The evolution of social networks in a group-based mentoring program for vulnerable teens: What types of relationships matter most?

Neil D. Yetz, M.P.H., M.S. candidate

Colorado State University

Thesis Proposal

# ABSTRACT

# ACKNOWLEDGEMENTS

TABLE OF CONTENTS

[ABSTRACT 2](#_Toc42774660)

[ACKNOWLEDGEMENTS 3](#_Toc42774661)

[CHAPTER I: INTRODUCTION 5](#_Toc42774662)

[**Adolescence – a critical time for intervention** 6](#_Toc42774663)

[**Mentorship Interventions** 8](#_Toc42774664)

[**Belongingness as an Intermediate Goal of Group-based Mentoring Programs** 10](#_Toc42774665)

[**Social Networks** 13](#_Toc42774666)

[*Defining Social Networks and Social Network Statistics* 14](#_Toc42774667)

[**Proposal** 16](#_Toc42774668)

[CHAPTER II: METHOD 18](#_Toc42774669)

[**Study Protocol** 18](#_Toc42774670)

[**Measures** 20](#_Toc42774671)

[*Demographics* 20](#_Toc42774672)

[*Belongingness* 20](#_Toc42774673)

[*Social Network* 20](#_Toc42774674)

[**Analysis Plan** 22](#_Toc42774675)

[*Analysis for Research Question 1* 22](#_Toc42774676)

[*Analysis for Research Question 2* 23](#_Toc42774677)

[**References** 25](#_Toc42774678)

# CHAPTER I: INTRODUCTION

When an adolescent is struggling to develop in a positive way, an adult mentor can be a catalyst for change (Wesely, Dzoba, Miller, & Rasche, 2017). As a result, numerous mentoring programs for at-risk adolescents have emerged, including Big Brothers Big Sisters of America (<https://www.bbbs.org/>) and MENTOR (<https://www.mentoring.org/>). Alongside these traditional dyadic mentoring programs (i.e., one mentor, one mentee), group-based mentoring programs are another common structure. In these programs, one mentor may be matched with multiple mentees or mentor-mentee pairs may participate in larger group settings. Examples of group-based mentorship programs include Campus Connections (<https://www.chhs.colostate.edu/cc/>) and Go Girls! (<https://www.bbbso.ca/programs/go-girls/>). While mentoring programs of various types and styles are ubiquitous in communities across the US, findings from meta-analytic reviews indicate that the treatment effects of mentoring interventions vary widely across programs, structures, and outcomes (DuBois, Portillo, Rhodes, Silverthorn, & Valentine, 2011). Thus, efforts to maximize treatment efficacy is needed, and this endeavor requires focused research.

The fundamental element of any mentoring program is the bond that the mentee forms with others in the program. That is, with their mentor, in the case of a dyadic mentoring program. Or, in the case of group-based mentoring programs, with mentors and other mentees. Thus, one approach to improving mentoring treatment effects is to optimize the bonds and friendships cultivated during the mentoring program. In this thesis, my focus is on enhancing the treatment effects of group-based mentoring programs in particular. Mentees have an opportunity to build relationships with many different individuals in a group-based mentoring program, thus, it is important to consider what types of bonds are most important for treatment effects to be realized. That is, to discover what types of relationships with other members of the group are most associated with positive program outcomes. For example, is it most important for a mentee to develop a close bond with their primary mentor, and/or with a set of mentors, and/or with other mentees in the program? If clarity about the most important relationships for an adolescent to cultivate during a group-based mentoring program can be gained, then this information may be used to restructure programs to maximize positive treatment effects.

In this thesis, I will characterize the evolution of the social network of mentees participating in a 12-week, group-based mentoring program for at-risk adolescents. Characterization of each mentee’s social network over the course of the program will involve assessment of the number and strength of bonds with their primary mentor, with other mentors and adult staff, and with other mentees participating in the program. Measures of the social network will be collated and then used as predictors of a key program mediator (sense of belonging in the program) and several key program outcomes (i.e., academic performance, depression, anger, and delinquent behaviors). In this way, new insights into the types of relationships most salient for positive program outcomes may be discovered.

## **Adolescence – a critical time for intervention**

Decades worth of research demonstrates that adolescence is a unique and consequential developmental period (Steinberg, 2007), and adolescents cannot be simply considered older children or younger adults (Crosnoe & Johnson, 2011). Numerous biological changes occur during adolescence. For example, pubertal development has been associated with increased activation of the frontal lobe, pruning and myelination of the brain (Paus, Keshavan, & Giedd, 2008; Steinberg, 2007). Additionally, there is enhanced capacity to the dopaminergic reward system of the brain (Siegel, 2015). Changes in the nucleus accumbens, a brain area associated with reward seeking, have also been seen in adolescent development (Galvan et al., 2006).

Amidst these critical biological developments, adolescents are prone to impulsivity, sensation-seeking, and inaccurate assessment of vulnerability (Steinberg, 2007). Thus, health-risking behaviors (Arthur et al, 2002; Broidy et al, 2003; Resnick et al., 1997), including substance use (Henry, Thornberry, & Huizinga, 2009), unsafe sexual practices (Myklestad & Rise, 2007) and violence (Resnick et al, 1997; Reiss & Roth, 1993) are most common during this developmental period. Longitudinal models indicate that depressive symptoms are often formed during adolescence (J. R. Cohen, Andrews, Davis, & Rudolph, 2018). Additionally, adolescents are at risk for various psychiatric illnesses such as schizophrenia, substance use disorders, and anxiety disorders (Paus et al., 2008). Such disorders have been found to continue into adulthood (Rohde et al. , 2013). Indeed, adolescence is a critical period for development, prosocial behaviors and the key to lifelong health and well-being. Interventions designed to maximize health and prosocial development during adolescence are of critical importance.

Certain personal and contextual factors increase the likelihood that an exposed adolescent will engage in risk behaviors, particularly risk behaviors that threaten prosocial and healthy development. In the literature, young people exposed to these risk factors are commonly labeled as *at-risk adolescents*. These personal and contextual factors can negatively contribute to an individual’s ability to thrive academically, socially, emotionally, and/or physically (Mcdaniel & Yarbrough, 2016). At-risk adolescents have the potential to escalate problem behaviors, such as drug abuse (Mcdaniel & Yarbrough, 2016), poor academic performance (Malecki & Demeray, 2006) and school misconduct (Schmidt, 2003). Given these considerations, preventive efforts are needed to minimize behavioral difficulties amongst at-risk adolescents. This is particularly salient for the design of interventions, as many existing interventions for adolescence are specifically designed for at-risk adolescents (Raposa et al., 2019). These complexities will be discussed in terms of the current thesis in subsequent sections.

## **Mentorship Interventions**

One promising intervention to promote positive adolescent outcomes among at-risk youths is mentorship. Mentorship programs provide adolescents with a role model straight from the community in which they both reside. Mentors are encouraged to enhance their mentee’s coping strategies, help their mentee reduce stressors, and create an attachment to the youth mentee (DeWit et al, 2016). Meta-analytic reviews show that adolescents in mentorship programs improve in behavioral and psychosocial outcomes as compared to their non-mentored counterparts (DuBois et al., 2011; Tolan, Henry, Schoeny, Lovegrove, & Nichols, 2014). A more recent meta-analysis found the averaged effect size of mentorship interventions across several outcomes (i.e. cognitive functioning, psychological, health) to be ḡ = 0.21 (Raposa et al., 2019), which constitutes a small effect size in terms of Cohen’s (1988) behavioral sciences effect size guidelines and a medium/moderate effect size in terms of universal youth prevention programs (Tanner-Smith, Durlak, & Marx, 2018). However, results are not always positive. For example, a meta-analytic review by Wood and Mayo-Wilson (2012) found mentorship intervention effect sizes to be small, and in some cases iatrogenic, for academic achievement, attendance and negative behavior (i.e., school misconduct, drug use). Thus, while mentoring is considered an evidence-based practice, more work to understand for whom and under what conditions mentoring leads to better outcomes for participants is needed.

*The promises and perils of group-based mentoring initiatives*

This thesis is focused specifically on group-based mentoring, which carries its own set of potential promises and perils. A group-based approach to mentorship can have several benefits. For example, group-based mentoring allows programs to serve a larger number of youths at once. Similar to dyadic (one on one) mentoring, group mentorship has seen promotions in resiliency and prosocial attitudes (Kuperminc, Chan, Hale, Joseph, & Delbasso, 2019; Weiler et al., 2015). However, group-based mentoring can also produce challenges. If the group-based mentoring program is focused on exclusively at-risk adolescents, then the act of congregating the at-risk adolescents may produce unwanted outcomes. This phenomena is described by Dishion and colleagues as deviancy training (Dishion, Eddy, Haas, Li, & Spracklen, 1997). Deviancy training is the process in which congregated deviant youth have a tendency to endorse and encourage negative and rule-breaking behavior (Poulin, Dishion, & Haas, 1999). Unfortunately, at-risk youth in group-based mentorship programs may be at risk to learn negative behaviors from each other as a result of deviancy training (Dishion & Tipsord, 2011). Friendship networks, formed during group interventions for at-risk youth, can be a root cause of deviancy training (Dishion & Tipsord, 2011; Poulin et al., 1999). Group-based mentorship interventions need to be aware of such unintended consequences.

There are effective strategies to prevent social deviancy in group interventions. Some protective moderators against the effects of deviancy training include adult monitoring, supervision, and structure (Dishion & Tipsord, 2011). Despite the known protective factors against negative deviancy training, not all group-based mentorship programs may utilize positive practices.

Youth mentoring programs have a rich history of providing positive outcomes to youth. For one, youths who participate in youth mentoring programs are much more likely to graduate from high school as opposed to their non-mentored counterparts (J. Rhodes, 2005). Research also indicates that youths with a mentor have better school attendance outcomes and better attitudes towards school (Jekielek, Moore, Hair, & Scarupa, 2002). Additionally, youths with volunteer mentors are less likely to partake in delinquent behaviors (J. Rhodes, 2005). However, differences in outcomes exist for group mentoring programs. In general, group mentoring shows more stagnant effects in terms of academic outcomes compared to traditional dyadic mentoring programs (Cummings, 2010). On the other hand, group mentoring programs show promising effects in terms of behavioral problem outcomes (Deutsch, Reitz-Krueger, Henneberger, Futch Ehrlich, & Lawrence, 2017).

## **Belongingness as an Intermediate Goal of Group-based Mentoring Programs**

An important aspect of any group-based mentorship program is perceived belongingness to the program. Belongingness is the need to gain acceptance within a community (Malone, Pillow, & Osman, 2012) and is, furthermore, an essential psychological need (Galliher, Rostosky, & Hughes, 2004). Belongingness has been studied for decades in adolescent research (Slaten, Rose, Bonifay, & Ferguson, 2018). Baumeister & Leary (1995) explain that belongingness is a fundamental part of forming relationships with adolescent peers. Prior evidence suggests that youth who report a greater sense of belonging are more likely to have higher levels of expressed relationship satisfaction (Marsh & Evans, 2009). Additionally, research conducted by Gummaden, Pittamen and Ioffe (2016) showed having a higher sense of belonging in school has positive impacts on psychological well-being. This general benefit of feeling a sense of belonging is likely extended to belonging within youth programs. For instance, measures of belonging have been positively correlated with program attendance in youth development programs (Anderson-Butcher & Conroy, 2002).

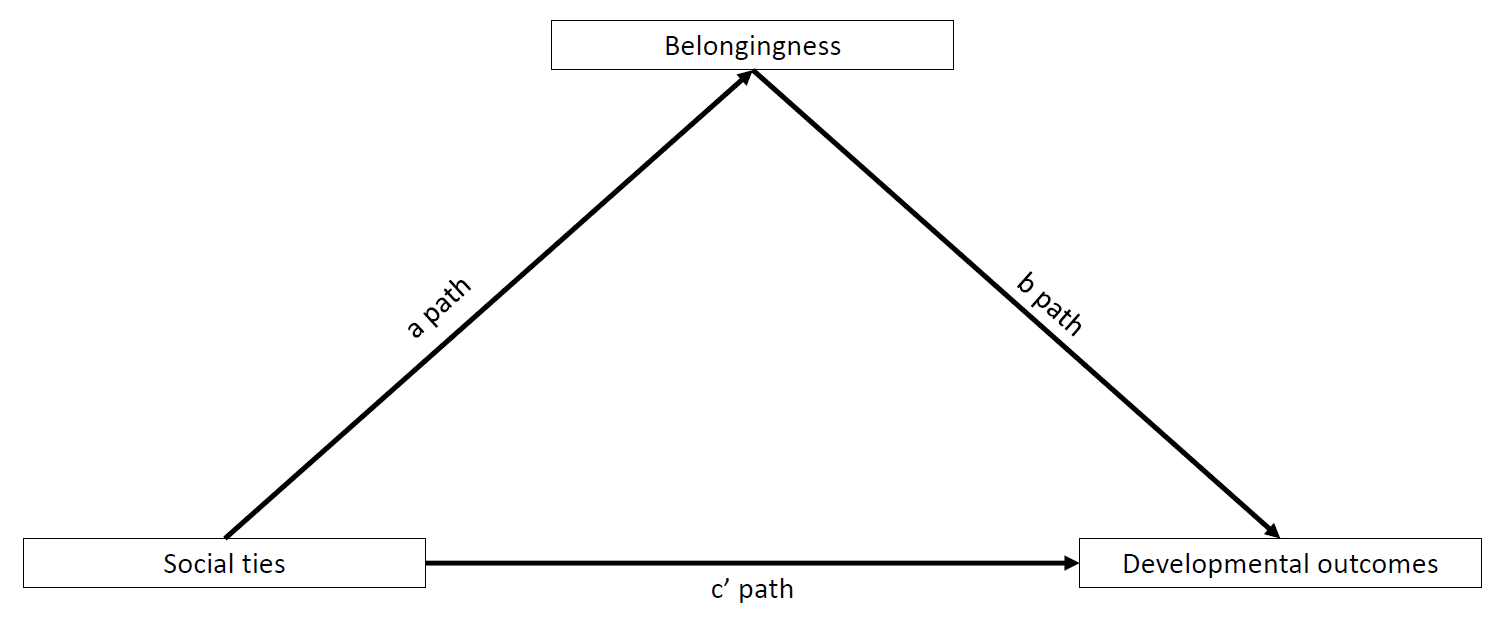
Developing a sense of belonging for youth is often a central goal of youth programs (Anderson-Butcher & Conroy, 2002). As such, a deep understanding of how belongingness is formed is essential. Two such features that lead to enhanced belonginess in youth interventions are group characteristics and staff practices (Akiva, Cortina, Eccles, & Smith, 2013).

We can also explain the need to measure belongingness from a theoretical perspective. Maslow (1943) famously indicates love and belonging as the third tier on the hierarchy of human needs. Thus, explaining its importance to humans and adolescents alike. Additionally, prosocial bonds between youth are theoretically and empirically implicated in the development of delinquent behavior (Hirschi, 2017). As such, it is important to examine an adolescent’s feeling of belongingness they form while participating in a social program focused on building positive friendships with peers.

A sense of belongingness in a group-based mentoring program is likely a necessary intervening variable that links program participation with the ultimate desired outcomes (e.g., decreased depression). That is, I hypothesize that a sense of belonging must be realized in order for a child to benefit from a group-based mentoring program. Without a sense of belonging, an adolescent is unlikely to benefit from the mentoring program. There is empirical support for this notion. Belongingness has been shown to mediate the relationship between social connections and achievement outcomes (Walton, Cohen, Cwir, & Spencer, 2012). Overall, people feel an innate need to maintain positive social bonds with one another (Baumeister & Leary, 1995). Furthermore, belonging to a group has a deep and profound impact on our attitudes and behaviors (G. L. Cohen, 2003; Walton et al., 2012). As such, an adolescent must gain a sense of belongingness in order to benefit from the program. Belonginess serves as an important mediator in any group-based program.

The feeling of belonging may be formed by social connections. Even a small, weak, connection may cause even a mere sense of belongingness (Walton et al., 2012). For example, Cwir and colleagues (2011) found that sharing preferences with a confederate stranger increased emotions and physiological arousal of a participant. Findings from Cwir and colleagues (2011) illustrate the impact of having even a subtle feeling of social connectedness. Further research shows belongingness predicts youth protective factors, such as engagement in a youth program (Anderson-Butcher & Conroy, 2002).

For my thesis, I plan to exhibit belongingness as an important mediator between social ties and several key developmental outcomes (e.g. academic achievement, anger, depression). My specific model can be seen in Figure 1. As can be seen in Figure 1, I predict that more social ties will be associated with a greater sense of belongingness, and a greater sense of belongingness will be associated with improved developmental outcomes. From this model, I will be able to identify the indirect effect (a\*b path) of social ties through belongingness. The c’ path will represent the direct effect of social ties on the developmental outcomes.



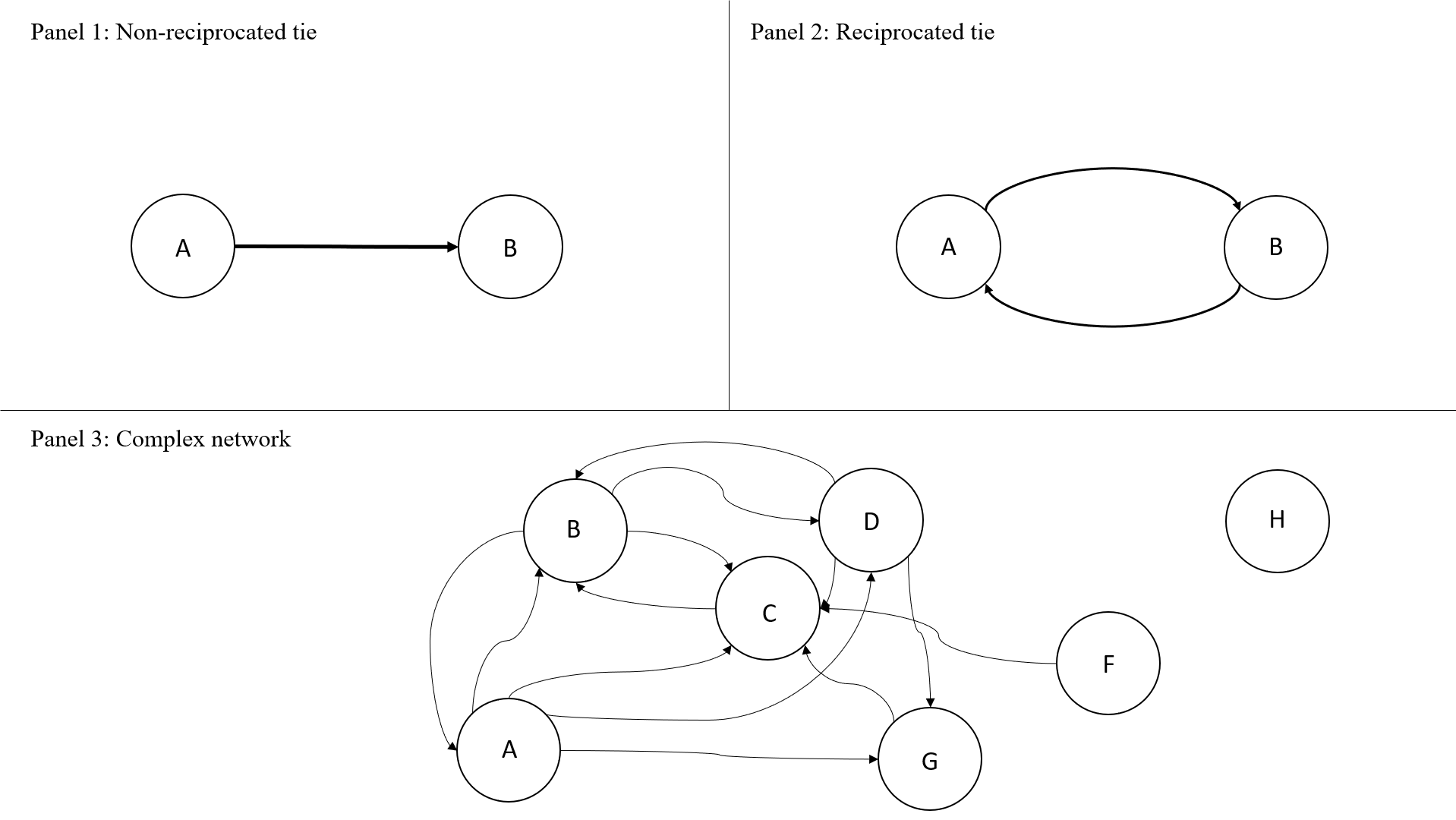
*Figure 1*. Proposed mediation model.

## **Social Networks**

For this thesis, I plan to understand how social ties lead to a sense of belonging, which will be a prime intermediate variable linking social ties to the key outcomes (i.e., academic performance, depression, anger, and delinquent behaviors). Social network analysis (SNA) is a path to understand that. For my thesis, I plan to use social network statistics derived from SNA to answer my research questions. A social network approach will shed light on how adolescents in a group-based intervention can develop an enhanced sense of belonging as they develop bonds to other individuals in the program, and ultimately, how the development of bonds with others and the resulting sense of belonging in the program can pave the way for better developmental outcomes for participants. Using a social network approach, I can help to identify what aspects of bonds formed in a mentorship intervention may contribute the most to an adolescent’s sense of belonging and ultimately to better developmental outcomes. In this section, I describe SNA in greater detail and SNA will be used to answer my research questions.

### *Defining Social Networks and Social Network Statistics*

A social network is the structure of relationships that connect people within a defined population. Every network consists of a set of actors with defining characteristics (nodes) and lines to represent the connections between them (known as ties or edges). The ties are directed, indicating whether the relationship is one-sided or reciprocal. For example, consider Figure 2, which depicts potential relationships between two nodes. In panel 1, Node A reports an outgoing connection with Node B, but Node B reports no connection with Node A (no incoming tie from Node B to Node A) – this is an unreciprocated tie. In panel 2, Node A reports a connection with Node B and Node B reports a connection with Node A – this is a reciprocated tie. Panel 3 presents a more complex social network with many nodes. Notice that some nodes (e.g, Node A) have many outgoing ties (i.e., the actor reports that he has a connection with many other actors) while other nodes (e.g., Node G) reports few connections with other actors. Some nodes (e.g., Node B) have many reciprocated connections, while others have few reciprocated connections (e.g., Node C). Notice that some Nodes (e.g., Node D) are very well connected in the network, they have may incoming and outgoing ties, while other nodes (e.g., Node F) are not well connected in the network, and there is even one node (Node H) which is completely isolated (they have no incoming or outgoing ties).



*Figure 2.* Three panels representing nodes and ties.

Social networks are analyzed via social network analysis (SNA), a vast set of techniques that allow for the quantitative assessment of networks, including all of the quantities touched on in my earlier example (e.g., number of incoming ties, number of outgoing ties, number of reciprocated ties, centrality in the network for each node), and much more (Kadushin, 2012; Valente, 2010). SNA is the process of understanding social structures quantitatively through network theory and graph theory (Butts, 2008). A wide array of statistics can be derived from social network analysis – often called network statistics. Network statistics allow researchers to quantitatively measure all levels of a social structure (Krause, Croft, & James, 2007). Network statistics may be represented at the person-level or network-level. On a person-level, any single node may be analyzed in terms of its centrality (the number of incoming and/or outgoing ties). From here, we may evaluate whom has the most social capital in a network and what attributes (i.e. age, gender) are related to having social capital. On the network-level, we are interested in the structure the network takes. Network density is one such network statistic that evaluates the whole network. Network density is the proportion of actualized network ties to the total possible number of ties (Giuffre, 2015). The denser the network, the more possible connections are formed.

## **Proposal**

This study aims to quantify each mentee’s connections with their primary mentor, with other mentors, and with mentees using SNA, and then to study how these various connections with others in the program are related to the mentee’s sense of belonging in the program and to their improvement in a set of key developmental outcomes (i.e., academic performance, depression, anger, and delinquent behaviors) over the course of the intervention. The reasoning for this approach is to understand which relationships matter most in an adolescent mentorship program. I hypothesize that as youth’s social network grows over the course of the intervention, their sense of belonging will also grow. However, the comparative effects of connections with each relevant party (primary mentor, other mentors, mentees) on growth in sense of belonging will be exploratory. Furthermore, I aim to expand our understanding of the most pertinent relationship ties in a mentorship intervention by analyzing which types of ties (i.e. ties with the mentor vs. ties with other youth in the program) are most associated with improvement in the developmental outcomes, and the extent to which a sense of belonging in the program mediates the effect of social ties on improvement in these developmental outcomes.

For this thesis, the following s. My first research question is: sense of belongingnesstype of social network connection I hypothesize that a youth’s growth in social network across time in a youth mentoring program will correlate highly with the change in belongingness. Next, for research question 2, I ask: How strong of a mediator is belongingness between a youth’s social connections and developmental outcomes (i.e., academic performance, depression, anger, and delinquent behaviors)? Figure 1 presents my proposed mediation model. (i.e., academic performance, depression, anger, and delinquent behaviors)

# CHAPTER II: METHOD

## **Study Protocol**

Data for this project were collected from youth who participated in the Campus Connections (CC) mentoring intervention at Colorado State University (CSU). Campus Connections at CSU is a mentoring program for youth at heightened risk for poor developmental outcomes, such as behavioral and emotional problems. It is flexibly designed to respond to the needs of a heterogeneous group of youth with varying risk levels and is grounded in theoretical and empirical research on positive youth development settings (Eccles & Appleton Gootman, 2002; Kelly, Ryan, Altman, & Stelzner, 2000; Tseng & Seidman, 2007) and Rhodes’ model of youth mentoring (J. E. Rhodes, 2005). See Haddock et al. (2013) and Weiler et al. (2015) for complete information on the program model.

At Campus Connections, youth are paired one-on-one with an undergraduate student who is enrolled in a 3-credit service-learning course for 12 weeks. The mentoring dyad meets four hours per week on campus and engages in a semi-structured program including “walk and talks,” academic support, dinner and other prosocial activities. Youth are constantly encouraged to engage in the mentoring community so they may gain a sense of belonging and mattering, develop social skills, and realize leadership skills. In addition, there are Marriage and Family Therapist (MFT) students and other trained staff around to help support youth and mentors. The MFT students and staff are trained to facilitate relationships between the mentors and mentees at CC.

Data were collected as part of a three-year grant funded by the William T. Grant (WTG) foundation to study two versions of a youth mentoring program. The first involved traditional dyadic mentoring, in which one mentor was assigned to one mentee to experience the 12-week program together. The second involved nesting 4 mentor-mentee pairs which were called mentor families. As a result, mentees were exposed to both a mentor of their own, as well as to 3 other mentor-mentee pairs in their mentor family over the course of the 12-week program. More information of the youth mentor family approach may be read in Haddock et al. (2013).

Campus Connections takes place four nights per week (Monday – Thursday) during a regular academic semester (12 weeks), with each mentee assigned to one night. Approximately twenty-eight mentees were assigned to each night. Each semester, two of the nights were randomly assigned to the traditional dyadic mentoring condition, and two of the nights were randomly assigned to the mentor family condition. Only the control group will be utilized for the proposed study. This decision was made because the control group more accurately reflects most group mentoring programs. Thus, the results from my thesis will be more generalizable to other group mentoring programs.

Youth (mentees) were referred to the CC program through several community agencies including the local school district, juvenile justice system, Department of Human Services, and various youth and family agencies. Upon receipt of the referral, trained CC staff contacted potential participants and conducted intake appointments to determine program eligibility and obtain youth assent and parental consent. Study inclusion criteria included: Youth aged 11-18 years of age, reported experience of at least one risk factor from the risk screening tool (Herrera, Dubois, & Grossman, 2013), and available to participate during the CC operating hours. Participants could not have participated in previous CC sessions to be eligible for this study.

## **Measures**

In the proposed investigation, data were drawn from multiple time-points. If eligible and willing to participate in the CC program, mentees were provided 6 surveys during their time at CC. Surveys were provided at intake (Baseline; wave 0), week 1 (wave 1), week 3 (wave 2), week 6 (wave 3), week 9 (wave 4), and week 11 (wave 5) of the 12-week program. Surveys were completed using Qualtrics, a web-based survey software. The Institutional Review Board at Colorado State University approved all the described procedures.

### *Demographics*

All youth demographics were collected at program intake (wave 0). Youth reported on their own primary demographic characteristics including age (11-18) and race/ethnicity. Parents reported child SES demographics (such as household income) and youth social emotional skills.

### *Belongingness*

Campus Connection mentees responded to a five-item scale that inquired about their sense of belongingness at CC via an adaption of the belonginess measure created by Youth Development strategies, Inc. This measure was distributed at wave 1-5. At wave 1, youth participants were asked about their expectations to belong (i.e. “I feel like I will belong at Campus Connections”). For all other weeks, youth were asked about their present feelings of belongingness in the program (i.e. “I belong at Campus Connections”). Cronbach’s alpha was adequate at all five time points (α = .88 - .92).

### *Social Network*

Youth were asked to indicate their relationships with other youth, mentors, and staff in the program during wave 1-5 of the program. Youth were shown pictures of other youth, mentors, and program staff within the program and were asked to select all that they had a relationship with. Youth were then asked to rate the relationship with each selected individual on a scale of 1-10.

From these data the following individual network statistics will be calculated: *Inbound connections* and *outbound connections*. Inbound connections are connections that someone else chose towards the individual of interest (the arrow points into the ego of interest). Specifically, the inbound connections will be the strength of ties that other individuals indicate towards the person of interest. For example, if three individuals each indicated a connection with the individual of interest and each of those three ties had a strength of 5, then the total strength of inbound ties will be 15. Outbound connections are those that the individual of interest is choosing towards another individual (the arrow is pointing out of the ego). Specifically, the outbound connections will be the strength of ties that the person of interest indicates towards other individuals in the program. For example, if the individual of interest indicated three ties outbound towards other people with a strength of 4 each, then the total strength of outbound ties will be 12. We are also interested in the combination of inbound and outbound connections. This will be the sum of the inbound and outbound strength.

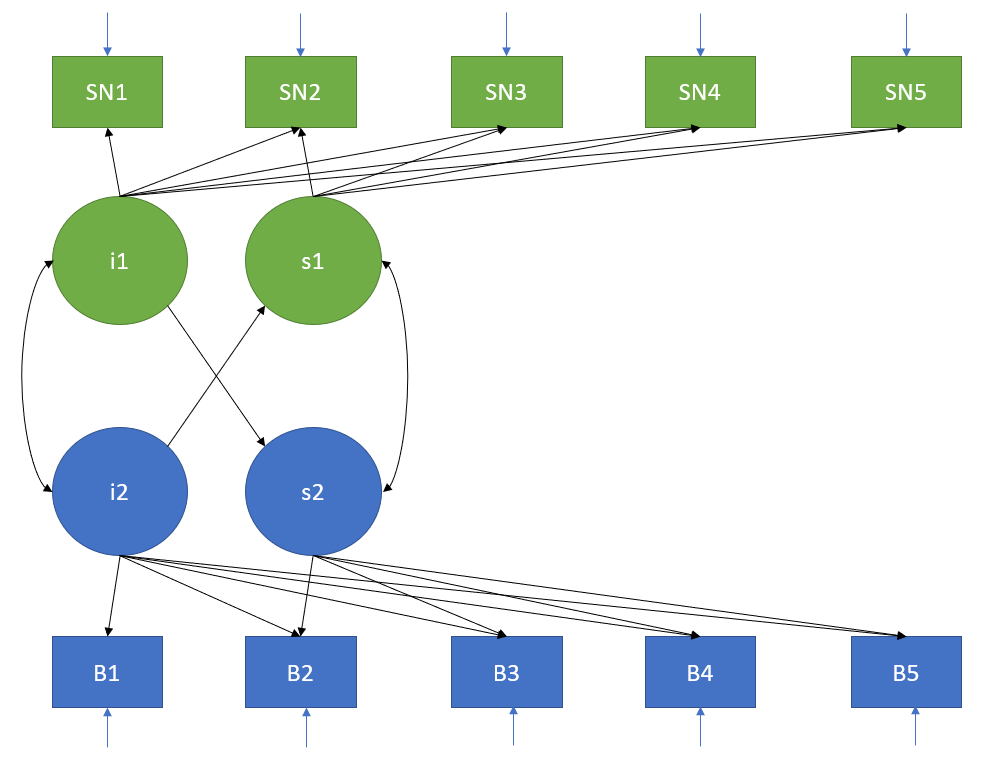
## **Analysis Plan**

All models will control for age, sex, ethnicity, SES (parent report) and youth social emotional skills (parent report).

### *Analysis for Research Question 1*

Latent growth modeling using Mplus, version 8 (Muthén & Muthén, 1998) will be used to model the growth of belongingness and the count of social ties across the five timepoints of CC. More specifically, a growth model for two parallel processes (one growth model for belonging and one growth model for strength of social ties) for continuous outcomes will be implemented. The growth parameters within and cross process will be specified to correlate. I hypothesize the correlation of the growth trajectory between the social network measures and the belongingness measures will be high. The latent growth curve model will analyze the changes in the strength of ties from wave 1 to wave 5 of the study. The latent growth curve model will additionally analyze the changes in the belongingness measure from wave 1 to wave 5 of the study.

Latent growth curve modeling is an appropriate model to answer this research question. Latent growth curve modeling is a method for describing within-person change and between-person change (Grimm, Ram, & Hamagami, 2011). It additionally tracks the growth trajectory of a repeated measures study. However, one aspect of growth models is that the growth trajectory is linear and to have a normalized distribution (characterized by a mean of zero; Grimm et al., 2011). For this thesis, I cannot assume that the growth of the social network grows at a linear rate. Therefore, I will utilize a non-linear growth curve model known as a *latent basis growth* *model* as proposed by Grimm, Ram and Hamagami (2011). The latent basis growth model is flexibly designed to capture a variety of nonlinear change patterns because it does not have a specific functional form. This model allows for an atheoretical structure of change, thus allowing for the exploratory analysis I am searching for to answer this research question.



*Figure 3.* Anticipated growth trajectory model for trajectory analysis plan. Straight arrows represent regression lines, curved arrows represent correlations and blue arrows represent error.

### *Analysis for Research Question 2*

Next, I will fit a mediation model with belongingness at week 9 (wave 4) as a mediator between the number of connections (inbound, outbound, and inbound/outbound) at week 6 (wave 3) and a developmental outcome (i.e. academic aspirations, delinquency) at week 11 (wave 5). The proposed model is shown in Figure 1. To calculate this, I will first analyze the direct effect of social connections on the developmental outcomes (i.e. delinquency, academic aspirations; the c path) at week 11 (wave 5). Next, I will regress belongingness from week 9 (wave 4) on the social connections (a path) at week 6 (wave 3) to obtain the coefficients. Then, I will regress the developmental outcomes (i.e. delinquency, academic aspirations) onto the strength of the social ties and belongingness (b path and c’ path). I will then multiply the a path and the b path to obtain the indirect effect. According to MacKinnon et al. (2007), the confidence intervals for a mediation model indirect effect are not distributed normally. Therefore, the bootstrapped confidence intervals for the indirect effect will be taken to determine more accurate confidence intervals and statistical significance. With this model, I aim to understand the impact belongingness has on developmental outcomes (i.e., academic performance, depression, anger, and delinquent behaviors).

# **References**

Akiva, T., Cortina, K. S., Eccles, J. S., & Smith, C. (2013). Youth belonging and cognitive engagement in organized activities: A large-scale field study. *Journal of Applied Developmental Psychology*, *34*(5), 208–218. https://doi.org/10.1016/j.appdev.2013.05.001

Anderson-Butcher, D., & Conroy, D. E. (2002). Factorial and criterion validity of scores of a measure of belonging in youth development programs. *Educational and Psychological Measurement*, *62*(5), 857–876. https://doi.org/10.1177/001316402236882

Baumeister, R. F., & Leary, M. R. (1995). The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation. In *Psychological Bulletin* (Vol. 117).

Butts, C. T. (2008). *Social network analysis: A methodological introduction*. https://doi.org/10.1111/j.1467-839X.2007.00241.x

Cohen, G. L. (2003, November). Party Over Policy: The Dominating Impact of Group Influence on Political Beliefs. *Journal of Personality and Social Psychology*, Vol. 85, pp. 808–822. https://doi.org/10.1037/0022-3514.85.5.808

Cohen, J. (1992). Statistical Power Analysis. *Current Directions in Psychological Science*, *1*(3), 98–101. https://doi.org/10.1111/1467-8721.ep10768783

Cohen, J. R., Andrews, A. R., Davis, M. M., & Rudolph, K. D. (2018). Anxiety and Depression During Childhood and Adolescence: Testing Theoretical Models of Continuity and Discontinuity. *Journal of Abnormal Child Psychology*, *46*(6), 1295–1308. https://doi.org/10.1007/s10802-017-0370-x

Crosnoe, R., & Johnson, M. K. (2011). Research on Adolescence in the Twenty-First Century. *Annual Review of Sociology*, *37*(1), 439–460. https://doi.org/10.1146/annurev-soc-081309-150008

Cummings, L. (2010). Evaluating the Influence of Participaiton in a Diverse High School-Based Group Mentoring Program. *Psychology Dissertations*. Retrieved from https://scholarworks.gsu.edu/psych\_diss/69

Cwir, D., Carr, P. B., Walton, G. M., & Spencer, S. J. (2011). Your heart makes my heart move: Cues of social connectedness cause shared emotions and physiological states among strangers. *Journal of Experimental Social Psychology*, *47*(3), 661–664. https://doi.org/10.1016/j.jesp.2011.01.009

Deutsch, N. L., Reitz-Krueger, C. L., Henneberger, A. K., Futch Ehrlich, V. A., & Lawrence, E. C. (2017). “It Gave Me Ways to Solve Problems and Ways to Talk to People”: Outcomes From a Combined Group and One-on-One Mentoring Program for Early Adolescent Girls. *Journal of Adolescent Research*, *32*(3), 291–322. https://doi.org/10.1177/0743558416630813

Dishion, T. J., Eddy, J. M., Haas, E., Li, F., & Spracklen, K. (1997). Friendships and violent behavior during adolescence. *Social Development*, *6*(2), 207–223. https://doi.org/10.1111/j.1467-9507.1997.tb00102.x

Dishion, T. J., & Tipsord, J. M. (2011). Peer Contagion in Child and Adolescent Social and Emotional Development. *Annual Review of Psychology*, *62*(1), 189–214. https://doi.org/10.1146/annurev.psych.093008.100412

DuBois, D. L., Portillo, N., Rhodes, J. E., Silverthorn, N., & Valentine, J. C. (2011). How Effective Are Mentoring Programs for Youth? A Systematic Assessment of the Evidence. *Psychological Science in the Public Interest*. https://doi.org/10.1177/1529100611414806

Eccles, J., & Appleton Gootman, J. (2002). *Community Programs to Promote Youth Development*. https://doi.org/10.17226/10022

Galliher, R. V., Rostosky, S. S., & Hughes, H. K. (2004). School belonging, self-esteem, and depressive symptoms in adolescents: An examination of sex, sexual attraction status, and urbanicity. *Journal of Youth and Adolescence*, *33*(3), 235–245. https://doi.org/10.1023/B:JOYO.0000025322.11510.9d

Galvan, A., Hare, T. A., Parra, C. E., Penn, J., Voss, H., Glover, G., & Casey, B. J. (2006). Behavioral/Systems/Cognitive Earlier Development of the Accumbens Relative to Orbitofrontal Cortex Might Underlie Risk-Taking Behavior in Adolescents. *Soc Neuroscience*. https://doi.org/10.1523/JNEUROSCI.1062-06.2006

Giuffre, K. (2015). Network Density - an overview | ScienceDirect Topics. Retrieved May 26, 2020, from https://www.sciencedirect.com/topics/computer-science/network-density

Grimm, K. J., Ram, N., & Hamagami, F. (2011). Nonlinear growth curves in developmental research. *Child Development*, *82*(5), 1357–1371. https://doi.org/10.1111/j.1467-8624.2011.01630.x

Gummadam, P., Pittman, L. D., & Ioffe, M. (2016). School Belonging, Ethnic Identity, and Psychological Adjustment Among Ethnic Minority College Students. *Journal of Experimental Education*, *84*(2), 289–306. https://doi.org/10.1080/00220973.2015.1048844

Haddock, S., Weiler, L., Krafchick, J., Zimmerman, T. S., Mclure, M., & Rudisill, S. (2013). Campus Corps Therapeutic Mentoring: Making a Difference for Mentors. In *Journal of Higher Education Outreach and Engagement* (Vol. 17). Retrieved from http://openjournals.libs.uga.edu/index.php/jheoe/article/viewFile/1115/720

Henry, K. L., Thornberry, T. P., & Huizinga, D. H. (2009). A discrete-time survival analysis of the relationship between truancy and the onset of marijuana use. *Journal of Studies on Alcohol and Drugs*, *70*(1), 5–15. https://doi.org/10.15288/jsad.2009.70.5

Herrera, C., Dubois, D. L., & Grossman, J. B. (2013). *The Role of Risk Mentoring experiences and outcomes for Youth with Varying Risk Profiles*. Retrieved from https://www.mdrc.org/sites/default/files/Role of Risk\_Final-web PDF.pdf

Hirschi, T. (2017). *Causes of delinquency*. Retrieved from https://content.taylorfrancis.com/books/download?dac=C2017-0-50434-3&isbn=9781351529723&format=googlePreviewPdf

Jekielek, S. M., Moore, K. A., Hair, E. C., & Scarupa, H. J. (2002). Mentoring: A Promising Strategy for Youth Development. In *ourchildrenla.org*. Retrieved from https://www.ourchildrenla.org/wp-content/uploads/2015/08/jekielek-mentoring.pdf

Kadushin, C. (2012). *Understanding social networks: Theories, concepts, and findings*. Retrieved from https://books.google.com/books?hl=en&lr=&id=ALOhpMgkW\_cC&oi=fnd&pg=PP2&dq=Kadushin,+C.+(2012).+Understanding+social+networks:+Theories,+concepts,+and+findings.+Oup+Usa.&ots=7Q06cxqXqO&sig=rQbi342gYoMXdwr4qU7tolnjtd8

Kelly, J. G., Ryan, A. M., Altman, B. E., & Stelzner, S. P. (2000). Understanding and Changing Social Systems. In *Handbook of Community Psychology* (pp. 133–159). https://doi.org/10.1007/978-1-4615-4193-6\_7

Krause, J., Croft, D. P., & James, R. (2007). Social network theory in the behavioural sciences: potential applications. *Behavioral Ecology and Sociobiology*, *62*(1), 15–27. https://doi.org/10.1007/s00265-007-0445-8

Kuperminc, G. P., Chan, W. Y., Hale, K. E., Joseph, H. L., & Delbasso, C. A. (2019). The Role of School-based Group Mentoring in Promoting Resilience among Vulnerable High School Students. *American Journal of Community Psychology*, ajcp.12347. https://doi.org/10.1002/ajcp.12347

MacKinnon, D. P., Fritz, M. S., Williams, J., & Lockwood, C. M. (2007). Distribution of the product confidence limits for the indirect effect: Program PRODCLIN. *Behavior Research Methods*, *39*(3), 384–389. https://doi.org/10.3758/BF03193007

Malecki, C., Quarterly, M. D.-S. P., & 2006, undefined. (n.d.). Social support as a buffer in the relationship between socioeconomic status and academic performance. *Psycnet.Apa.Org*. Retrieved from https://psycnet.apa.org/doiLanding?doi=10.1037%2Fh0084129

Malone, G. P., Pillow, D. R., & Osman, A. (2012). The general belongingness scale (gbs): Assessing achieved belongingness. *Personality and Individual Differences*, *52*(3), 311–316. https://doi.org/10.1016/j.paid.2011.10.027

Marsh, S. C., & Evans, W. P. (2009). Youth Perspectives on Their Relationships With Staff in Juvenile Correction Settings and Perceived Likelihood of Success on Release. *Youth Violence and Juvenile Justice*, *7*(1), 46–67. https://doi.org/10.1177/1541204008324484

Maslow, A. H. (1943). A THEORY OF HUMAN MOTIVATION. In *psycnet.apa.org*. Retrieved from https://psycnet.apa.org/journals/rev/50/4/370/

Mcdaniel, S., & Yarbrough, A.-M. (n.d.). *A Literature Review of Afterschool Mentoring Programs for Children At Risk*.

Muthén, L. K., & Muthén, B. O. (1998). *Statistical Analysis With Latent Variables User’s Guide*. Retrieved from www.StatModel.com

Myklestad, I., & Rise, J. (2007). Predicting Willingness to Engage in Unsafe Sex and Intention to Perform Sexual Protective Behaviors Among Adolescents. *Journals.Sagepub.Com*, *34*(4), 686–699. https://doi.org/10.1177/1090198106289571

Paus, T., Keshavan, M., & Giedd, J. N. (2008, December). Why do many psychiatric disorders emerge during adolescence? *Nature Reviews Neuroscience*, Vol. 9, pp. 947–957. https://doi.org/10.1038/nrn2513

Poulin, F., Dishion, T. J., & Haas, E. (1999). The peer influence paradox: Friendship quality and deviancy training within male adolescent friendships. *Merrill-Palmer Quarterly*, *45*(1), 42–61. Retrieved from https://colostate.primo.exlibrisgroup.com/discovery/openurl?institution=01COLSU\_INST&vid=01COLSU\_INST:01COLSU&volume=45&date=1999&aulast=Poulin&issue=1&issn=0272-930X&spage=42&auinit=F&title=Merrill-Palmer quarterly.&atitle=The Peer Influence Paradox: Fri

Raposa, E. B., Rhodes, J., Stams, G. J. J. M., Card, N., Burton, S., Schwartz, S., … Hussain, S. (2019, March 15). The Effects of Youth Mentoring Programs: A Meta-analysis of Outcome Studies. *Journal of Youth and Adolescence*, Vol. 48, pp. 423–443. https://doi.org/10.1007/s10964-019-00982-8

Resnick, M. D., Bearman, P. S., Robert, ;, Blum, W., Bauman, K. E., Harris, K. M., … Udry, ; J Richard. (n.d.). *Protecting Adolescents From Harm Findings From the National Longitudinal Study on Adolescent Health*. Retrieved from https://jamanetwork.com/

Rhodes, J. (2005). A model of youth mentoring. In *Handbook of youth mentoring*. Retrieved from https://books.google.com/books?hl=en&lr=&id=H5h2AwAAQBAJ&oi=fnd&pg=PA30&dq=Rhodes,+J.+E.+(2005).+A+model+of+youth+mentoring.+In+D.L.+Dubois+%26+M.J.+Karcher+(Eds.),+Handbook+of+youth+mentoring,+(pp.+30-43).+Thousand+Oaks,+CA:+Sage.&ots=bxTbGXiCa7&sig=8wdW

Rhodes, J. E. (2005). A model for youth mentoring. In *Handbook of youth mentoring* (pp. 30–43).

Rohde, P., Lewinsohn, P., … D. K.-C., & 2013, undefined. (2013). Key characteristics of major depressive disorder occurring in childhood, adolescence, emerging adulthood, and adulthood. *Journals.Sagepub.Com*, *1*(1), 41–53. https://doi.org/10.1177/2167702612457599

Schmidt, J. A. (2003). Correlates of Reduced Misconduct among Adolescents Facing Adversity. *Journal of Youth and Adolescence*, *32*(6), 439–452. https://doi.org/10.1023/A:1025938402377

Siegel, D. (2015). *Brainstorm: The power and purpose of the teenage brain*. Retrieved from https://books.google.com/books?hl=en&lr=&id=u0cCDAAAQBAJ&oi=fnd&pg=PA1&dq=brainstorm+siegel&ots=Y9hW50pPpW&sig=TCbsK0eDFXcwwMqHSp9Zbw507Ns

Slaten, C. D., Rose, C. A., Bonifay, W., & Ferguson, J. K. (2018). The Milwaukee Youth Belongingness Scale (MYBS): Development and Validation of the Scale Utilizing Item Response Theory. *School Psychology Quarterly*. https://doi.org/10.1037/spq0000299

Steinberg, L. (2007). Risk taking in adolescence: New perspectives from brain and behavioral science. *Current Directions in Psychological Science*, *16*(2), 55–59. https://doi.org/10.1111/j.1467-8721.2007.00475.x

Tanner-Smith, E. E., Durlak, J. A., & Marx, R. A. (2018, November 1). Empirically Based Mean Effect Size Distributions for Universal Prevention Programs Targeting School-Aged Youth: A Review of Meta-Analyses. *Prevention Science*, Vol. 19, pp. 1091–1101. https://doi.org/10.1007/s11121-018-0942-1

Tolan, P. H., Henry, D. B., Schoeny, M. S., Lovegrove, P., & Nichols, E. (2014). Mentoring programs to affect delinquency and associated outcomes of youth at risk: A comprehensive meta-analytic review. *Journal of Experimental Criminology*. https://doi.org/10.1007/s11292-013-9181-4

Tseng, V., & Seidman, E. (2007). A systems framework for understanding social settings. *American Journal of Community Psychology*, *39*(3–4), 217–228. https://doi.org/10.1007/s10464-007-9101-8

Valente, T. W. (2010). *Social Networks and Health: Models, Methods, and Applications - Thomas W. Valente - Google Books*. Retrieved from https://books.google.com/books?hl=en&lr=&id=xnMzd1-7iGgC&oi=fnd&pg=PR11&dq=Valente,+T.+W.+(2010).+Social+networks+and+health:+Models,+methods,+and+applications.+Oxford+University+Press.&ots=YrsR7jQ0\_E&sig=7VK2PHWqvd9qupqZPvR5b2msCrQ#v=onepage&q=Valente%2C

Walton, G. M., Cohen, G. L., Cwir, D., & Spencer, S. J. (2012). Mere belonging: The power of social connections. *Journal of Personality and Social Psychology*, *102*(3), 513–532. https://doi.org/10.1037/a0025731

Weiler, L. M., Haddock, S. A., Zimmerman, T. S., Henry, K. L., Krafchick, J. L., & Youngblade, L. M. (2015). Time-Limited, Structured Youth Mentoring and Adolescent Problem Behaviors. *Applied Developmental Science*, *19*(4), 196–205. https://doi.org/10.1080/10888691.2015.1014484

Wesely, J. K., Dzoba, N. P., Miller, H. V., & Rasche, C. E. (2017). Mentoring At-Risk Youth: an Examination of Strain and Mentor Response Strategies. *American Journal of Criminal Justice*, *42*(1), 198–217. https://doi.org/10.1007/s12103-016-9353-7

Wood, S., & Mayo-Wilson, E. (2012). School-Based Mentoring for Adolescents. *Research on Social Work Practice*, *22*(3), 257–269. https://doi.org/10.1177/1049731511430836