumental support, promoting healthy norms that discourage suicide, and connecting individuals to resources such as mental health services. As most people who consider suicide do not attempt suicide (Nock et al., 2008), social capital may also serve as a buffer for those considering suicide from transitioning to attempting suicide. Suicide theories suggest that a lack of social connections can make those considering suicide more likely to attempt suicide (Klonsky & May, 2015; Van Orden et al., 2010). Although most research finds a beneficial effect for social capital, this is not universal. For example, social capital may increase suicide risks for groups more prone to mental health risks, such as military veterans, homeless youth, and men who have sex with men (MSM) populations (Fitzpatrick, Irwin, Lagory, et al., 2007; Kushner & Sterk, 2005; Stahlman et al., 2016). A few multi-level studies have found that adults with low individual social capital and high group social capital have worse health outcomes than individuals with low individual and group level social capital (Poortinga, 2006a; Subramanian, Kim, & Kawachi, 2002). These results suggest that groups high in social capital may use their social capital to exclude others from benefits (R. D. Putnam, 2007). At the same time, individuals may benefit from high group social capital, even if the individual themselves are not well connected (Caughy, O'Campo, & Muntaner, 2003). These results highlight the need to consider how different aspects of social capital may be linked to suicide.

Social capital consists of both cognitive and structural components. *Cognitive* social capital refers to how relationships are perceived (i.e., how much others are trusted), whereas *structural* social capital refers to how people interact (i.e., their social connections and

participation within their networks). Further, social capital is a multilevel concept consisting of

both *individual* and *collective* (or *group*) properties. Taken together, social capital consists of

four distinct components: individual cognitive, individual structural, group cognitive, and group

structural. Despite these distinct components, many studies examine suicide at the purely

individual (Bae, 2019; J. Y. Kim, Yoon, Kim, & Kim, 2017b; Langille et al., 2012; Yu & Chen,

2020) or purely group level (Kelly, Davoren, Mhaoláin, Breen, & Casey, 2009b; Kunst et al.,

2013; Nakamura et al., 2019; Okamoto et al., 2013; Steelesmith et al., 2019b). Furthermore,

many studies do not differentiate between cognitive and structural social capital, making it

difficult to determine if some dimensions of social capital are differentially linked to suicide.

Further, most research examining structural social capital uses self-reported measures of

participation in formal group settings, such as voluntary civic organizations (Ehsan & De Silva,

2015; K. Lochner, Kawachi, & Kennedy, 1999; Whitley & McKenzie, 2005). Few studies

measure informal relationships, such as social ties with friends, that also make up structural

social capital, and those that do measure informal relationships use self-reported measures such

as how often the respondent gets together with friends (Berkman, Glass, Brissette, & Seeman,

2000b; Harpham, 2008; Harpham, Grant, & Rodriguez, 2004). Social network analysis has

potential to capture structural social capital at both the individual and group level by positioning

individuals within their network, describing the nature and direction of relationships, and

capturing the structure of a bounded network, such as a school. An advantage to this approach is

capturing how others relate to an individual rather than only relying on an individual's self-report

of their perceptions of relationships. Individual measures such as degree (the number of

connections an individual has) and betweenness (how often someone links otherwise

disconnected others in the network) and group measures such as network reciprocity (the

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proportion of relationships that are bidirectional) could measure structural social capital in ways that individual self-reports cannot. Social network analysis also allows for cross-level interactions. As the prior multi-level studies find that greater group cognitive social capital can have a negative effect on individuals with low cognitive social capital, a study using social network analysis could examine if similar relationships exist for structural social capital. Although a few studies have examined the effects of school friendship networks on predicting adolescent suicidal thoughts and behaviors (Bearman & Moody, 2004a; Wyman et al., 2019) these studies do not account for student's perceptions of their relationships which could predict their suicidal thoughts and behaviors above and beyond their network position and structure.

Another limitation of existing studies is that they primarily examine social capital and suicide in adult populations. Social capital may operate differently in different contexts, particularly schools and among adolescents. For example, adolescents spend a significant amount of their time in schools and schools are one of the predominant areas they form their networks and learn social skills (Sellström & Bremberg, 2006). As adolescence is a time when many first engage in risky behaviors such as substance use and risky sexual behaviors, social capital may increase these behaviors as these norms and exposures may diffuse more effectively through cohesive networks (Rogers, 1962). Finally, much of the social capital research focuses on civic involvement, and at times political involvement, which can exclude adolescents.

The present study tests whether each of the four social capital components of social capital are associated with suicidal thoughts and behaviors among a sample of high school students. As prior multi-level studies have demonstrated that group social capital can change associations between individual social capital and health, this study will also explore whether cross-level interactions exist, in which group social capital changes the association between

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individual social capital and suicidal thoughts and behaviors. This study will examine these cross-level interactions for both cognitive social capital and structural social capital. This study tests three specific research questions: (1) To what extent are (a) cognitive social capital and (b) structural social capital independently associated with suicide ideation and suicide attempts? (2) Does group level cognitive social capital moderate the relationship between individual structural level social capital and either suicide ideation or suicide attempts? and (3) Does group level structural capital moderate the relationship between individual structural level social capital and either suicide ideation or suicide attempts?

This study will also build on prior findings by Wyman and colleagues (2019). Using data from *Sources of Strength*, Wyman and colleagues found certain social network variables were associated with suicide outcomes, with higher indegree (number of friend nominations received) and higher outdegree (number of friend nominations made) associated with lower rates of suicide ideation and suicide attempts. They also found network level variables such as mean number of friendship ties and network transitivity (how often two friends of a student name each other as a friend) were associated with lower school-wide rates of suicide ideation and suicide attempts. This study will use some of these same network variables (indegree and outdegree) and test network variables that were not included in the study by Wyman that may capture structural social capital (betweenness and network reciprocity). This study will also test variables in a multilevel model that will include individual perception of integration and school level variables to test how social network variables may predict STBs above and beyond their perceptions of school integration.

Methods

Sample

The study uses data collected from the baseline survey of an evaluation of the *Sources of Strength* suicide prevention program. Data for the study were collected from 40 high schools in North Dakota and New York. A web-based questionnaire was administered during class time to all students in grades 9-12 in the school. Students were assessed on their perceptions of their school, their friends, adults in their life, and suicide attitudes and behaviors. To create school-wide friendship networks, each student was asked to name up to seven of their closest friends at school. Schools were enrolled in four cohorts with schools in the first cohort starting in 2010 and the fourth cohort starting in 2013.

Measures

Individual Cognitive Social Capital

School integration was the average of four items that measured students' perceptions of their school social environment: At my school, I "feel close to other students," "have many friends," "am socially accepted," and "often hang out with other students" (1=Strongly Disagree to 4=Strongly Agree; α=0.853). Scores for students missing more than one item were set as missing. Scores were centered around the mean score for the school.

Individual Structural Social Capital

In-degree was the number of friendship nominations received. *Out-degree* was the number of friendship nominations made. *Betweenness* is a network centrality measure that captures how often a person in a network acts as a connection on the shortest path between any other two people in a network (Freeman, 1978). An individual with higher betweenness may have higher social capital as they may bridge across network subgroups and have access to fewer

redundant social resources (Burt, 2017) *Betweenness* was standardized to compare across schools and multiplied by 100.

Group Cognitive Social Capital

The *mean school integration* was calculated by computing the average school integration score across all students at the school. Scores were mean-centered around the mean school integration score for all schools.

Group Structural Social Capital

Reciprocity was calculated as the proportion of all nominations that are bidirectional. Students that name each other as a friend are reciprocal ties. The proportion was multiplied by 10.

Suicidal Thoughts and Behaviors

Suicide Ideation was calculated from the item "In the past 12 months, did you ever seriously consider attempting suicide?" (0 = "No"; 1 = "Yes"). *Suicide Attempt* was calculated from the item "During the past 12 months, how many times did you actually attempt suicide?" Responses were dichotomized into 1 = "Attempted suicide at least one time in the past 12 months" and 0 = "Did not attempt suicide in the past 12 months."

Control Variables

Gender was based on students' responses as to whether they were 1 = "Male" or 2 = "Female". To compute a measure for *Race/Ethnicity,* the items "What is your race?" ("White," "Black or African American," "Native American," "Asian," or "other") and "Are you Hispanic or Latino?" ("yes" or "no") were used. *Race/Ethnicity* was dichotomized to 0 = "Non-Hispanic White" and 1 = "Non-White", which included all students who indicated that they were Hispanic or Latino, as well as any students who indicated they were at least one other race other than

White. Students responded whether they were in 0 = "9th grade," 1 = "10th grade," 2= "11th grade," or 3 = "12th grade" for their *grade. School Size* was computed based on the number of students that were at the school and divided by 100.

Data Analysis

To test the independent associations between dimensions of social capital and suicide ideation, a series of multilevel logistic regression models were used. First, a null model including control variables and a random intercept were tested. Next, four models testing each social capital component separately and adjusted for control variables were tested   Lastly, a final model including all social capital measures and control variables was tested.

To test for independent associations between dimensions of social capital and suicide attempts, a subsample of only students that had considered suicide in the past 12 months was used. A preliminary analysis of a null model using a random intercept revealed the variance estimate for the random intercept to be 0, so single level logistic regression models were used. Four models were created to test the association between each social capital dimension and suicide attempts and a final model included all social capital measures and control variables.

To test for a cross-level interactions, four interaction models were used. Two models including an interaction between school peer integration and mean school peer integration on suicide attempts and suicide ideation were tested and two models including the interaction between indegree and reciprocity on suicide ideation and suicide attempts were tested.

Results

Two schools chose to only sample a subset of their student population and therefore had insufficient network data to be included in the analysis, leaving a total of 38 schools in the final analysis. Participants were 10,082 students with complete data of a total population of 12,294 students. Students with missing data on friendship nominations but complete data on all other study variables were included in the analysis and had an outdegree of 0.

Half of the study sample identified as female (50.1%) and students were evenly distributed across grade level ranging from 26.5% in 9th grade to 23.4% in 12th grade. The majority of students identified as Non-Hispanic White (78.8%). Nearly 15% of students seriously considered suicide in the past year. Of those that considered suicide, 14 were removed from the models predicting suicide attempts because they did not answer the suicide attempt item. Of the subsample of students who had seriously considered suicide, most were female (65.6%) and Non-Hispanic White (75.1%) Nearly half of students who had seriously considered suicide also made at least one suicide attempt in the past 12 months (55.8%). The sample demographics are summarized in table 3.

Table 3. Sample Demographics for Study 1

	All Students *N*=10,082 *N* (%) or mean	Students who had previously considered suicide *N*=1,420 *N (%)* or mean
Female	5052 (50.1)	931 (65.6)
Grade		
9th	2667 (26.5)	370 (26.1)
10th	2605 (25.8)	372 (26.2)
11th	2451 (24.3)	370 (26.1)
12th	2359 (23.4)	308 (21.7)
Race		
White	7948 (78.8)	1067 (75.1)
Black/AA	599 (5.9)	69 (4.9)
Hispanic/Latino	654 (6.5)	134 (9.4)
Native American	446 (4.4)	77 (5.4)
Other	435 (4.3)	73 (5.1)
Considered Suicide	1434 (14.2)	-
Attempted Suicide	807 (8.0)	793 (55.8)
Peer Integration Score	3.14	2.81
Indegree	4.37	3.95
Outdegree	4.99	4.41
Betweenness	0.89	0.79

Schools were selected from New York State (n= 29) and North Dakota (n=9). The school characteristics are summarized in table 4.

Table 4. School Characteristics

	Mean (Range)
School Size (x 100)	3.24 (.60 – 10.95)
Peer Integration	3.16 (2.99 – 3.32)
Reciprocity	4.22 (2.74 – 5.90)

Table 5 provides the results of the multilevel regression models predicting suicide ideation. The variance estimate for the intercept in the null model was .063 and the intraclass correlation was .019. In models that only tested each social capital dimension individually. measures for individual cognitive social capital (OR = 0.35; 95% CI = .32, .39), individual structural social capital (Indegree: OR = .97; 95% CI = .94, .99; Outdegree: OR = .91; 95% CI = .89, .93) and group cognitive social capital (OR = .12; 95% CI = .04, .48) were associated with lower odds of suicide ideation whereas group structural social capital was not significantly In the full model, individual cognitive social capital as peer integration (OR = .36; 95% CI = .32, .41), individual structural social capital as outdegree (OR = .97; 95% CI = .95, .99), and group cognitive social capital as school peer integration (OR = .14; 95% CI = .03, .60) were independently associated with a lower odds of suicide ideation.

Table 5. Multilevel Models of Social Capital Predicting Suicide Ideation

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Intercept	.10***	.08, .12	.09***	.07, .11	.17	.14, .21	.10***	.09, .12	.21***	.09, .47	.14***	.06, .31
CSC												
Peer Integration			.35***	.32, .39							.36***	.32, .41
SSC												
Indegree					.97**	.94, .99					1.01	.99, 1.04
Outdegree					.91***	.89, .93					.97**	.95, .99
Betweenness					1.02	.97, 1.08					1.01	.95, 1.06
School CSC												
School Peer Integration							.12**	.03, .48			.14**	.03, .60
School SSC												
Reciprocity									.84	.70, 1.01	.94	.78, 1.13
Control Variables												
Female Indicator	2.15***	1.91, 2.42	2.07***	1.83, 2.33	2.26***	2.01, 2.54	2.16***	1.91, 2.43	2.15***	1.91, 2.42	2.09***	1.87, 2.34
Non-White Indicator	1.26**	1.08, 1.47	1.21*	1.03, 1.41	1.18	.99, 1.40	1.22*	1.02, 1.45	1.23*	1.03, 1.47	1.15	.97, 1.37
10th Grade	1.03	.88, 1.21	1.02	.87, 1.20	1.01	.84, 1.22	1.04	.86, 1.25	1.03	.86, 1.25	1.02	.84, 1.25
11th Grade	1.14	.97, 1.34	1.11	.94, 1.30	1.12	.93, 1.34	1.15	.96, 1.37	1.14	.96, 1.37	1.11	.92, 1.35
12th Grade	.94	.80, 1.11	.89	.75, 1.05	.89	.74, 1.06	.95	.79, 1.14	.94	.78, 1.13	.89	.74, 1.07
School Size x100	1.00	.97, 1.03	1.00	.97, 1.04	1.00	.98, 1.03	.98	.97, 1.00	.99	.96, 1.02	.98	.97, 1.00

CSC: Cognitive Social Capital
SSC: Structural Social Capital
OR: Odds Ratio
CI: 95% Confidence Interval
*p<.05
**p<.01
***p<.001

Table 6 provides the results of the logistic regression models predicting suicide attempts. In models that only examined one social capital dimension, individual cognitive social capital (OR = .66; 95% CI = .56, .78), one measure of individual structural social capital (outdegree OR = .93; 95% CI = .89, .98) and group structural social capital (OR = .81; 95% CI = .66, 1.00) were associated with lower odds of suicide attempts whereas group cognitive social capital was not associated with suicide attempts. In the full model, only individual cognitive social capital was independently associated with suicide attempts (OR = .69; 95% CI = .58, .82).

Table 6. Logistic Regression Models of Social Capital Predicting Suicide Attempts

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI	OR	CI
Constant	.96	.69, 1.33	.82	.59, 1.14	1.42	.97, 2.10	.96	.69, 1.34	2.31	.88, 6.03	2.04	.69, 6.03
CSC												
Peer Integration			.66***	.56, .78							.69***	.58, .82
SSC												
Indegree					.99	.95, 1.03					1.01	.97, 1.05
Outdegree					.93**	.89, .98					.96	.92, 1.01
Betweenness					.97	.88, 1.08					.97	.87, 1.07
School CSC												
School Peer Integration							.36	.10, 1.27			.59	.13, 2.63
School SSC												
Reciprocity									.81*	.66, 1.00	.85	.67, 1.08
Control Variables												
Female Indicator	1.22	.97, 1.52	1.20	.96, 1.50	1.24	.99, 1.55	1.22	.97, 1.54	1.22	.98, 1.53	1.23	.98, 1.54
Non-White Indicator	1.50**	1.16, 1.93	1.54***	1.19, 1.99	1.46**	1.13, 1.89	1.45**	1.11, 1.88	1.41**	1.09, 1.83	1.43**	1.10, 1.86
10th Grade	1.07	.80, 1.44	1.07	.79, 1.44	1.04	.78, 1.41	1.07	.79, 1.45	1.07	.80, 1.44	1.06	.79, 1.43
11th Grade	.85	.63, 1.14	.86	.64, 1.16	.83	.62, 1.12	.86	.63, 1.16	.86	.64, 1.15	.86	.64, 1.16
12th Grade	.78	.58, 1.06	.78	.57, 1.06	.74	.54, 1.01	.80	.58, 1.10	.80	.58, 1.09	.77	.56, 1.06
School Size x100	1.02	.99, 1.06	1.03	1.00, 1.06	1.02	.99, 1.06	1.02	.98, 1.05	1.02	.99, 1.05	1.01	.98, 1.05

CSC: Cognitive Social Capital
SSC: Structural Social Capital
OR: Odds Ratio
CI: 95% Confidence Interval
*p<.05
**p<.01
***p<.001

Tables 7 and 8 provides the results testing for interaction effects on suicide ideation and suicide attemts. There was a significant cross-level interaction for structural social capital predicting suicide ideation (OR = .94; 95% CI = .91, .98) and all other interaction effects were statistically non-significant. The interaction effect for structural social capital indicates that the relationship between indegree and suicide ideation is stronger in schools with a high network reciprocity (Figure 1).

Table 7. Cross-Level Interactions Predicting Suicide Ideation

	Model 1		Model 2		Model 3		Model 4	
	OR	CI	OR	CI	OR	CI	OR	CI
Intercept	.10**	.080, .12	.10**	.08, .12	.23***	.10, .49	.09***	.03, .24
Cognitive Social Capital Interaction								
Peer Integration	.35***	.32, .39	.35***	.31, .38				
School Peer Integration	.11***	.03, .34	.09***	.03, .29				
Peer Integration*School Peer Integration			.44	.15, 1.33				
Structural Social Capital Interaction								
Indegree					.95**	.93, .97	1.20**	1.03, 1.39
Reciprocity					.87	.73, 1.04	1.10	.88, 1.38
Indegree*Reciprocity							.94**	.91, .98
Control Variables								
Female Indicator	2.07***	1.83, 2.34	2.07***	1.84, 2.34	2.18**	1.94, 2.46	2.19***	1.95, 2.47
Non-White Indicator	1.17	1.00, 1.36	1.16	1.00, 1.36	1.20*	1.03, 1.40	1.21*	1.04, 1.41
10th Grade	.89	.76, 1.06	1.03	.87, 1.21	.92	.78, 1.09	1.03	.88, 1.20
11th Grade	1.11	.95, 1.31	1.11	.95, 1.31	1.14	.97, 1.33	1.14	.97, 1.34
12th Grade	1.03	.88, 1.21	.89	.75, 1.06	1.03	.88, 1.20	.92	.78, 1.09
School Size x100	.98	.96, 1.01	.98	.96, 1.01	.99	.96, 1.03	.99	.96, 1.03

OR: Odds Ratio
CI: 95% Confidence Interval
[*]p<.05
[**]p<.01
[***]p<.001

Table 8. Cross-Level Interactions Predicting Suicide Attempts

|	Model 1		Model 2		Model 3		Model 4	
	OR	CI	OR	CI	OR	CI	OR	CI
Intercept	.83	.60, 1.16	.83	.60, 1.15	2.45	.97, 6.21	2.10	.48, 9.22
Cognitive Social Capital Interaction								
Peer Integration	.66**	.56, .77	.65**	.55, .77				
School Peer Integration	.31	.09, 1.10	.28	.07, 1.15				
Peer Integration*School Peer Integration			.78	.12, 4.97				
Structural Social Capital Interaction								
Indegree					.97	.93, 1.00	1.01	.75, 1.35
Reciprocity					.83	.67, 1.02	.86	.60, 1.22
Indegree*Reciprocity							.99	.92, 1.06
Control Variables								
Female Indicator	1.21	.96, 1.51	1.21	.96, 1.51	1.22	.98, 1.53	1.22	.98, 1.53
Non-White Indicator	1.48**	1.14, 1.91	1.48**	1.14, 1.91	1.40*	1.08, 1.81	1.40*	1.08, 1.81
10th Grade	1.07	.79, 1.44	1.07	.79, 1.44	1.06	.79, 1.42	1.06	.79, 1.43
11th Grade	.88	.65, 1.18	.88	.65, 1.18	.85	.63, 1.14	.85	.63, 1.14
12th Grade	.80	.58, 1.09	.80	.58, 1.09	.78	.57, 1.06	.78	.57, 1.06
School Size x100	1.02	.99, 1.05	1.02	.99, 1.05	1.02	.99, 1.05	1.02	.99, 1.05

OR: Odds Ratio
CI: 95% Confidence Interval
$^{*}p<.05$
$^{**}p<.01$
$^{***}p<.001$

Figure 1. Cross-Level Interaction for Structural Social Capital on Suicide Ideation
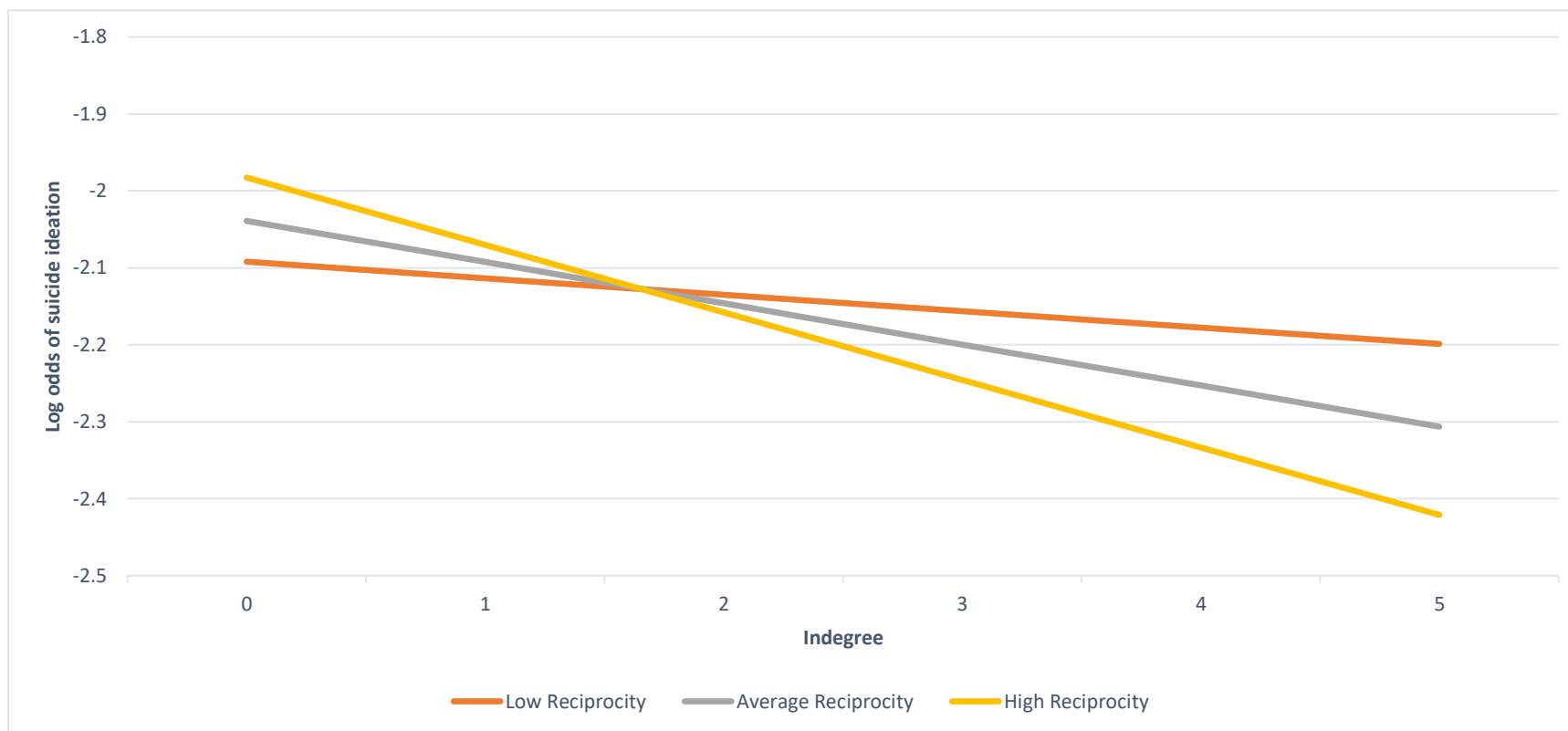
Discussion

This study tested the independent contributions of cognitive and structural social capital at individual and group levels in predicting suicidal thoughts and behaviors. Overall, the results strengthen the evidence that social capital reduces suicidal thoughts and behaviors, social capital is a multidimensional concept, and future research should continue to examine cognitive and structural components at individual and group levels. Furthermore, the study suggests social network analysis can contribute to the understanding of suicide outcomes after accounting for student's perceptions of their social environments. Prior research has indicated social ties are important for predicting suicide outcomes (Bearman & Moody, 2004b; Janet Kuramoto et al., 2013; Joo & Roh, 2016; Tsai, Lucas, & Kawachi, 2015b; Wyman et al., 2019), and this study indicates that social ties provide a unique contribution to understanding suicide risk. This study also suggests that for certain individual measures of social capital, the relationship with suicide may depend on group characteristics, such as the level of group-level social capital.

The results from this study are consistent with prior research that has found social capital is associated with lower suicide ideation (J. Y. Kim et al., 2017a; Langille et al., 2012; Simning & Conwell, 2017). This study found cognitive social capital at both the individual and school level are independently associated with lower suicide ideation as is individual structural social capital measured as outdegree. These results indicate that the overall perceptions of an integrated school environment within a school can lower the risk of suicide ideation among students even after controlling for individual perceptions of peer integration. The study also found that making more friendship nominations is associated with a decreased risk of considering suicide above and beyond the effects of perceptions of peer integration.

Although the final model predicting suicide attempts indicated that only individual cognitive social capital is uniquely associated with suicide attempts, both group level structural social capital and individual cognitive social capital were also associated with lower suicide attempts in univariate models. Perceptions of peer integration appears to provide a buffer against a suicide attempt for those who are considering suicide. When examining univariate models, it is important that structural social capital measures had a significant association with reduced risks of suicide attempts. Consistent with other studies, structural social capital appears to reduce the risk for a suicide attempt by providing relationships that can intervene to prevent suicide or linking to tangible resources such as a trusted adult or mental health services (Desai et al., 2008; Fitzpatrick, Irwin, Lagory, et al., 2007; Pisani et al., 2012).

The cross-level interaction between indegree and reciprocity in predicting suicide ideation indicate that students with fewer friends may be at a greater risk of considering suicide in schools where stronger peer relationships, captured by more reciprocal friendships, is the norm. When embedded in a higher social capital environment, students with low social capital may have fewer opportunities for social relationships as connections may be more concentrated in fewer students, have fewer opportunities to access social resources, and could feel more isolated in a cohesive peer network. These results are consistent with prior research that found adults with low social capital can be at an increased risk for negative outcomes in a high social capital environment, including suicide (Peng et al., 2019; Poortinga, 2006b; Subramanian et al., 2002).

This study provides evidence that social capital can decrease the risk of considering and attempting suicide. Interventions that promote social capital at both the individual and group level should be considered and support recent policy efforts to promote multifaceted approaches

to suicide prevention that address multiple levels along the socioecological framework (CDC, 2011; U. S. Department of Health and Human Services, 2020). Schoolwide interventions that promote cohesive, integrative environments could be beneficial for reducing suicidal thoughts and behaviors; however, it is important that these interventions also target at-risk, less integrated students who may be at an increased risk of suicide if their school environment becomes more cohesive.

The results from this study should be considered in light of several limitations and call for future research examining the relationship between social capital and suicidal thoughts and behaviors in school settings. First, the data were collected from mostly rural schools that were in communities with high adolescent suicide rates (Wyman et al., 2010b). Schools with greater racial and ethnic diversity, in more urban settings, and in other geographical locations may show different relationships between the study variables and should be examined. Second, data were collected during the early 2010s. Increased digital communication and remote learning may affect how high school students interact and perceive their social environments. Future research should consider how online and digital communication and relationships may affect high school student's social capital. Third, traditional measures of structural social capital that capture participation in formal groups such as voluntary or religious organizations were not measured and could not be included in these analyses. Although the study was novel in using social network analysis to measure structural social capital, this method only captures informal relationships. A large body of research has demonstrated structural social capital as participation in formal organizations is beneficial for several health outcomes (Ehsan & De Silva, 2015; Long et al., 2022; Noel, Cork, & White, 2018). Future research should consider how participation in formal school groups, such as student government, sports teams, junior civic organizations, and

student clubs may provide independent contributions above and beyond the social capital measures used in this study. Fourth, although schools are an important social environment for adolescents, it is not the only setting in which high school students may have social capital. Future research can consider the social capital in the neighborhood, families, and the broader school environment that includes teachers and school staff. Finally, the results were limited by a relatively small number of schools. A greater number of schools could provide more precise estimates of higher-level variables.

Conclusion

Given the high rates of suicidal thoughts and behaviors among high school students, it is important to identify underlying individual and contextual factors contributing to suicide ideation and suicide attempts. The results from this study provide evidence that multiple social capital components are independently associated with a reduction in suicide ideation and individual cognitive social capital is independently associated with a reduction in suicide attempt risk among those considering suicide. Furthermore, high school students low in social capital may be at an increased risk of suicide ideation when belonging to a high social capital school. These results highlight the importance of considering social capital as a multidimensional, multilevel concept and future research should consider examining the independent associations of cognitive and structural social capital at individual and group levels. This study also calls for more research using social network analysis to capture structural social capital that can describe the structure of social networks beyond measures of group participation. These results also provide further evidence that promoting social capital in a school environment can be effective in reducing suicidal thoughts and behaviors among high school students.

CHAPTER V: THE ROLE OF SOCIAL CAPITAL IN PREDICTING CHANGES IN

ADOLESCENT SUICIDAL THOUGHTS AND BEHAVIORS OVER TIME

Introduction

From 2008-2019, suicide deaths among high school aged students increased by 61.7%, going from 6.0 to 9.7 per 100,000 (Ivey-Stephenson et al., 2020) making suicide the second leading cause of death among this age group. Other suicide related outcomes have also increased during the last decade, including the percent of WHO that have seriously considered suicide (13.8% to 18.8%), attempted suicide (6.3 to 8.9%), and been admitted to emergency departments for suicide related injuries (1.9% to 2.5%) (CDC, 2022). These trends have coincided with increases in other known suicidal risk factors such as depression which has increased from 12% in 2016 to 16% in 2020 (Panchal, Rudiwitz, & Cox, 2022). Trends in how adolescents perceive their social environment have also shown adolescents are more likely to feel lonely than adolescents 10 years ago and are more likely to experience loneliness than other age groups including the elderly (Pollack, 2018; Twenge et al., 2019).

Studies examining suicidal thoughts and behaviors (STBs) in adolescents have largely focused on individual and clinical risk factors, such as anxiety and depression (Gould, Greenberg, Velting, & Shaffer, 2003) substance misuse (Esposito-Smythers & Spirito, 2004) and adverse childhood events (Cluver, Orkin, Boyes, & Sherr, 2015). More recently, researchers and policy makers have focused on the association between more social connections and STBs (Bearman & Moody, 2004a; CDC, 2011; Wyman et al., 2019). Social capital is a concept that has been associated with better health outcomes and may have potential to reduce STBs in adolescents.

Social capital is a concept that captures the value that exists in relationships and defined as "the connections among individuals' social networks and the norms of reciprocity and trustworthiness that arise from them" (Putnam, 2000). Social capital consists of both cognitive and structural components. Cognitive social capital measures how individual's feel about their relationships, (i.e., perceptions of belonging, interpersonal trust, perceived norms of reciprocity). Structural social capital measures how people interact in their network, (i.e., participation in civic organizations, spending time with friends). Despite several measures that could capture structural social capital, few studies use social network analysis measures to capture structural social capital. Social network analysis could measure structural social capital that exists in more informal networks, such as adolescent friendship networks. In a friendship network, measures such as indegree (how often a person is named as a friend by others in the network), can capture structural social capital that doesn't rely on individual self-report of relationship perceptions.

Although some studies have found greater social capital is associated with lower suicidal risk factors such as better mental health (Ehsan & De Silva, 2015; Hamano et al., 2010a; Mitchell & LaGory, 2002b), few studies have examined the association between social capital and suicidal thoughts and behaviors directly. These studies find that greater social capital is associated with a reduction in suicidal thoughts and behaviors (Bae, 2019; Kunst et al., 2013; Langille et al., 2012; Smith & Kawachi, 2014a; Wu et al., 2018; Yu & Chen, 2020); however, with a few exceptions, most studies examining social capital and suicide are cross-sectional. Two longitudinal studies conducted on samples of Korean adults found at least some dimensions of social capital predict lower suicidal ideation over time (Han & Lee, 2013a; J. Y. Kim et al., 2017a). These studies show that social capital may predict suicidal thoughts and behaviors over

time, but there is a dearth of literature that examines how social capital may predict suicidal thoughts and behaviors in adolescents in the United States over time.

Longitudinal research often examines how a characteristic may predict some future outcome, such as social capital at time 1 predicting suicidal thoughts and behaviors at time 2. However, this approach only accounts for the social capital context at a single point in time and cannot determine whether this level of social capital is typical for the individual or a deviation from their typical social capital. Time-varying multilevel models can disentangle the effects that are due to a student's typical level of social capital (between-person effects) and the effects of their deviation from their typical level of social capital (within-person effects). If students who typically have higher social capital are on average less likely to consider suicide or attempt suicide, then this would indicate a negative association between social capital and suicidal thought and behaviors. If students are more likely to consider suicide or attempt suicide when they are lower than their typical level of social capital, then this would indicate a negative association between their current social capital and suicidal thoughts and behaviors. With this approach, this study addresses two distinct research questions: (1) Does a student's typical level of social capital (between-person effects) predict suicidal thoughts and behaviors? And (2) Are students more (or less) likely to consider or attempt suicide when they are lower (or higher) than their typical social capital (within-person effects)? To answer these research questions, this study examined how a cognitive social capital measure (measured as school integration) and a structural social capital measure (measured as indegree) predict suicide ideation and suicide attempts over time in a sample of high school students.

Methods

Sample

Data were from eighteen schools in New York and North Dakota participating in an

evaluation of the peer-led suicide prevention program, *Sources of Strength*. A web-based

questionnaire was administered during class time to all students that assessed their perceptions of

the school social environment, supports at their school, and their perceptions and experiences

with suicide. Schools were enrolled in four cohorts with the first cohort starting in 2010 and the

fourth cohort starting in 2013. For each school, data were collected every six months for two

years. For the present study, only control schools are used in the analysis to eliminate any

intervention effects.

Measures

Cognitive Social Capital-School Integration

Students responded how strongly they felt at their school they (a) feel close to other

students (b) have many friends (c) are socially accepted and (d) often hang out with other

students (1=strongly disagree to 4=strongly agree). These responses were averaged (Wave 1:

α=0.867; Wave 2: α=0.901; Wave 3: α=0.909; Wave 4: α=0.911) to capture *school integration.*

Students who responded to at least 3 of the items were included in the analysis.

Structural Social Capital-Indegree

All students were asked to name up to seven of their closest friends at school. *Indegree*

measures the number of times a student was named by another student as a friend.

Suicide Ideation

Students responded to the item "In the past 12 months have you ever considered

suicide?" (0 = No, 1 = Yes). Because data were collected every six months, the item was

transformed to ensure that the response measured a new event at each wave. Students responding "no" to the previous wave and "yes" to the present wave were considered to have contemplated suicide for the present wave. Students who responded "yes" at the present wave and reported that they considered suicide at least two waves prior were considered to have contemplated suicide for the present wave. For example, a student responding "no" at time 1 and "yes" at time 2 would have considered suicide at time 2. However, if a student responded "yes" at time 1 and time 2, this student would be considered to not have a new suicide ideation at time 2. If a student responded "yes" at time 1, "no" at time 2, and "yes" at time 3, this student had a new suicide ideation at time 3 and was recorded as "yes" at time 3.

Suicide Attempt

Students responded to the item "In the past 12 months, how many times did you actually attempt suicide?" (0 times, 1 time, 2-3 times, 4-5 times, 6 or more times). If a student reported they had attempted suicide more times than they did in the wave immediately prior to the present wave, or reported any attempt in the present wave and no attempts in the wave immediately prior, they were considered to have attempted suicide for the present wave. Responses were dichotomized into 0 = "Did not attempt suicide" and 1 = "Attempted Suicide."

Control Variables

Gender was a dichotomous variable computed from the item "Your gender?" (0 = "Male"; 1 = "Female"). *Race/Ethnicity* was dichotomized to 0 = "Non-Hispanic White" and 1 = "Non-White", which included all students who indicated that they were Hispanic or Latino, as well as any students who indicated they were at least one other race other than White. *Grade* was computed from the item "Your grade?" (9 = "9th grade," 10 = 10th grade," 11 = "11th grade," and 12 = "12th grade.") For data collected during the spring semester (waves 2 and 4), 0.5 was

added to their grade score. *School Size* was computed by the number of students that were administered a questionnaire at baseline and divided by 100.

Data Analysis

Social capital variables were grand-mean centered to capture between-person effects and person-mean centered to capture within-person effects. Between-person social capital was created by averaging a student's school integration and indegree across all waves and centering around the grand mean (i.e. the mean school integration and mean indegree for the entire sample were subtracted from each individual's mean school integration and mean indegree). To align the measures so that past social capital predicts present suicide outcomes, within-person social capital was person-mean centered using the social capital measure for the previous wave. Lagged within-person social capital was created by subtracting a student's mean school integration and mean indegree across all waves from the school integration and indegree at the previous wave. (i.e. social capital at time 1 – person average social capital to predict suicide ideation and suicide attempts at time 2).

Three time-varying multilevel logistic regression models were used for each suicide outcome variable to test the study aims. First, a model including the outcome (suicide ideation or suicide attempts) and control variables was tested to establish the intraclass correlation. Next, models including the between-person and lagged within-person cognitive social capital effects to predict suicide ideation and suicide attempts were tested (models 2). Finally, models including the between-person and lagged within-person structural social capital effects to predict suicide ideation and suicide attempts were tested (models 3).

Results

Two schools were removed from the final analysis for having insufficient network data,

leaving the final sample at students from 18 schools. These schools ranged in size from 67

students to 1,125 students. Of the 7,278 students who were administered a questionnaire, 1,226

had insufficient data to be included in the final analysis and 790 students only had data for a

single time point, leaving a total of 5,262 students in the final sample. Nearly half of the student

population identified as female (49.3%), and the majority of the sample identified as white

(86.5%). Across waves, new suicide ideations ranged from 9.6% to 10.3% and new or increased

suicide attempts ranged from 3.7% to 4.5%. Previous wave school integration ranged from 3.20

to 3.22 and previous wave indegree ranged from 4.61 to 4.86. Table 9 presents the sample

demographics for students in the final sample.

Table 9. Sample Demographics for Study 2

	Students *N*=5,262		
	Time 2 ***N* = 3,753** ***N (%)* or Mean**	**Time 3** ***N* = 2,679** ***N (%)* or Mean**	**Time 4** ***N* = 3,250** ***N (%)* or Mean**
Suicide Ideation	361 (9.6)	274 (10.2)	335 (10.3)
Suicide Attempts	139 (3.7)	104 (3.9)	147 (4.5)
Previous Wave School Integration	3.20	3.21	3.22
Previous Wave Indegree	4.86	4.78	4.61

Table 10 presents the results for the time-varying logistic regression models predicting

suicide ideation and suicide attempts. For suicide ideation, the intercept variance for the controls

only model (model 1) was 7.124 and the intraclass correlation was .687. For suicide attempts,

the intercept variance for the controls only model (model 1) predicting suicide attempts was 11.096 and the intraclass correlation was .771.

The between-person effects for school integration were significantly associated with a lower risk of suicide ideation (OR = .19; 95% CI = .16, .23) and suicide attempts (OR = .11; 95% CI = .08, .15) suggesting that students who generally had higher cognitive social capital were less likely to consider and attempt suicide. However, the within-person lagged effects for previous wave school integration were significantly associated with a higher risk of suicide ideation (OR = 1.69; 95% CI = 1.47, 1.94) and suicide attempts (OR = 1.43; 95% CI = 1.28, 1.59) at the present wave. This suggests that when students had higher cognitive social capital than usual at the previous wave, they were more likely to consider and attempt suicide at the current wave.

For structural social capital, the between-person effects for indegree were significantly associated with a lower risk of suicide ideation (OR = .93; 95% CI = .89, .97) and suicide attempts (OR = .85; 95% CI = .79, .91), suggesting that on average, students with higher structural social capital were less likely to consider and attempt suicide. The within-person lagged effects for previous wave indegree were not significantly associated with present wave suicide ideation (OR = 1.01; 95% CI = .98, 1.04), suggesting that a deviation from a student's typical level of structural social capital at the previous wave is not related to a student considering suicide at the current wave. However, the within-person lagged effects for previous wave indegree were significantly associated with a higher risk of current wave suicide attempts (OR = 1.08; 95% CI = 1.04, 1.12), suggesting that when students have higher structural social capital than usual at the previous wave, they are more likely to attempt suicide at the current wave.

Table 10. Time-Varying Logistic Regression Models Predicting Suicide Ideation and Suicide Attempts

	Suicide Ideation						Suicide Attempts					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Intercept	.05***	.02, .12	.05***	.02, .11	.05***	.02, .12	.00***	.00, .00	.00***	.00, .00	.00***	.00, .00
Grade	.91*	.85, .98	.92*	.85, .99	.91*	.85, .98	.97	.90, 1.05	1.00	.92, 1.08	.99	.92, 1.08
Race/Ethnicity	2.36***	1.90, 2.93	2.07***	1.67, 2.57	2.31***	1.86, 2.86	3.23***	2.62, 3.99	2.98***	2.41, 3.69	3.21***	2.60, 3.96
Gender	1.60***	1.30, 1.96	1.51***	1.22, 1.86	1.65***	1.34, 2.03	1.81***	1.34, 2.46	1.72***	1.24, 2.40	1.96***	1.44, 2.68
School Size	.97*	.95, .1.00	.97	.95, 1.00	.98	.95, 1.00	.96*	.93, 1.00	.96	.93, 1.00	.97	.94, 1.01
CSC (School Integration)												
Between-Person Effects			.19***	.16, .23					.11***	.08, .15		
Within-Person Lagged Effects			1.69***	1.47, 1.94					1.43***	1.28, 1.59		
SSC (Indegree)												
Between-Person Effects					.93***	.89, .97					.85***	.79, .91
Within-Person Lagged Effects					1.01	.98, 1.04					1.08***	1.04, 1.12

OR: Odds Ratio
CI: Confidence Interval
CSC: Cognitive Social Capital
SSC: Structural Social Capital
*: p<.05
**:p<.01
***:p<.001

Discussion

In this study, high school students who typically had higher than average social capital compared to other students in the sample were at lower risk for considering suicide and attempting suicide across two years. This was true for both cognitive and structural social capital. This study was unique in using a social network analysis measure to capture structural social capital and found that having a higher indegree on average is associated with lower risk of STBs. Although having higher social capital across the study period was associated with lower suicidal thoughts and behaviors, this study found that after controlling for these typical effects, students who had more cognitive social capital than they usually had was associated with an increased risk of suicide ideation and suicide attempts and having more structural social capital than the individual average across waves was associated with an increased risk of suicide attempts.

These results are consistent with some of the cross-sectional studies demonstrating an association between higher social capital and lower STBs (Bae, 2019; Han & Lee, 2013a; Langille et al., 2012; Smith & Kawachi, 2014a). Although the within-person results appear to contradict much of the literature on social capital and suicide, there is some precedent to support these findings. Some studies have revealed that not all dimensions of social capital are beneficial and at times, social capital can even be detrimental to the health of an individual, including increased suicidality. Durkheim (1951) suggested that over-integration in a network could increase the risk for suicide as too much integration may increase stress, cause individuals to feel burdensome to their network, or through overly rigid discipline. This has been supported in research examining the effects of religious participation, showing that although some religious participation can decrease suicide risk, excessive participation can create little freedom from

moral directives and regulation, increasing the adverse mental health and suicide risks (Abrutyn & Mueller, 2015; Pescosolido & Georgianna, 1989). Specifically in studies examining social capital and suicide, Fitzpatrick and colleagues (2007) found that only certain forms of structural social capital that promoted group participation are beneficial for reducing suicide ideation, and that cognitive social capital could increase the risk for suicide ideation. In an ecological study of European countries, Kelly and colleagues (Kelly et al., 2009b) found that for certain countries, cognitive social capital measured as trust was associated with an increase in suicide rates. In a study of Chinese college students, Peng and colleagues (2019) found that after controlling for certain measures of cognitive social capital, structural social capital as participation in extracurricular activities was associated with an increase in suicide ideation and at high levels, social capital exhibits some diminished benefits as connections may become redundant.

Despite the within-person social capital effects on suicide ideation and suicide attempts, this study still demonstrates that social capital is associated with lower suicide ideation and suicide attempts among high school students. Interventions that promote social capital, specifically through promoting school integration, building trust in students and teachers, and building friendships should be considered. However, as the within-person results from this study demonstrated, it is important that any intervention recognizes the potential dangers of over-integration and is careful to avoid promoting integration that can be harmful to students. Suicide contagion, the process in which exposure to a peer's suicidal behavior can increase the risk of suicidal behavior of the individual, may be more likely for well-integrated students if there are students who are considering, attempting, and completing suicide in the network (Insel & Gould, 2008). Multifaceted interventions that promote social capital in individuals and schools that also promote healthy norms around suicide should be considered.

More research should be conducted to examine how changes in social capital predict changes in STBs over time in adolescents. Although this study only examined social capital at the individual level, most scholars agree that social capital is a multi-level concept with both individual and group components. Future research should examine how changes in social capital at the school level can predict changes in STBs in adolescents. This study was also unique in using a social network analysis measure to capture structural social capital. Although this measure is useful for capturing the structure of friendship networks, future research that incorporates participation in group settings, such as sports, band, civic clubs and other extra-curricular activities would measure structural social capital that exists in participation in more formal networks. Prior research has found that participation in extra-curricular activities is associated with lower suicidality in high-school students (Bauer, Capron, Ward-Ciesielski, Gustafsson, & Doyle, 2017), so future research could examine these effects after controlling for other forms of cognitive and structural social capital.

The results for this study should be considered in light of several limitations. First, the data were collected from predominantly rural high schools in New York and North Dakota where suicide rates were higher than average (Wyman et al., 2010a). More research is needed to examine these associations in other settings such as high schools in urban environments. Secondly, data were collected in schools that were relatively racially homogenous. As students are likely to form relationships with those that are demographically similar (Mcpherson, Smith-Lovin, & Cook, 2001), more research on how social capital may operate in more racially diverse networks is needed. Finally, although this study was able to determine temporal relationships between social capital and STBs, friendship networks are not static and can change quite frequently over the course of a school year (Poulin & Chan, 2010). This study collected data

every six months, and it is possible that friendships, and social capital, could change between the study waves. Studies with more frequent follow-ups could strengthen the understanding of the temporal relationship between social capital and suicide.

Conclusions

This study contributes to the literature on social capital and suicide by examining a measure of cognitive and structural social capital and its relationship with STBs over time. Higher social capital is associated with lower suicide ideation and suicide attempts over time, but an increase in social capital above an individual's typical level of social capital is associated with an increased risk of STBs. This study also included a social network analysis measure to capture structural social capital. Further research that uses social network analysis to capture structural social capital is needed, along with future research examining the associations between additional measures of social capital, such as group level social capital and structural social capital as participation and suicide outcomes.

CHAPTER VI: DISCUSSION AND IMPLICATIONS

Study Purpose

This study aimed to examine the independent effects of social capital components (individual cognitive social capital, individual structural social capital, group cognitive social capital and group structural social capital) on suicidal thoughts and behaviors, explore the effects of social network analysis measures as structural social capital measures, explore cross-level interactions between individual and group social capita and STBs, and examine the effect of changes in social capital on changes in STBs. The aims for this study were:

1. Is there a relationship between social capital and suicidal thoughts and behaviors?

   a. To what extent are (a) cognitive social capital and (b) structural social capital independently associated with (a) suicide ideation and (b) suicide attempts?

   b. Does group level structural capital moderate the relationship between individual structural level social capital and suicide ideation?

   c. Does group level cognitive social capital moderate the relationship between individual structural level social capital and suicide ideation?

2. Do *changes* in social capital predict *changes* in suicidal ideation and suicide attempts over time, after controlling for typical levels of social capital (i.e., between-person effects)?

Key Findings

This study found that in general, greater social capital is associated with lower suicide ideation and lower suicide attempts. These results were consistent with prior research that found positive health effects for social capital, particularly in adult populations (Choi et al., 2014; I Kawachi et al., 1997; Daniel Kim et al., 2006; Kunst et al., 2013; Mansyur et al., 2008). While the literature on adolescent social capital is sparse, the results from this study add to the literature

that has found social capital is associated with better health in adolescent populations (Ahlborg, Svedberg, Nyholm, Morgan, & Nygren, 2019; Winstanley et al., 2008) and can contribute to lower STBs (Bae, 2019; Langille et al., 2012).

Although years of research on social capital have often demonstrated a positive effect on health outcomes, determining which components of social capital matter for predicting health outcomes has been difficult as social capital measurements often vary greatly across studies, studies mix the effects of cognitive and structural social capital, only measure social capital at an individual or group level, or only measure social capital at a single point in time. This study aimed to find which components of social capital matter when studying their effects simultaneously and how changes in social capital predict changes in social capital over time. This study found that multiple components of social capital have independent effects on adolescent STBs. The results support the idea that social capital is multi-faceted and its effects are most appropriately examined when cognitive and structural social capital are measured as independent components. When possible, individual and group level measures of cognitive and structural social capital should also be included. This study also supports the idea that social capital may change over time, and these changes can predict STBs.

Although this study did not measure the magnitude of effects, the study did find that individual cognitive social capital was most consistently associated with suicide ideation and suicide attempts. In their literature review on social capital and mental health, Ehsan and De Silva (2015) found that of the four components of social capital, individual level cognitive social capital was most consistently associated with better mental health and lower risk for common mental disorders. This study supports those results, and it appears that cognitive social capital

measured as perceptions of trust, feelings of belongingness and integration with the social environment are beneficial for mental health and lower suicide ideation.

Additionally, this study supports the idea that context matters for understanding social capital and suicide. Several studies examining the effects of social capital are ecological studies that find group level social capital is associated with better health outcomes (I Kawachi et al., 1997; Kelly et al., 2009b; Mansyur et al., 2008; Nakamura et al., 2019; Smith & Kawachi, 2014b). However, these studies are susceptible to the ecologic fallacy, and it can't be determined if group social capital is beneficial to all individuals in the group. This study found that group cognitive social capital matters above and beyond the social capital of the individual and the effects of individual social capital may depend on the social capital of the group. Individual context also matters for understanding how changes in social capital are related to changes in suicide ideation and suicide attempts. This study found that students who typically have higher levels of social capital are less likely to consider and attempt suicide, but having more social capital at a specific time may increase the risk of suicide.

This study was unique in using social network analysis to measure structural social capital and test its effects independent of cognitive social capital. Although some research has used social network analysis to predict adolescent STBs (Bearman & Moody, 2004a; Prochnow et al., 2020; J. Whitlock et al., 2014), these studies do not take a social capital perspective and do not simultaneously examine the effects of social network measures along with measures that could be considered cognitive social capital. Some scholars use social network analysis to measure social capital (Burt, 2017; N. Lin, 2001), but these perspectives take a view of social capital as resources embedded in networks, such as information and connections to important actors, and don't account for a cognitive social capital component. They also take a

predominantly individualistic view of social capital. This study found that social network measures of friendships were associated with suicidal thoughts and behaviors above and beyond measures of cognitive social capital.

Although this study supports the literature that finds greater social capital is associated with better health outcomes, there is also evidence that social capital may not be beneficial for all individuals, and at times, social capital can be detrimental. Some scholars have referred to this as the "dark side" of social capital (Portes, 1998; R. Putnam, 2000) and suggest caution from believing that social capital is universally beneficial. Putnam suggested that too much social capital and community bonding can foster trust for those in the "in-group," but promote animosity and mistrust of those outside the group (R. Putnam, 2000; R. D. Putnam, 2007). Those on the periphery of the group may experience increased risk of negative outcomes if their group is particularly tight knit. At times, greater social capital may increase health risks through increasing stress to participate in the group and beliefs that the needs of the group are greater than the needs of the individual, or through promoting normative deviant behavior. This study found some evidence to support the dark side of social capital in adolescents in that students with low social capital may experience an increased suicide ideation if they are in a high social capital network and when students have greater social capital than their typical levels, they may be at an increased risk of STBs.

Implications and Future Research

This study has several implications for practitioners looking to promote social capital or reduce STBs and scholars engaging in social capital and suicide research. Although this study found that some components of social capital are associated with adolescent STBs, more research is needed on the causal pathways that link social capital and suicide. There is a large

body of research on the relationship between social capital and mental health (Ehsan & De Silva, 2015; McKenzie & Harpham, 2006). Though there is a strong association between mental health and suicide (Herba, Ferdinand, Van Der Ende, & Verhulst, 2007) there is little research that examines if mental health may be a mediator between social capital and suicide. Future research should examine more causal pathways between social capital and suicide.

More multi-level studies that examine cognitive and structural social capital are needed. Many studies that examine social capital only study the effects at the individual level that ignore the group level social capital that exists within the groups these individuals reside. This study demonstrates that the context matters for understanding social capital and that group level social capital can matter above and beyond the individual levels of social capital. Although the study from chapter V did not account for group level social capital, the indegree measure captured how an individual is seen as a friend by others in the network and captures some contextual effect on the individual. Multi-level studies can also examine additional cross-level interactions to examine further how different social capital contexts may determine relationships between individual social capital and health outcomes.

Studies that examine the different components of social capital find that different dimensions of social capital may matter more for different subgroups. For some disadvantaged individuals, structural social capital appears to matter more than cognitive social capital (Fitzpatrick, Irwin, Lagory, et al., 2007; Stahlman et al., 2016) while cognitive social capital seems to matter more in the general population (Langille et al., 2012; Peng et al., 2019) in preventing suicide. Future research should examine the independent effects of social capital components on other adolescent outcomes and examine these effects within different populations

and subpopulations. This research could also be used to develop more targeted interventions to promote the kinds of social capital that matter for the targeted population.

There are several research directions that should be taken to continue to examine structural social capital. Future research should continue to examine structural social capital through social network analysis. There are other social network measures that could measure structural social capital that were not included in this study, such as transitivity (how often an individual's two friends are friends with each other), coreness (how many friends does and individual's friends have) and density (the number of ties in a network divided by the number of possible ties). There is some evidence that these social network measures are associated with adolescent STBs (Bearman & Moody, 2004a; Wyman et al., 2019), so examining them simultaneously with cognitive social capital measures could determine their independent effects. Additionally, future research should incorporate structural social capital measures that measure participation in group settings, such as sports, band and school clubs. Using these measures along with social network analysis will help elucidate if participation measures of structural social capital are making independent contributions to understanding suicide and other health outcomes more broadly. Finally, as the world becomes more digital and adolescents spend more time interacting and communicating online, future research should examine how social capital may exist in digital spaces. Research should examine if relationships that are made and maintained predominantly online contribute to social capital and if they have effects that matter above and beyond the structural social capital that comes from physically participating in networks.

Future research should also continue to explore the effects of social capital over time in predicting adolescent STBs. This study shows that both individual and group components of

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social capital can have some effect on adolescent suicidal thoughts and behaviors and that

changes in social capital has some effect on changes in STBs. Future research should explore

the effects of group level cognitive and structural social capital over time and how changes in

group level social capital can predict changes in adolescent STBs.

This research can inform future interventions that are developed to promote social capital

in adolescents and to reduce STBs among adolescents. As more interventions aim to build

connectedness as a means to reduce STBs (CDC, 2011) and building social capital has been

named as an objective for Healthy People 2030 (U. S. Department of Health and Human

Services, 2020), there is some momentum to develop interventions that could specifically

promote social capital in schools with the goal to reduce suicides. Interventions to build social

capital should be multi-faceted and aim to promote social capital within individuals and schools.

Interventions that solely target individuals may not be effective in promoting social capital of the

school and could miss the benefits that school-wide interventions could provide. Additionally,

interventions that focus solely on promoting social capital at a school level could be beneficial

for reducing STBs for some students but could run the risk of increasing suicide risk for some

vulnerable students. If a student already lacks integration at their school or have few friends,

promoting social capital in the school could backfire as these students may feel increasingly

isolated if the social capital of the school increases. Interventions that promote social capital

within the school and targets at-risk individual students should be explored.

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