SOCIAL NETWORK INFLUENCES ON DEPRESSIVE SYMPTOMS AMONG CHINESE ADOLESCENTS

by

Janet Okamoto

A Dissertation Presented to the
FACULTY OF THE USC GRADUATE SCHOOL
UNIVERSITY OF SOUTHERN CALIFORNIA
In Partial Fulfillment of the
Requirements for the Degree
DOCTOR OF PHILOSOPHY
(PREVENTIVE MEDICINE (HEALTH BEHAVIOR))

August 2010

Copyright 2010 Janet Okamoto
DEDICATION

To my family for their unconditional support and faith in me.
ACKNOWLEDGEMENTS

I would like to thank my committee members, Drs. Adam Leventhal, Joel Milam, Mary Ann Pentz, and David Schwartz for their time, support, and assistance. I would especially like to thank my mentor and committee chair, Dr. Thomas Valente for his guidance, advice, the opportunities he has given me and for being a wonderful teacher.

I am grateful to the wonderful faculty, past and present, at the Institute for Health Promotion and Disease Prevention Research (IPR) who have helped me along the way, with special thanks to Drs. C. Anderson Johnson, Paula Palmer, Ping Sun, and Jennifer Unger. I would also like to acknowledge the administrative staff at IPR who is so good at helping out with the small, everyday details that were necessary to move through this process.

I would also like to thank all of the many colleagues I have met on my journey through this program, including those in China who made this dissertation possible with their efforts to make the TTAURC intervention project happen and who collected all of the data that was used for these studies. They not only taught me a lot about the Chinese culture, but about patience, understanding, and the power of cooperative effort. I am also grateful to all of my fellow doctoral students throughout these years, who helped to challenge me and also lend an ear to listen or a shoulder to lean on.

This research was supported in part by the Transdisciplinary Tobacco and Alcohol Use Research Center (5P50-CA 084735) and a Cancer Control and Epidemiology Research Training Grant (5T32CA009492-24)
# TABLE OF CONTENTS

Dedication \hspace{2cm} ii  
Acknowledgements \hspace{2cm} iii  
List of Tables \hspace{2cm} v  
List of Figures \hspace{2cm} vi  
Abstract \hspace{2cm} vii  
Chapter 1: Introduction \hspace{2cm} 1
  Specific Aims \hspace{2cm} 3
    Background & Significance \hspace{2cm} 5
    Peer Relationships in Adolescence \hspace{2cm} 6
    Depression in Adolescence \hspace{2cm} 7
    Peer Relationships and Depressive Symptoms \hspace{2cm} 9
    Theoretical Overview of the Influence of Peers on Depression \hspace{2cm} 13
  Parent Study \hspace{2cm} 19
  Conceptual Model Overview \hspace{2cm} 20
  Conclusion & Chapter Summary \hspace{2cm} 23
Chapter 2: Social integration and depression among adolescents: Associations between social network status and depressive symptoms in a Chinese sample \hspace{2cm} 24
  Introduction \hspace{2cm} 25
  Methods \hspace{2cm} 28
  Results \hspace{2cm} 34
  Discussion \hspace{2cm} 40
Chapter 3: Peer Contagion and Adolescent Depression: The Effects of Peers’ Depressive Symptoms and Social Network Status \hspace{2cm} 47
  Introduction \hspace{2cm} 48
  Methods \hspace{2cm} 53
  Results \hspace{2cm} 59
  Discussion \hspace{2cm} 68
Chapter 4: The Classroom Social Network and Depressive Symptoms: Do Network Composition and Characteristics Influence Adolescent Depression? \hspace{2cm} 75
  Introduction \hspace{2cm} 76
  Methods \hspace{2cm} 79
  Results \hspace{2cm} 85
  Discussion \hspace{2cm} 89
Chapter 5: Discussion & Conclusions \hspace{2cm} 95
Bibliography \hspace{2cm} 109
<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Study One Sample Characteristics</td>
<td>35</td>
</tr>
<tr>
<td>Table 2</td>
<td>Standardized coefficients (β) for Three Models of Social Network Status and Depressive Symptoms by School Type &amp; Gender</td>
<td>38</td>
</tr>
<tr>
<td>Table 3</td>
<td>Adjusted Odds Ratios for Three Models of Social Network Status and Depression (CES-D ≥28) by School Type &amp; Gender</td>
<td>39</td>
</tr>
<tr>
<td>Table 4</td>
<td>Study Two Sample Characteristics</td>
<td>59</td>
</tr>
<tr>
<td>Table 5</td>
<td>Standardized Coefficients for Multilevel Models of Friend Depressive Symptom on Depressive Symptoms</td>
<td>63</td>
</tr>
<tr>
<td>Table 6</td>
<td>Odds Ratios for Multilevel Models of Friend Depressive Symptom on Depressive Symptoms</td>
<td>64</td>
</tr>
<tr>
<td>Table 7</td>
<td>Standardized Coefficients for Multilevel Models of Friend Depression on Depressive Symptoms</td>
<td>66</td>
</tr>
<tr>
<td>Table 8</td>
<td>Odds Ratios for Multilevel Models of Friend Depression on Depression</td>
<td>67</td>
</tr>
<tr>
<td>Table 9</td>
<td>Standardized Coefficients for Multilevel Models of Friend Social Network Status on Depressive Symptoms</td>
<td>69</td>
</tr>
<tr>
<td>Table 10</td>
<td>Study Three Sample Characteristics</td>
<td>86</td>
</tr>
<tr>
<td>Table 11</td>
<td>Standardized coefficients (β) for multilevel models for effects of social network measures on classroom depression</td>
<td>88</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Figure 1</td>
<td>Adapted Main Effects Theoretical Model</td>
<td>21</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Ecological Perspective: Levels of Social-Contextual Analysis</td>
<td>22</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Basic Conceptual Model</td>
<td>23</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Friendship Network Diagram</td>
<td>31</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Most Liked Network Diagram</td>
<td>32</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Examples of Centralized and Decentralized Networks</td>
<td>82</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Distribution of Peer Status Categories (Friend Nominations)</td>
<td>83</td>
</tr>
<tr>
<td>Figure 8</td>
<td>Distribution of Peer Status Categories (Most Liked Nominations)</td>
<td>84</td>
</tr>
</tbody>
</table>
ABSTRACT

The goal of this dissertation was to investigate the impact of social network influences on depression in adolescents. Three studies assessed this goal by examining the social determinants of depressive symptoms among adolescents at different levels of analysis: the intrapersonal or individual level, the friendship group level, and the social network level. Study One tested a main effects model of depression at the individual level, hypothesizing that social integration would be associated with depressive symptoms. It investigated whether network status was related to depression and depressive symptoms. Study Two moved to the next level of analysis and looked at depressive contagion. This was assessed by testing whether the level of friends’ depressive symptoms and friend social status was related to an adolescent’s own depressive symptoms. Finally, Study Three explored the network level by looking at the classroom social network structure and characteristics and examined how these factors work to influence depression outcomes. Results from the statistical models in the three studies indicated that social network influences are associated with depression-related outcomes. However, this basic pattern varied in relation to gender, school type, and social integration at the classroom, peer group, and individual levels. General results indicate that individuals who are better integrated into their social networks, who have fewer depressed friends, and whose classroom social networks contain fewer peripheral members are less likely to report depressive symptoms and depression. The findings from this dissertation suggest boys and girls and those in different school types may be oriented to different contexts and types of social networks (e.g. friend versus most liked networks); therefore, specific conceptualizations of social network influences should be carefully formulated and assessed in relation to the particular contexts that are relevant and meaningful to an adolescent. This work represents early steps in the investigation
of the complex social environment in which adolescents must navigate and which are so meaningful for healthy development. The ultimate goal of such work is to glean useful constructs upon which prevention interventions can operate.
CHAPTER 1: INTRODUCTION

The prevalence of depressive symptoms increases substantially during adolescence, particularly between ages 15 through 18 (Birmaher, Ryan, Williamson, & Brent, 1996; Petersen et al., 1993). The incidence of depression similarly increases from adolescence to early adulthood (Pine, Cohen, Brook, Gurley, & Ma, 1998). These high rates of depression and depressive symptoms in adolescence has led many investigators to view depression as the most serious mental health problem of the adolescent years (Aseltine, Gore, & Colton, 1994). Thus, it is particularly important to identify and study etiologic factors, such as social processes and cognitions, which may contribute to the development of depression in adolescence.

Peer relationships are critical to the social development of an adolescent (e.g. Bronfenbrenner, 1979; Furman & Burhmester, 1992; Hartup, 1995). They also play a prominent role in identity development, through peer experiences such as social comparison, reflected self-appraisal, and peer group affiliation (Harter, Stocker, & Robinson, 1996). Membership, acceptance, and healthy functioning in larger peer groups are also acutely important to adolescents’ psychological well-being (Brown & Lohr, 1987). Adolescents spend almost one-third of their free time interacting with peers, more than twice the time they spend with parents (Csikszentmihalyi & Larson, 1984; Larson & Richards, 1991; Larson, Richards, Moneta, Holmbeck, & Duckett, 1996), resulting in increased feelings of closeness and intimacy with peers during adolescence (Furman & Buhrmester, 1992). Social interactions also become more emotionally rewarding for youth (Larson & Richards, 1991). Peers are the primary components of an adolescent’s social network and are relied upon more heavily as sources of support and advice during this developmental period (Brown, 1990; Buhrmester, 1996). Therefore, problems in the domain of peer relationships and social environment are likely to be particularly distressing during adolescence (Hammen, 2009; La Greca & Harrison, 2005; La Greca & Lopez, 1998).
Individuals, dyads, and networks make up the intricate layers of the social world adolescents inhabit, with peer relations being weighted differently across development. Cillessen (2007) aptly noted that the unique processes at each of these three levels of analysis have been found to be “uniquely affected by and have unique effects on social development.” Several studies have identified structural features of social networks in childhood and adolescence and examined the effects of social network membership on various outcomes (e.g. Cairns, Cairns, Neckerman, Gest, & Gariépy, 1988; Kindermann, 1996; Urberg, Degirmencioğlu, & Pilgrim, 1997; Kiesner, 2002; Ueno, 2005). Social networks have been found to be an important environment in which socialization occurs, for both positive and negative developmental outcomes. For example, social networks have been associated with antisocial behavior and delinquency (Dishion, McCord, & Poulin, 1999), but also with positive academic outcomes (Espelage, Holt, & Henkel, 2003).

The majority of research examining the relationship between peer relationships and psychosocial functioning has focused on this relationship in middle childhood and pre-adolescence. In comparison, only a few studies have explored this relationship in detail during adolescence (e.g. Chan & Poulin, 2009; La Greca & Harrison, 2005; Stevens & Prinstein, 2005; Ueno, 2005). However, the link between peer relationships and depressive symptoms is not necessarily the same for all age groups (Petersen et al., 2003; Ueno, 2005), and the developmental changes in the quality and importance of friendships during adolescence make understanding this association for this time of life particularly important (Rudolph & Hammen, 1999).

The relationship between social networks and depression has been studied in elderly (Holahan & Holahan, 1987; Seeman et al., 1987), immigrant (Vega, Kolody, & Weir, 1991), and post-pregnancy (O’Hara, Rehm, & Campbell, 1983) populations, but there has been a lack of
research using these concepts with adolescent populations to study depression. This represents a large gap in the literature, considering both the significant influence peer relationships have on healthy functioning and the dynamic, flexible nature friendship ties and social network composition can have during adolescence.

Understanding the etiology of depression is one of the most important goals of depression research, with adolescence emerging as a key developmental period to study depression and depressive symptoms. Interpersonal theories of depression assert that without attention to interpersonal functioning, depression cannot be fully understood (Coyne, 1976; 1999; Lewinsohn, 1974; Cole, 1990). These interpersonal theories fit well within an ecological framework, which focuses attention on both individual and social environmental factors as important determinants of health behavior (Bronfenbrenner, 1979). Similarly, a social network perspective is also distinguished by a focus on context, and the understanding that an individual is embedded within an environment that influences, and is influenced by, the person. Network analysis makes it possible to understand an adolescent within their “real-world” social environment and provides an opportunity to observe the social structure, social influence, and socialization processes that define interpersonal functioning. The major goal of this work is to investigate the impact of social network influences on depression in adolescents from different levels of network analysis. The relationships between social network factors and depressive symptoms will be tested in a large sample of Chinese adolescents. In order to assess these relationships, a specific aim at each level of social network analysis will be examined:

**Aim One: Individual level**

- To examine whether different measures of peer status are associated with depression outcomes.
Aim Two: Friendship/Popularity Group Level

- To determine if the depressive symptoms of an adolescent are influenced by the depressive symptoms and peer status of their self-reported friends.

Aim Three: Classroom Level

- To discover if classroom network composition and characteristics are associated with students’ depression outcomes.
BACKGROUND AND SIGNIFICANCE

Adolescent depression has emerged as a significant and challenging research topic in the past two decades, with important and far-reaching implications (see Petersen et al., 1993; Birmaher et al., 1996a; 1996b; Costello, Erkanli, & Angold, 2006 for reviews). For example, due to the high prevalence and chronic nature of depression, the World Health Organization (2008) found it to be the third most burdensome disease in the world, with projections of it becoming the most burdensome by 2030. Recent findings regarding noticeable increases in the prevalence of depression and depressive symptoms during adolescence as well as the important predictive role of depressive cognitions in the onset and maintenance of adolescent and later adult depression, have led to a corresponding increased interest in the possible antecedents of these outcomes in order to inform more effective prevention and intervention efforts (Burke, Burke, Rae, & Regier, 1991; Klerman, 1988; Garber & Flynn, 2001). Understanding the etiology of depression is one of the most important goals of depression research (Kistner, 2006).

It has become clear that depression has an impact on adolescent adjustment and psychological functioning (Petersen et al., 1993). Depressed mood and depressive symptoms have been found to explain over two-thirds of the variance in adolescent well-being (Mahon & Yarcheski, 2001). These and other findings (e.g. Harrington, 1998) indicate that even relatively mild depressive symptoms can result in impaired functioning. Therefore, those with subclinical depressive symptoms during adolescence also need to be considered at increased risk for negative outcomes, both during this developmental period and into adulthood.

Adolescence is a critical period in social development, marked by an expansion of peer networks, increased importance of close friendships, and the emergence of romantic relationships. Social networks increase not only in size, but in complexity and peer group affiliations become a more important aspect of relating to peers (La Greca & Prinstein, 1999). A
transition from parents to close peers of the primary social support role is another important change that can have important contributions to an adolescent’s self-concept and identity development (Furman & Buhrmester, 1992).

The number of studies investigating characteristics and experiences of childhood and adolescence as possible causes and contributors to depression has increased noticeably (Kistner, 2006). Most of the studies have focused on the contribution family factors have on the origins of depression. And, while familial relations are critical in the etiology of depression, relations outside the family, particularly with peers, need greater attention and consideration, especially during adolescence. The detrimental effect of poor interpersonal functioning is certainly not specific to depression; it has been associated with numerous negative developmental outcomes. Therefore, comprehension of the developmental processes associated with depression is essential. Those viewing risk and protective factors from a developmental perspective have been particularly interested in depressive disorders due to their complexity and the unique synthesis of psychological, social, and biological determinants involved.

Theory and research suggest that the increases in depressive symptoms observed during the transition to adolescence are probably related in some way to the significant changes that occur in interpersonal functioning during this same time (Hankin & Abramson, 2001; Rudolph & Hammen, 1999).

**Peer Relationships in Adolescence**

It is well established that peer relationships and the social environment have an important role in adolescent psychological and behavioral development (see Crosnoe & McNeely, 2008; Hoffman, Sussman, Unger, & Valente, 2006; Kobus, 2003 for reviews). As adolescents become increasingly independent from their families and oriented more towards peers, susceptibility to
peer influences increases (Aseltine, 1995; Chassin, Presson, Sherman, Montello, & McGrew, 1986; Glynn, 1981). Another potential result of the more extensive and intimate connections to peers is the influence friends’ psychological and behavioral characteristics can have an adolescent’s own functioning. Peer contagion has been studied primarily in regards to externalizing behaviors, such as aggression (Cohen & Prinstein, 2006), deviant and antisocial behavior (Prinstein & Wang, 2005), and other health risk behaviors (Dishion, McCord, & Poulin, 1999; Kandel, 1978; Heilbron & Prinstein, 2008). Fewer studies have looked at peer contagion of internalizing problems among adolescents (Steven & Prinstein, 2005; Prinstein, 2007), but findings from these select studies support the idea of peer contagion of depressive symptoms.

Peer relationships among adolescents are often organized in a hierarchical manner. The daily social world of youth often carries a specific social order with rewards and penalties depending on the skill with which an adolescent navigates this environment. Differences in health by social status have been found among adolescents, showing a similarity to the adult research on this topic. For example, peer status has been found to have effects on both physical health and general feelings of well-being (Hansell, 1985). The peer status of youth has also been linked to mental health and negative health behaviors in young adulthood (Michell & Amos, 1997; Ostberg, 2002; Roff & Wirth, 1984). Both friendship ties and the overall structure of the school classroom, in addition to individual social status, have also been found to influence health (Ueno, 2005; Kiesner, 2002). This suggests that the organization, structure, and distribution of social status among a peer group can influence adolescent development.

**Depression in Adolescence**

Much of the research on depression has been conducted with adult and aging populations. Developmental psychopathologists have focused attention on childhood and early adolescent
predictors for later depression, but fewer studies have looked at the etiology and health implications of depression and depressive symptoms during adolescence. Depression in youth has been associated with poor academic performance, social dysfunction, substance abuse, suicidal ideation, and attempted and completed suicide (Institute of Medicine (IOM), 1994; National Research Council & Institute of Medicine (NRCIOM), 2009). It has been suggested that psychological problems, such as depression, may form the root of health problems for adolescents (NRCIOM, 2009). Unfortunately, research examining the effects of mental health problems on other health issues in adolescence has not been a top priority in the past, so the true costs of depression during this developmental period are hard to accurately estimate (IOM, 1994; NRCIOM, 2009).

Adolescent Depression and Negative Health Outcomes. Study of the relationship between depression and health outcomes has been a major focus in depression research. This is primarily due to the concentration on finding cost-effective ways to treat and prevent depressive disorders, as well as the many co-morbid health conditions associated with them. The results of this work suggest that depression during adolescence is related to a variety of health-related problems, both concurrently and into adulthood. For example, one study alone found depression to be associated with low energy and fatigue, poor sleep, loss of appetite, aches and pains, headaches, stomachaches, and heaviness in the chest in an adolescent sample (Mondimore, 1990). In addition, longitudinal studies have linked depression to other problem behaviors, such as higher rates of smoking, alcohol use, substance abuse, unhealthy eating, risky sexual behavior, and less physical activity (Franko et al., 2005; Haarasilta, Marttunen, Evans, & Aro, 2004; Hallfors et al., 2004; Keenan-Miller, Hammen, & Brennan, 2007; Mahon & Yarcheski,
Furthermore, depression is the major risk factor for suicide, which is one of the five leading causes of death in adolescents worldwide (Wasserman, Cheng, & Jiang, 2005).

Determining the circumstances leading to depression in adolescence, and from depression to negative health behavior outcomes, will have important theoretical implications regarding etiology as well as clinical and public health implications. Depression and depressive symptoms during adolescence have far-reaching consequences as well as the more immediate negative outcomes. One recent longitudinal study found an association between adolescent depression and later medical and social costs, including more visits to medical professionals and impaired work functioning due to physical health in young adulthood, even after controlling for current depression (Keenan-Miller, Hammen, & Brennan, 2007). These findings provide further support for the importance of examining risk factors for adolescent depression.

Peer Relationships and Depressive Symptoms

Due to better understanding of the importance peer relationships have in adolescent development, an increasing number of studies have examined the associations between peer relations in adolescence and internalizing problems, such as depression (Aseltine, Gore, & Colton, 1994; Chan & Poulin, 2009; Hogue & Steinberg, 1995; Mahon & Yarcheski, 2001). These symptoms of depression are becoming more common among adolescents and may be a risk for later impaired functioning in adulthood (Keenan-Miller, Hammen, & Brennan, 2007; Peirce, et al., 2000). Research is also finding that depressive symptoms may be precursors to more severe disorders, such as Major Depressive Disorder (MDD) and social anxiety disorder (Birmaher et al., 1996a; 1996b).

Integration into a social network that provides social support has been found to have overall beneficial effects for adults (Cohen & Wills, 1985). The association is assumed to be similar for
adolescents, but further details of the influence peer processes have on a variety of health outcomes need to be examined. Some have found that friendships among depressed adolescents include lower levels of positive reinforcement and social support than other friendships (Barrera & Garrison-Jones, 1992; Hammen & Brennan, 2001; Stice, Ragan, & Randall, 2004). Depressed mood and depressive symptoms have been linked to peer rejection (Kiesner, 2002; Prinstein & Aikens, 2004) and peer victimization (Hawker & Boulton, 2000; Nolen-Hoeksema, & Girkus, 1994; Prinstein, Cheah, & Guyer, 2005) in adolescents. Quantity and quality of adolescents’ friendships (Nangle, Erdley, Newman, Mason, Carpenter, 2003) have also been related to depression. Overall, substantial evidence now exists to establish that the social, emotional, and psychological adjustment of an adolescent is associated with the psychosocial adjustment of their peers, particularly close friends.

Social Networks and Depression. An individual is embedded within an environment that influences, and is influenced by, the person. A wealth of research exists that emphasizes the importance of the social context on health. In order to understand these social contextual influences on health behavior, social networks have been identified as a potentially rich source of information that can provide greater insight into the complex relationships between social processes and health outcomes. Social networks are often defined simply as a set of actors or people who are connected by a set of ties, or relations. An example of the network ties of a person would be their familial, professional, friend, and community relationships. Healthy integration into a social network has been related to physical and mental well-being (Ostberg, 2003; Ueno, 2005), while the type, quality, and quantity of support provided by one’s social network have been linked to mental distress (Rosenberg & McCullough, 1981). Some network researchers have suggested that the link between social network integration and mental health
symptoms, including depressive symptoms, could work through promoting positive attitudes and feelings about one’s relationships with others and one’s ability and skill in fostering these relationships (Hansell, 1985; Ueno, 2005). Given the importance of social integration and peer influences, many researchers have turned to formal network analysis to understand peer network structures.

There are a number of ways that a network can be described. The size of one’s network is one of the most common measures examined. It would seem that those with larger networks have a greater potential for social support, and to some extent this is supported by the literature. Larger egocentric networks have been associated with better mental health (Coates, 1985; Field, Diego, & Sanders, 2001; Gest, Graham-Bermann, & Hartup, 2001). For example, larger networks are associated with fewer depressive symptoms (Cohen & Wills, 1985). However, some have also found that larger networks may create the potential for more negative interactions (Stokes, 1983) and that beyond a certain network size, larger networks may not be helpful for an individual (Polister, 1980). A few studies have looked at other measures of network structure and found that density is also important to measures of well-being, and may be more important than network size (Kadushin, 1983; Berkman, Glass, Brissette, & Seeman, 2000).

Social network research is usually interested in the structure or the network and the effects of relationships between people and groups, however, more recently, the effect of individual psychological characteristics on social networks and network characteristics on individual’s psychological functioning have been examined (Kalish and Robins, 2006; Mehra, Kilduff, & Brass, 2001). For example, one study examining the multiple types of networks found lower neuroticism, characterized by traits such as depression and anxiety, was associated with higher
degree centrality (Klein, Lim, Saltz, & Mayer, 2004). This has been supported by other work that found those high in neuroticism have fewer people who provide social support (Stokes, 1983).

Research examining social networks of adolescents has naturally focused on school and classroom networks. Youth who are rejected or neglected have been found to have higher levels of depression than those who are more accepted by their peers (Hecht, Inderbitzen, & Bukowski, 1998; Lansford et al., 2007). Popular individuals are less likely to become depressed than those who are unpopular (Prinstein & La Greca, 2002). Findings from a study looking at social network integration among adolescents found an association with good mental health that resulted from positive social cognitions (Cauce, 1986) Others have provided additional evidence that point to adolescent’s peer relationships having an association with depressive symptoms and with social cognitions (Jacobson, 2007), suggesting that how an adolescent interprets their social world and what they think of their ability to navigate within that environment plays a significant role in vulnerability to depression and could possibly mediate the relationship between social status and depressive symptoms.

Most of these studies with adolescents use peer nominations of “friends” or, more commonly, those who are “well liked.” Some have pointed out that these are not two measures of the same construct, however, as the influences of an adolescent’s friends and the popular crowd may not be the same. For certain outcomes friends may be more influential, but for other health behaviors the behavior of the popular crowd may hold sway. It is reasonable, then, that nomination measures of popularity and friendship are generally only moderately correlated and have been found to have independent effects on such things as emotional development (Gest, Graham-Bermann, & Hartup, 2001). Other studies have looked at larger adolescent networks and found few effects of school-level network measures on depressive symptoms, indicating
that the more immediate classroom and friendship networks have more impact than the larger, less intimate social environment (Fischer, 1982).

One limitation in the health behavior research using social network approaches is that much of it examines only a few measures of social networks, such as network size and sociometric status. Therefore, it is difficult to fully understand social network influences on depression because of the lack of diversity in measures used by current studies. Network analysis has an array of different measures that could potentially provide important information on the relationship between social processes and depression in adolescents.

Establishment of healthy social networks is a critical and developmentally appropriate task of adolescence. However, for those individuals with underdeveloped or dysfunctional networks, the many stressors that accompany the changes of adolescence may potentially cause great harm. Disrupted or poorly functioning social networks can fail adolescents in times when they seek and perhaps need the most support. They can reinforce thoughts of worthlessness, rejection, failure, and hopelessness, increasing the risk of developing depressive symptoms (Davidson, Rieckmann, & Lesperance, 2004; Wade & Kendler, 2000). Further study of the peer processes of adolescents through social network measures is needed to understand how dysfunction occurs and the means by which it influences depression.

**Theoretical Overview for the Influence of Peers on Depression**

Of the various theoretical explanations developed to describe and predict depression, main effects models of social relationships and depression may be the most relevant for the developmentally-driven influences on adolescent mental health. These models also fit well within both ecological and social network perspectives, which add depth to existing models by highlighting contextual and structural factors in the social environment.
Main Effects Model of Social Relationships and Depression.

The link between social isolation and poor psychological well-being is well established; with poor quality relationships, small social networks, and few close relationships all linked to depressive symptoms. Cohen and Wills (1985) proposed two models by which social relationships influence health outcomes, such as depression. The first model is the stress-buffering model, which proposes that social relationships influence well-being only for people under stress. The main effects model, however, states that social relationships have a beneficial (or deleterious) effect regardless of whether a person is under stress. Much of the work examining Cohen and Will’s models regarding depression-related outcomes has focused on the stress-buffering model. However, more recent work has suggested that the structural aspects of social ties, such as social network factors, operates through the main effect model rather than the stress-buffering model. Kawachi & Berkman (2001) stated, for example, that “the perceived availability of functional support is thought to buffer the effects of stress by enhancing an individual’s coping abilities. In contrast, the degree of integration in a social network is postulated to have a direct effect on well-being regardless of the presence of stressful circumstances.”

Others have pointed to the inability of stress-buffering models to fully explain the magnitude of the relationship between social ties and health outcomes (for example, see Hammer, 1983). They have posited that this is an indication that social network factors are more directly involved in psychological and physical well-being than stress-buffering hypotheses assume. In Hammer’s (1983) study, it was found that “people in very poor health do tend to have smaller social networks than people in better health; but in every health category, people with higher social network scores have lower mortality rates over the subsequent 9 years,” which was suggested as further support for the relevance of a main effect model.
Social Contagion Theories.

Contagion theories seek to understand social networks as pathways for the spread of “infectious” attitudes, norms, beliefs, and behaviors. A core assumption of these theories is that contact between members of a social network serves as the mechanism that exposes individuals, groups, and networks to information, attitudes, norms, beliefs, and behaviors of others (Burt, 1980; Carley, 1991). Network factors such as frequency of interaction, strength of ties, asymmetry, and stability can impact the extent to which others within a network can influence an individual and each other. Contagion theories are related to a number of other theories, such as Symbolic Interaction, Gatekeeping Theory, and Structurational Theory, which all focus on the influence of social networks and social structures on behavior. These theories do not require intent or even awareness to influence to be present, only the exposure itself. Support for these theories can be found in the robust findings in the peer relations literature regarding similarities between adolescents and their friends’ beliefs, behaviors, and psychological characteristics (for examples, see Keenan, Loeber, Zhang, Stouthamer-Loeber, & Van Kammen, 1995; Prinstein, 2007; Prinstein, Boergers, & Spirito, 2001).

Social Networks.

Analysis of social networks has become an increasingly popular way to examine social relationships. However, a clear definition of social network theory is difficult to determine. There are many explanations of what constitutes social network theory, but no real consensus. Many of these explanations describe social network analysis and the concepts used in this analysis. A general description of the theory often given is that it focuses on the relations among actors, where actors can consist of individuals, organizations, or other components of a social environment. Perhaps this theoretical ambiguity stems from the multidisciplinary background of this body of research and the varied way these different disciplines view theory. Major
contributions to social network analysis have come from almost every major scientific field of study; including, sociology, anthropology, mathematics, physics, communication, business, and public health. It may be more appropriate to refer to this as a theoretical perspective or orientation than to represent it as a single theory.

No matter the background or terminology, two of the main theoretical precursors of network theory are mathematic graph theory and social theory. Both are very broadly defined and suffer similar conceptualization problems as social network theory, but they provide the foundation from which much of this work has developed. Graph theory is the formal mathematic study of graphs as a representation of relations, either symmetric or asymmetric, between discrete objects. Social theory has been described as the use of theoretical frameworks to “study and interpret social structures and phenomenon within a particular school of thought” (Harrington, 2005). If viewed as a social network theoretical perspective then there are numerous theories that could be categorized under this designation, including Social Comparison Theory, Social Identity Theory, Contingency theory, Social Exchange Theory, and Critical Mass Theory.

According to the network perspective, individuals are “embedded within networks of interconnected relationships that provide opportunities for and constraints on behavior” (Brass, Galaskiewicz, Greve, & Tsai, 2004). This perspective takes a different view than much of the past work examining adolescent health behavior, which typically examines individual actors in isolation. It also has multiple levels of analysis, from pairs of close friends to peer groups to classrooms within schools to schools within a district and beyond. Each level has properties that are unique, but the properties and structure of one level can have an influence on other levels. One of the basic tenets of the social network perspective is that social structure matters and can be operationalized as patterns of interactions and relationships within social groups (Hinde,
This network structure and an individual’s position in the social network can have significant effects on how the group functions, social dynamics, and the individual’s skill and efficacy regarding their social competence (Sih, Hanser, & McHugh, 2009). The metrics of social network analysis provide the means by which to quantify this structure.

Social network analysis has a unique terminology that can prove challenging. Just a few of the common terms from network analysis include actors, relations, attributes, and egocentric and sociocentric. Actors, also called nodes, are the members of the network and can be either individuals or collective units, such neighborhoods that make up a city or classrooms that make up a school. Relations are the second necessary component of a social network and serve as the ties by which actors are linked. Attribute data is information about the properties, qualities, or characteristics of the actors. Egocentric networks are also called personal networks and are defined from a focal actor’s (or ego’s) point of view. The ties leading to and from the focal actor in the network are the primary interest when examining this type of network. Sociocentric networks, also called complete networks, are the ties among members of a bounded group. The information about the relations of all members of the group to each other is the focus and usually the network’s structure along with social position and roles are of key interest.

Ecological Frameworks.

A theoretical framework that is complimentary to, and often overlapping with, the social network perspective is Bronfenbrenner’s (1979; 1999) ecological systems theory. This is one of the early, and still one of the most widely used, theoretical frameworks for understanding how environment influences the behavior and experiences of an individual. The original models viewed the individual within the center of concentric circles representing the ever-widening levels of the environment. There were four original levels, with the microsystem representing an individual’s immediate environment, such as the family, peers, or workplace. The mesosystem...
connects the different microsystem components, for example the connection between an adolescent’s teacher and parents. The exosystem is explained as the larger social system which can indirectly influence an individual. The final level is the macrosystem and is defined as the cultural context that is made up of norms, values, rules and laws, and customs.

There are many ecological theories in the social sciences literature. Cassel’s work (1976) outlines another seminal ecological perspective. He delineated the importance of the social environment, which consists of psychosocial factors that are generated by social interactions. In his original work (1976), the central hypothesis states that the social environment can alter susceptibility to disease by directly influencing neuroendocrine functioning. He went on to list some psychosocial factors that make up the social environment, including isolation, the hierarchical organization of social networks, and loss and grief. Much of the recent work on social capital has been grounded in Cassel’s work.

Another, more recent theoretical model developed from an ecological perspective that is relevant to describing the relationship between social interactions and depression is Ho and Chiu’s (1998) model called Methodological Relationism. This theoretical view focuses not on the individual or the context separately, but rather proposes that the unit of analysis is “person-in-relations.” This means a focus on individuals interacting within a relational context. It maintains that the social network of an individual must be included in any analysis of the individual’s social behavior.

The delineation of different levels of analysis is similar in both ecological and social network perspectives. The different levels of network analysis can be fit into the levels put forth by ecological systems theory. The ecological systems can be translated into intrapersonal factors, interpersonal processes, institutional factors, and community and cultural factors. When broken down in this manner, using an ecological framework as a guide for examining the influence of
interpersonal relationships on adolescent health behavior by looking at social network characteristics appears to be a natural collaboration.

Parent Study

The reform of social and economic systems in China over the past few decades has resulted in significant challenges to traditional concepts, values, and lifestyles. Previous work has shown that the psychological stress originating from these rapid changes in the form and function of daily living has had increasing effects on both the physical and mental health of the Chinese people (Li et al., 2006; Miller, 2006; Phillips, Liu, & Zhang, 1999; Smith, 1998). Adolescence is already a time of rapid change, so it may be that adolescents are particularly vulnerable to the health behavior effects of additional life stressors. To that end, the University of Southern California Pacific Rim Transdisciplinary Tobacco Use Research Center (TTURC) was created to investigate how social circumstances, cultural setting, dispositional phenotype, and genes might influence the course of tobacco and alcohol use trajectories in youth, and how they moderate the effectiveness of programs for tobacco and alcohol abuse prevention.

The studies presented in the following chapters examined data from Project 2 of the second generation TTURC at USC that was implemented with a large sample of Chinese adolescents in the city of Chengdu. Project 2, Effect Moderation and Mediation in Prevention Programs, sought to fill current research gaps by enhancing understanding of the extrinsic and intrinsic factors that modify the effects of prevention programs. A large intervention trial was conducted in Chengdu high schools using a curriculum developed specifically for the trial that focused on enhancing students’ social decision-making and assessing the presence of interactive effects between adolescents’ personal and social characteristics and program characteristics in the prediction of prevention outcomes.
Chengdu is a densely populated and prosperous city in southwest China, with a population of over 10 million people (United Nations Population Division). It is the capital of Sichuan Province and is considered a progressive city and, due to this openness, has experienced some of the most rapid changes in recent decades in China; moving from a primarily agricultural provincial capital to an urban, industrial city. The city was selected as the site of the intervention trial due to a strong collaborative relationship with the Chengdu Center for Disease Control and Prevention (CDC), who provided unequivocal support for the project and also had the capacity to carry out such a large research trial. The study was approved by the Institutional Review Boards of the University of Southern California and the Chengdu Center for Disease Control.

**Conceptual Model Overview**

Peer relations constructs, such as low peer acceptance and social support, have been associated with dysphoria and depressive symptoms among adolescents and have also been found to predict later depression (Boivin, Hymel, & Bukowski, 1995; Coie, Terry, Lenox, Lochman, & Hyman, 1995; Kupersmidt & Patterson, 1991; Panak & Garber, 1992). According to main effects models of depression (Hammer, 1983; Kawachi & Berkman, 2000), interpersonal functioning contributes significantly to the onset and maintenance of depressive symptoms. Research utilizing these models has found promising support; for example, reduced use of a social network has been associated with increasing depressive symptoms (Possel et al., 2005). Further studies among adolescents can help to clarify how these models operate and suggest factors that can be targeted in future prevention work.
This dissertation examined data from adolescents attending high schools enrolled in a large smoking prevention trial in Chengdu, China to investigate interpersonal influences on depressive symptoms. The main theoretical model guiding the proposed studies suggests a main effects model of social relationships and depression, in which social network factors directly influence adolescent depressive symptoms and depression (see Figure 1). The model presented in Figure 1 is an adaptation of the main effects model proposed by Cohen and Wills (1985) and further refined by Kawachi and Berkman (2000). The model shows a portion of the original main effects model and focuses on the influence of social network factors on negative affective states (depressive symptoms) and internalizing symptoms (depressive symptoms and depression). These two constructs, along with social influences lead to health behaviors (either positive or negative) or directly to mental health.

The three studies are also conceptualized from an ecological perspective and each will test components of this overall model from different levels of analysis (see Figure 2). Study one examines the individual level of influence and focuses on social integration of the individual adolescent and depressive symptoms. Study two extends out to the level of the friendship- or
It examines peer contagion effects on adolescent depression. The final study focuses on network-level influences on depression outcomes.

The final conceptual model for the study (Figure 3) combines elements from all of the theories presented, with the strongest influences from ecological theoretical perspectives and the main effects model. It differentiates three levels of social analysis: the individual level, the friendship- or peer-group level, and the network level and proposes that social network factors at each level of analysis influence adolescent depressive symptoms and depression. The individual level factors should have the strongest effects and have been tested the most in previous research, but the group and network levels will also contribute significantly to psychological well-being. The peer-group level of analysis addresses peer contagion effects, while the network level focuses more the influence of network structure and composition on the outcomes.
Conclusion and Chapter Summary

Social networks can influence health on many levels, through different pathways. The present work examines the influence of social network factors on depression among adolescents. It will test these associations at three different levels of social analysis: the individual, the peer group, and the network level. Social network influences are expected to be associated with depression at all three levels through a modified main effects model of depression that is heavily influenced by ecological theoretical perspectives.

Chapter two describes the first study, which examined social network factors, peer status in particular, and depressive symptoms at the individual level of analysis. Chapter three, presents the second study, which also examined the effects of interpersonal factors and depressive symptoms, though it more closely investigated the effects interpersonal factors have on intrapersonal outcomes at the level of the friendship and peer group. The influence of friends’ social position and depressive symptoms on an individual’s own depressive symptoms was the main focus of study two. Finally, chapter four describes study three, which was analyzed at the classroom level of analysis and examined the influence of network structure on depression.
CHAPTER 2:
Social integration and depression among adolescents: Associations between social network status and depressive symptoms in a Chinese sample

CHAPTER TWO ABSTRACT

The developmentally important tasks related to peer functioning and competence become criteria for judging successful adjustment and aptitude by an individual, parents, teachers, and the larger society for youth. Despite the importance of peer experiences during adolescence, there has been relatively little research examining the importance of peer context and social environment in understanding the increase in the prevalence of depression-related outcomes that accompanies the transition into adolescence. **Methods:** Multilevel regression models were used to analyze a sample of 5,563 10th grade students in China. Social network nominations were used to calculate peer status categories and the CES-D was used to measure depressive symptoms. **Results:** Having peers nominate one as a friend is more important than peers considering one as most liked in relation to depressive symptoms. In-degree is associated with depression (AOR=0.88, p<0.01), with the association being protective and driven by girls attending professional schools (AOR=0.83, p<0.05). The risk of depression for those who are marginal members of professional school networks is substantial, with marginalized girls showing the greatest risk (AOR=4.71, p<0.01) and boys reporting fairly high risk as well (AOR=2.51, p<0.01). For professional school girls, popular status network members are also at greater risk for depression (AOR=1.68, p<0.05). **Conclusions:** Lower social network status is associated with increased risk, so increasing social integration within a classroom, particularly for those on the fringes of the network may help to decrease depression outcomes. These findings suggest that a social network perspective could help to increase the effectiveness of programs aimed at preventing adolescent depression.
INTRODUCTION

Adolescence is a developmental period marked by significant growth and change, particularly as it relates to the social environment. It is a time of self-concept and identity development, when peers and peer groups often become a way to explore these new roles and identities. Combine this with research demonstrating that individuals who are less socially integrated have more internalizing problems, and social environmental and competence factors become increasingly important (Ueno, 2005). Social integration is sometimes measured with social network instruments which allow for examination of the structural elements of peer groups and also permits a more comprehensive view of the patterns and influence of social relationships.

The link between social isolation and decreased psychological well-being has been well established (for reviews see, Berkman, 1995; House, Landis, & Umberton, 1988), historically dating back to Durkheim’s work in sociological theory (see Gibbs, & Martin, 1958; Inkeles, 1959). Small social networks, low social support, and few or poor quality close relationships have all been linked to depressive symptoms (see Seeman, 1996). For children and adolescents in particular, depression and depressive symptoms have been associated with lower peer acceptance (Rose & Rudolph, 2006) and being less liked by classmates (Caldwell, Rudolph, Troop-Gordon, & Kim, 2004).

Many developmental theories include peer relations as important concepts in both positive and negative adaptation during adolescence, which is not surprising given the prominent place they occupy in an adolescent’s life. The developmentally important tasks related to peer functioning and competence become criteria for judging successful adjustment and aptitude by an individual, parents, teachers, and the larger society in general. Despite the importance of peer experiences during adolescence, there has been relatively little research
examining how peer context and social environment might be important in understanding the increase in the prevalence of depression-related outcomes that accompanies the transition into adolescence.

Social Network Status and Depression among Adolescents

Theorists have long proposed that the environment, the social environment in particular, plays a critical role in the development of psychological distress and illness (for example, see Bowlby, 1951; 1980; 1988; Bronfenbrenner, 1979; 1999), including depression and depressive symptoms. Bowlby (1951) even stated a universal human need to form close affective bonds. Over the past several decades of research, these ecological models and methodologies have been increasingly emphasized in efforts to understand health behaviors.

Luke and Harris (2007) described social network analysis as “uniquely suited to describing, exploring, and understanding these types of structural and relational aspects of health.” As mentioned previously, social integration has received the bulk of the attention, but more recent efforts have begun examining other structural elements of social networks and their influence on health and well-being (Falci & McNeely, 2009; Ostberg, 2003; Ueno, 2005). For example, measures of centrality in networks look at the extent to which one node connects to other nodes, and the tendency of that node to be positioned near the center of its network. Centrality is often considered an indicator of importance or influence, with the simplest centrality measure being a count of the number of network nominations received from others (the term for this is degree centrality). Those with more connections or ties tend to be more central to the network. Network centrality has been associated with various health behavior outcomes, such as sexual activity (Ellen et al., 2001), aggression (Xie, Cairns, & Cairns, 2002), and smoking (Valente, Unger, & Johnson, 2005). Other research has suggested associations with more positive outcomes, such
as being more athletic, popular, and better students (Farmer & Rodkin, 1996). Fowler and Christakis (2008) found centrality to be associated with greater happiness, with centrality leading to happiness rather than the opposite.

Peer status normally has a positively skewed distribution, with a few individuals that are quite popular but the majority liked by some and many not chosen by anyone (Ostberg, 2003). Social status in a classroom is assigned by others and is not a measure of how an individual perceives their social influence or competence. Peer status, much like similar measures of social isolation and integration, has been linked to psychological health and well-being (Berkman, Glass, Brissette, & Seeman, 2000; Ostberg, 2003). As adolescents seek out connections to others in the course of developmental processes, peer status becomes an important indicator of growth and adjustment. If efforts to connect are unsuccessful, result in failure, or dysfunctional relationships and social networks, youth can feel socially isolated and excluded which can develop further into depressive symptoms and other maladaptive health outcomes.

**Study Hypotheses**

This study will use social network measures to investigate the influence of network status on adolescent depressive symptoms. Structural aspects of peer networks during adolescence—a period when friendships play an increasingly powerful role in development—merits examination as a potential cause of depressive symptomatology.

The primary aim of this study was to examine whether social network status in the classroom is associated with adolescent’s depression outcomes. To assess this aim, the study tested whether adolescents with more limited social networks had higher self-reported depressive symptoms. Six hypotheses were developed and tested for this study:
H1: In-degree is negatively associated with adolescent depressive symptoms.

H2: High social network status based on friend nominations is negatively associated with depressive symptoms.

H3: Low social network status based on friend nominations is positively associated with depressive symptoms.

H4: High social network status based on most liked nominations is negatively associated with depressive symptoms.

H5: Low social network status based on most liked nominations is positively associated with depressive symptoms.

These models were tested using the continuous measure of depressive symptoms, as well as using cut-points identified in past work with the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) as a measure of depression. The hypothesis tested for these analyses was:

H6: The associations between social network measures and depression are stronger than those for depressive symptoms in the same proposed directions.

METHODS

Sampling. Unlike in the United States, China has two primary high school types, academic (regular) and professional (vocational). Students are tested in middle school and scores from those tests determine which school type they will attend. Generally, those attending academic schools have a rigorous schedule of courses for three years of high school (10th through 12th grades), designed to increase the chances students will pass college entrance exams. Those attending professionals schools are enrolled in a career track, such as computers/IT or public relations, and will complete an internship during their final year(s) in high school with the goal of
entering the workforce once they have completed high school. Both school types were included in the study, with an equal number of schools and students from each school type. There are more professional school classes in the study, however, due to a trend for these classes to be smaller.

The study included a total sample of 5,563 10th grade students from a convenience sample of 24 schools, 12 of each school type, from 124 classes.

Data Collection. The data for this study was collected as pre-intervention, baseline measurements of a larger parent study examining the efficacy of a school-based tobacco prevention program focusing on social influences. All assessments were paper-based surveys and all participants had active parental consent and student assent. Pre-intervention assessments were collected prior to any intervention delivery, with the pre-test occurring approximately one week prior to intervention implementation for those assigned to the Program condition. The baseline survey was collected approximately one month prior to the pre-test. There were two reasons for the two waves of pre-intervention data collection: 1) the major holiday, Chinese New Year, occurred during that time and would have disrupted data collection efforts and 2) the assessments were each fairly substantial and splitting the measures between two surveys prevented students from becoming fatigued and improved the quality of the data.

Measures

Depressive Symptoms (CES-D; Radloff, 1977). The CES-D is a self-administered scale containing 20 items. The answers to each item, which indicate the frequency of the symptoms, are structured on a 4-point likert scale ranging from 1 (Less than 1 day) to 4 (5-7 days). The answers
are summed across all 20 items. The total scores can range from 0 to 60. Radloff (1977) suggested and it is commonly accepted that persons who score 16 or above are likely to be clinically depressed; however, some studies suggest that the cut-point needs to be raised to 24 or higher if the tool is to achieve appropriate diagnostic characteristics (Gotlib, Lewinsohn, & Seeley, 1995; Roberts, Lewinsohn, & Seeley, 1991). A Mandarin-Chinese version of the CES-D (MC-CES-D) has been validated and used in Hong Kong (Cheung & Bagley, 1998; Lam et al., 2004) and among community samples of adolescents in Taiwan a cut-point of scores ≥ 28 has been determined, with those above this score more likely to have major depressive disorder (Yang, Soong, Kuo, Chang, & Chen, 2004; Lin et al., 2008). The Cronbach’s alpha for the scale for the entire sample was good at α = 0.89.

**Social Network Measures.** Sociometric procedures were used to obtain measures of adolescents’ social network status. Peer nominations were used to collect information from each student regarding peer status. Adolescents were asked to list up to five people in their class who they considered their best friends. Students wrote the first and last names of their friends. Similarly, students nominated the five people they considered to be the most liked by people in their class. Peer nominations were later matched to study id’s and names were dropped from the data to protect confidentiality. These nominations were then used to calculate network metrics for the study.

Measures of centrality in social networks capture the extent to which a node connects other nodes and its tendency to be positioned near the center of a network. Centrality is often used as a marker of importance. The simplest centrality measure is a count of the number of nominations (this is called “degree” centrality) a person gives (“out-degree”) or receives (“in-degree”). People with more friends will tend to be more central. Degree centrality, more specifically in-degree, was calculated and used in the models for this study.
In order to define peer or social network status in a school classroom, researchers often divide individuals into different status categories based on their social network nominations.

The status categories are created to represent a more normal distribution. Five social network status categories were created from the friend nomination data for this study, similar to those created in past research (Ostberg, 2003). The first category included those who did not receive any nominations. This group, the “marginalized” category, is usually considered at highest risk for many negative health behavior outcomes. The second group consists of the “peripheral” members of the network, who received one or two friend nominations. The “accepted” category is the largest and includes those receiving three to five nominations. The “popular” category is those with six or seven nominations and the “favorite” those who received eight or more (see Figure 4). The same five status categories were created for the most liked nominations; however, because the distribution for this type of nomination differs from the friend data, the construction of the categories was different. Most liked nominations, often called “sociometric popularity,” usually have a larger range than friend nomination data with more network members receiving zero or only one nomination. A few network members usually
receive the bulk of the most liked nominations in a classroom (see Figure 5). Therefore, the marginal category remains the same, but the others are slightly different (peripheral = 1 nomination; accepted = 2-4; popular = 5-8; and favorite = 9 or more nominations).

Demographic covariates and control variables. Variables controlled for in the models include: gender (female), school type (academic or professional), socioeconomic status, and age. Socioeconomic status was calculated using both mother’s and father’s education level and a measure of an adolescent’s disposable income.

Perceived social self-efficacy was also controlled for in the models and was measured with the Perceived Social Self-Efficacy Scale (Smith & Betz, 2000). This is a twenty-five item scale that asks about confidence in your ability to perform social tasks, with items structured on a 5-point likert scale ranging from 1 (No confidence at all) to 5 (Complete confidence). Answers are summed with total scores ranging from 1 to 125.
Data Analysis

Both multilevel linear and logistic regression analysis procedures were used to analyze the data. Multilevel analysis was needed to explain individual-level outcomes with school and class level characteristics. All analyses were done using STATA version 11 (StataCorp, 2009), with social network status variables calculated using UCINet (Borgatti, Everett, & Freeman, 1999).

There is a large body of research indicating cognitions regarding social relationships and social self-efficacy are strongly associated with depression-related outcomes (for review, see Jacobs, Reinecke, Gollan, & Kane, 2008); therefore, perceived social self-efficacy was controlled for in all models in order to get a true measure of the associations between social network status and depressive symptoms.

To examine the first hypothesis, that in-degree centrality is negatively associated with depressive symptoms, multi-level linear regression analyses were conducted, simultaneously entering in-degree and the demographic and control variables in the level-one (fixed effects) model and school type in the level-three (school-level random effects) model for depressive symptoms. There were no level two (class level) variables, though level of analysis was included in the random effects model.

Two other models were tested in the same fashion to examine hypotheses two through five, that social network status is associated with depressive symptoms. Dummy variables for each status category were included in these models, Model 2 for status based on friend nominations and Model 3 for status based on most liked nominations. The accepted category served as the reference group, as it represented the largest groups and was not addressed in the hypotheses. High status as mentioned in hypotheses two and four was considered the two categories higher than “accepted,” the “popular” and “favorite” categorizations. Low status as
mentioned in hypotheses three and five was considered the two categories below “accepted,” the “peripheral” and “marginalized” categorizations.

The final hypothesis was analyzed by multilevel logistic regression and examined the same independent variables as the first three models. These final three models used an outcome that was a dichotomized version of the CES-D score, with scores of ≥28 equal to one and all other scores equal to zero (see Measures for further details of cut-scores).

RESULTS

Sample Characteristics

Distribution of Demographic Characteristics and Main Study Variables.

The participation rate for the study was high, with a 93.3% participation rate. Table 1 presents descriptive data for the sample. The average age of participants was 15.8 and the mean SES, ranging from 1-10 on a composite measure including mother and father education and allowance per week, was 4.4. The mean depressive symptoms score (CES-D; range: 1-60) for the sample is 17.9. Using a cut-point score of 28 or greater on the CES-D resulted in 16.8% of the sample reporting high depressive symptoms. The mean score on the perceived social self-efficacy scale was 80.4 with a range of 1-125. The average number of friends a student nominated was 3.7, and 3.5 was the average for most liked nominations. The most friend nominations received by a single student was 17 and the most liked nominations received by a single student was 40. About half of the sample (49.3%) had a friend network status of “accepted,” whereas 33% had an “accepted” most liked network status.

Differences in Study Variables by School and Gender.

A series of t-tests were conducted to determine equivalence on the main study variables for adolescents in the different school types and for males and females. Age and perceived
social self-efficacy (PSSE) did not differ between school types or males and females. The mean age was about 16 for all groups and the mean PSSE score was about 80. Academic and professional school students were significantly different in depressive symptoms (t=5.29, p<0.01) with those attending academic schools having significantly higher CES-D scores (a mean score of 18.7 versus 17.1 for those in professional schools).

<table>
<thead>
<tr>
<th>Table 1. Sample Characteristics</th>
<th>Total</th>
<th>Academic</th>
<th>Professional</th>
<th>Girls</th>
<th>Boys</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td>24</td>
<td>12</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classes</td>
<td>124</td>
<td>56</td>
<td>68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean class size (SD)</td>
<td>51.8 (12.2)</td>
<td>55.6 (13.8)</td>
<td>48.3 (9.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (%)</td>
<td>50.3%</td>
<td>49.4%</td>
<td>50.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female (%)</td>
<td>49.7%</td>
<td>50.6%</td>
<td>49.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>15.8 (0.72)</td>
<td>15.7 (0.64)</td>
<td>16.0 (0.77)</td>
<td>15.7 (0.70)</td>
<td>15.9 (0.73)</td>
<td>13-19</td>
</tr>
<tr>
<td>Mean SES(^a) (SD)</td>
<td>4.4 (1.5)</td>
<td>5.0 (1.5)</td>
<td>3.8 (1.2)</td>
<td>4.4 (1.5)</td>
<td>4.4 (1.5)</td>
<td>1-10</td>
</tr>
<tr>
<td>Mean CES-D Score (SD)</td>
<td>17.9 (11.0)</td>
<td>18.7 (11.4)</td>
<td>17.1 (10.5)</td>
<td>18.6 (11.4)</td>
<td>17.1 (10.5)</td>
<td>0-60</td>
</tr>
<tr>
<td>CES-D Score ≥ 28(^b) (%)</td>
<td>16.8%</td>
<td>21.7%</td>
<td>16.2%</td>
<td>21.5%</td>
<td>16.2%</td>
<td></td>
</tr>
<tr>
<td>Mean PSSE (SD)</td>
<td>80.4 (19.9)</td>
<td>80.8 (20.4)</td>
<td>80.0 (19.5)</td>
<td>80.3 (18.6)</td>
<td>80.6 (21.3)</td>
<td>1-125</td>
</tr>
<tr>
<td>Social network measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean friend nominations (SD)</td>
<td>3.7 (2.4)</td>
<td>4.0 (2.3)</td>
<td>3.8 (2.3)</td>
<td>4.1 (2.2)</td>
<td>3.7 (2.3)</td>
<td>0-17</td>
</tr>
<tr>
<td>Mean friends nominated (SD)</td>
<td>3.7 (2.0)</td>
<td>3.9 (1.9)</td>
<td>3.6 (2.1)</td>
<td>4.0 (1.8)</td>
<td>3.5 (2.1)</td>
<td>0-5</td>
</tr>
<tr>
<td>Mean most liked nominations (SD)</td>
<td>3.2 (4.3)</td>
<td>3.5 (4.5)</td>
<td>3.5 (4.3)</td>
<td>3.2 (4.2)</td>
<td>3.8 (4.6)</td>
<td>0-40</td>
</tr>
<tr>
<td>Mean most liked nominated (SD)</td>
<td>3.5 (1.9)</td>
<td>3.6 (1.8)</td>
<td>3.5 (1.9)</td>
<td>3.8 (1.8)</td>
<td>3.3 (1.9)</td>
<td>0-5</td>
</tr>
<tr>
<td>Friend social network status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marginalized (0 friend noms.)</td>
<td>3.0%</td>
<td>2.4%</td>
<td>3.2%</td>
<td>2.0%</td>
<td>3.7%</td>
<td></td>
</tr>
<tr>
<td>Peripheral (1-2 noms.)</td>
<td>11.7%</td>
<td>25.7%</td>
<td>28.3%</td>
<td>23.4%</td>
<td>30.8%</td>
<td></td>
</tr>
<tr>
<td>Accepted (3-5 noms.)</td>
<td>49.3%</td>
<td>47.1%</td>
<td>46.8%</td>
<td>49.3%</td>
<td>44.3%</td>
<td></td>
</tr>
<tr>
<td>Popular (6-7 noms.)</td>
<td>28.8%</td>
<td>17.2%</td>
<td>15.0%</td>
<td>17.5%</td>
<td>14.7%</td>
<td></td>
</tr>
<tr>
<td>Favorite (8+ noms.)</td>
<td>7.2%</td>
<td>7.6%</td>
<td>6.7%</td>
<td>7.8%</td>
<td>6.5%</td>
<td></td>
</tr>
<tr>
<td>Most liked network status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marginalized (0 most liked noms)</td>
<td>21.0%</td>
<td>22.3%</td>
<td>19.7%</td>
<td>24.6%</td>
<td>17.3%</td>
<td></td>
</tr>
<tr>
<td>Peripheral (1 nom.)</td>
<td>20.1%</td>
<td>20.1%</td>
<td>20.0%</td>
<td>20.3%</td>
<td>19.8%</td>
<td></td>
</tr>
<tr>
<td>Accepted (2-4 noms.)</td>
<td>33.0%</td>
<td>31.5%</td>
<td>34.5%</td>
<td>31.2%</td>
<td>34.9%</td>
<td></td>
</tr>
<tr>
<td>Popular (5-8 noms.)</td>
<td>15.7%</td>
<td>14.7%</td>
<td>16.7%</td>
<td>14.9%</td>
<td>16.7%</td>
<td></td>
</tr>
<tr>
<td>Favorite (9+ noms.)</td>
<td>10.2%</td>
<td>11.4%</td>
<td>9.1%</td>
<td>9.0%</td>
<td>11.3%</td>
<td></td>
</tr>
</tbody>
</table>

*SES was measured by calculating the mean of the answers on three questions for each student. Two questions asked about father’s and mother’s highest level of education (1-7) and the third question asked about allowance per week (1-10).

Students in the different school types also differed significantly on the SES measure (t=33.7, p<0.01), which is not that surprising considering those in academic schools are probably more likely to have parents that attended academic schools themselves which also makes it more
likely they attended college than parents of professional school students. There were also significant differences on the social network measures for the different school types, with academic school students nominating more friends (t=5.41, p<0.01) and most liked (t=3.38, p<0.01) as well as being nominated more as friends (3.51, p<0.01). The only network measure with no significant differences by school type was most liked nominations received. Due to these significant baseline differences by school type, all models were run separately for each school type.

Differences also existed between males and females on certain study variables. As expected, depressive symptoms were significantly different (t=5.13, p<0.01), with females reporting higher mean CES-D scores (18.6 versus 17.1 for males). Females nominated more friends (t=8.87, p<0.01) and more people as most liked (t=9.14, p<0.01). Girls also received more friend nominations (t=6.77, p<0.01) than boys, but boys received more nominations for most liked (t=5.33, p<0.01) than girls. Males and females did not differ on socioeconomic status. Again, due to these significant differences in the main variables, the models were run separately for girls and boys in order to more fully examine the study hypotheses.

**Main Results**

*Multilevel Linear Regression Analysis of Social Network Status and Depressive Symptoms.*

The first model tested hypothesis one, that in-degree is negatively associated with depressive symptoms (see Model 1 in Table 2) indicating that those who receive more nominations are less likely to report depressive symptoms. Perceptions of social self-efficacy was the strongest predictor of adolescents’ depressive symptoms across all subgroups. In-degree centrality was significantly associated with CES-D scores for the total sample ($\beta= -0.04$, p<0.01) and for the professional school sample ($\beta= -0.05$, p<0.05). The association, however, is
driven primarily by the significant association found for professional school girls ($\beta = -0.08$, $p<0.01$). Hypothesis one was not confirmed for academic school students. Socioeconomic status was also significantly associated with depressive symptoms, though mainly for professional school students ($\beta = 0.17$ for girls and $\beta = 0.07$ for boys). The relationship between SES and depressive symptoms was positive, indicating that as SES increases so do depressive symptoms.

Model 2 examined hypotheses two and three, which state that social network status based on friend nominations is associated with depressive symptoms, and resulted in mixed findings (see Table 2). Hypothesis two, high social status is negatively associated with depressive symptoms, was not confirmed overall. The one exception was a trend towards significance for academic school boys ($\beta = -0.05$, $p<0.10$). Hypothesis three appeared more likely, with both marginal and peripheral status being positively associated with CES-D scores ($\beta = 0.04$, $p<0.05$ for both). Again, when subgroups were analyzed separately the results were different. Marginal status was significant for professional students ($\beta = 0.07$, $p<0.01$), though is stronger for girls ($\beta = 0.11$, $p<0.01$) with boys only showing a trend towards significance ($\beta = 0.05$, $p<0.10$). For academic school students, the marginal categorization was not significantly associated with depressive symptoms. Peripheral status was only significant for academic school girls ($\beta = 0.07$, $p<0.05$).

Model 3 examined hypotheses two and five, which state that social network status based on most liked nominations is associated with depressive symptoms, and was not well supported (see Table 2). Only marginal status was significantly associated with depressive symptoms for academic girls ($\beta = 0.07$, $p<0.05$). This indicates, that for this sample, not being nominated as a friend is more important than having peers consider one as most liked in relation to depressive symptoms.
Table 2: Standardized coefficients (β) for Three Models of Social Network Status and Depressive Symptoms by School Type & Gender

<table>
<thead>
<tr>
<th>Depressive Symptoms</th>
<th>Total Sample</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>In-Degree (Friend)</td>
<td>-0.04**</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.03</td>
<td>-0.05*</td>
<td>-0.08**</td>
<td>-0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Social Self Efficacy</td>
<td>-0.19**</td>
<td>-0.23**</td>
<td>-0.25**</td>
<td>-0.20**</td>
<td>-0.16**</td>
<td>-0.23**</td>
<td>-0.10**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td>0.02</td>
<td>0.03</td>
<td>0.05*</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SES</td>
<td>0.08**</td>
<td>0.05*</td>
<td>0.06*</td>
<td>0.05*</td>
<td>0.12**</td>
<td>0.17**</td>
<td>0.07*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.07**</td>
<td>0.17**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed Effects Estimates (Odds Ratios)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Status (Friend)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marginal</td>
<td>0.04**</td>
<td>0.01</td>
<td>0.01</td>
<td>&lt;0.01</td>
<td>0.07**</td>
<td>0.11**</td>
<td>0.05*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peripheral</td>
<td>0.04*</td>
<td>0.04*</td>
<td>0.07*</td>
<td>0.02</td>
<td>0.17**</td>
<td>0.05</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accepted</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Popular</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.05</td>
<td>-0.01</td>
<td>-0.02</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Favorite</td>
<td>0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.05*</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network Status (Liked)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marginal</td>
<td>0.02</td>
<td>0.04</td>
<td></td>
<td>0.07*</td>
<td>-0.01</td>
<td>0.01</td>
<td>&lt;0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peripheral</td>
<td>0.03</td>
<td>0.03</td>
<td>0.05</td>
<td>0.02</td>
<td>0.02</td>
<td>0.01</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accepted</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td>ref.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Popular</td>
<td>0.02</td>
<td>0.01</td>
<td>0.03</td>
<td>-0.02</td>
<td>0.02</td>
<td>0.05</td>
<td>-0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Favorite</td>
<td>0.01</td>
<td>&lt;0.01</td>
<td>0.05</td>
<td>-0.04</td>
<td>0.01</td>
<td>&lt;0.01</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random Effects Estimates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 3 (School)</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School Type</td>
<td>0.06**</td>
<td>0.06**</td>
<td>0.05**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 2 (Class)</td>
<td>0.07**</td>
<td>0.08*</td>
<td>0.10**</td>
<td>0.09*</td>
<td>0.10*</td>
<td>0.12*</td>
<td>0.17**</td>
<td>0.14**</td>
<td>0.16**</td>
<td>0.19**</td>
<td>0.10**</td>
<td>0.08*</td>
<td>0.09*</td>
<td>0.12*</td>
</tr>
<tr>
<td>Observations</td>
<td>4626</td>
<td>4442</td>
<td>3935</td>
<td>2267</td>
<td>2162</td>
<td>1929</td>
<td>1202</td>
<td>1164</td>
<td>1048</td>
<td>1065</td>
<td>998</td>
<td>881</td>
<td>2359</td>
<td>2280</td>
</tr>
<tr>
<td></td>
<td>1262</td>
<td>1229</td>
<td>1095</td>
<td>1097</td>
<td>1051</td>
<td>911</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<0.10,  p<0.05,  p<0.01; 95% confidence intervals in brackets
Table 3: Adjusted Odds Ratios for Three Models of Social Network Status and Depression (CES-D ≥28) by School Type & Gender

<table>
<thead>
<tr>
<th>Model</th>
<th>Total Sample</th>
<th>Academic</th>
<th>Professional</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fixed Effects Estimates (Odds Ratios)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>In-Degree (Friend)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.88**</td>
<td>0.91*</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>PSSE</td>
<td>0.69**</td>
<td>0.58**</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>1.06</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>SES</td>
<td>1.17**</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1.48**</td>
<td>1.52**</td>
</tr>
<tr>
<td></td>
<td>Network Status (Friend)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marginal</td>
<td>1.92**</td>
<td>0.95</td>
</tr>
<tr>
<td></td>
<td>Peripheral</td>
<td>1.29**</td>
<td>1.26*</td>
</tr>
<tr>
<td></td>
<td>Accepted</td>
<td>ref.</td>
<td>ref.</td>
</tr>
<tr>
<td></td>
<td>Popular</td>
<td>0.85</td>
<td>0.76*</td>
</tr>
<tr>
<td></td>
<td>Favorite</td>
<td>0.92</td>
<td>0.72</td>
</tr>
<tr>
<td></td>
<td>Network Status (Liked)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marginal</td>
<td>1.14</td>
<td>1.24</td>
</tr>
<tr>
<td></td>
<td>Peripheral</td>
<td>1.16</td>
<td>1.15</td>
</tr>
<tr>
<td></td>
<td>Accepted</td>
<td>ref.</td>
<td>ref.</td>
</tr>
<tr>
<td></td>
<td>Popular</td>
<td>1.17</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>Favorite</td>
<td>1.06</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>Random Effects Estimates</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 3 (School)</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td></td>
<td>School Type</td>
<td>0.14**</td>
<td>0.13**</td>
</tr>
<tr>
<td></td>
<td>Level 2 (Class)</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Observations</td>
<td>4629</td>
<td>4444</td>
</tr>
</tbody>
</table>

* p<0.10,  ** p<0.05,  *** p<0.01; 95% confidence intervals in brackets
Multilevel Logistic Regression Analysis of Social Network Status and Depression.

Table 3 presents the results for logistic regression analyses testing hypothesis six, that the associations will be stronger between social network status and depression than depressive symptoms. While direct comparisons between coefficients cannot be made, the magnitude of the associations can be considered. The associations between in-degree and depression show a similar pattern in this analysis as with the linear regression. Higher in-degree is protective against depression (AOR=0.88, p<0.01), with the association being primarily driven by professional school girls (AOR=0.83, p<0.05). The main differences between the logistic and linear regression results appear for Model 2. While the pattern of significant associations remains mostly the same, with professional school students showing significant associations between lower social status and depression (AOR=3.30, p<0.01) and academic school students not showing this, the additional information comes in the form of the magnitude of the associations. The risk of depression for those who are marginal members of professional school social networks is substantial, with marginal girls at greatest risk (AOR=4.71, p<0.01) and with boys reporting fairly high risk as well (AOR=2.51, p<0.01). Peripheral status showed a trend towards significance for professional girls (AOR=1.39, p<0.10), but not for boys.

Model 3 in Table 3 does not support an association between network status based on most liked nominations, similar to the linear regression results, with one notable exception. For professional school girls, those with popular status are at greater risk for depression (AOR=1.68, p<0.05).

DISCUSSION

This study examined the association between social network status and depressive symptoms among Chinese adolescents. Consistent with previous research on social integration
and depressive symptoms, the findings support a negative association between the more general measure of social network status, in-degree centrality for friend nominations, and depressive symptoms. These findings indicate that the higher the in-degree, the lower the depressive symptoms. The specific hypothesis regarding low friend social network status and depressive symptoms was also supported, which is consistent with previous research that has shown that a lack of integration is associated with depression outcomes. People with fewer friends report higher depressive symptoms (Brendgen, Vitaro, & Bukowski, 2000; Falci & McNeely, 2009; Ueno, 2005). This finding was primarily driven by professional school students, with significant associations for both boys and girls, yet a stronger association for girls. The hypotheses regarding high social status being negatively associated with depressive symptoms were not confirmed, indicating that while low social network status appears to be a risk factor for depression outcomes, it does not necessarily follow that high status is protective. Contrary to one study hypothesis, professional school girls with popular status based on “most liked” nominations actually had an increased risk for depression. There is some research supporting this finding, Falci & McNeely (2009) reported adolescents with social networks that were either too small or too large reported higher levels of depressive symptoms. They put forth the idea that for those with high social status, higher depressive symptoms stem from a sense of duty or obligation. They stated that more friends require more time and energy to maintain and “could result in role strain.” Findings from this study indicate that this is the case for girls but not boys and professional school students and not academic school students. Also, this was not the case for status based on friend nominations.

Differences in study findings between social status based on friend nominations and status based on most liked nominations indicates that these are distinct constructs that measure unique aspects of an adolescent’s social status. Status based on friend nominations was more
significantly associated with depressive symptoms, indicating that close friendships are perhaps a more important indicator for depression-related outcomes for Chinese adolescents. However, there was one instance where “most liked” status was important, for professional school girls, as mentioned previously. This finding suggests that while lower friend status is a risk factor as would be expected, it may be *higher* “most liked” status that is a risk depression.

There are clear differences between the two school types in the relationship between social network status and depressive symptoms. The associations are stronger for professional school students. The Chinese school system is set up differently than Western school systems, with academic school students required to spend many more hours per week studying for college entrance exams. They also have more pressure put on them to do well academically by their parents and teachers and more competition from their classmates. They have little free time to socialize, which may be one reason for the differences noted in the study. Professional school students have more free time and fewer pressures – though for some, they may already consider themselves “failures” for not getting into an academic school which could present a risk factor for depressive symptoms. While academic school students, particularly the girls, report the highest levels of depressive symptoms, they do not appear to be that closely associated with what occurs in their social environment. Dealing with school and family stress as well as gender role expectations could be a larger factor in their depression outcomes; however, further study would be required to examine this.

*Study Limitations*

The study presented several limitations that should be considered when interpreting the findings. First, this study did not include measures of the quality or strength of a reported relationship. It may be that the quality of social network ties can weight the relationship
between these measures and depressive symptoms. For example, it may not matter if an individual has few friends if the quality of those friendships is very high, where friends provide maximum support, feelings of closeness, and understanding. It may also be the case that reciprocated nominations are more important than the overall number of nominations to depressive symptoms.

Second, while the associations reported were significant, the effects were small. This could potentially limit the meaningfulness of the findings; however some have suggested that small effect size can still have practical applicability (Rosenthal, Rosnow, & Rubin, 2000). Due to the cross-sectional nature of the data, causal direction cannot be determined. The results can suggest avenues for future research, but cannot explain causal mechanism leading from social network status to depressive outcomes. Further study with longitudinal data is necessary.

Also, the CES-D is a self report assessment of depressive symptoms, rather than a clinical assessment of syndrome or disorder, therefore the findings of this study do not generalize to populations who have diagnosable disorders and it is not possible to determine whether the suggested relationships between social network status and depression-related outcomes are important mechanisms operating in more clinical populations. Also, though the design and measurement of the study enables examination of data from more than one source, which is a considerable strength of the study, the social network nomination format was limited to school-based peers which may not be the most influential peers for all youth.

Despite these limitations, the results confirm, although modestly, that social network status is significantly associated with depressive symptoms for Chinese adolescents.
Implications and Future Directions

It has become clear that depression has an impact on adolescent adjustment and psychological functioning (Petersen et al., 1993). Depressed mood and depressive symptoms have been found to explain over two-thirds of the variance in adolescent well-being (Mahon & Yarcheski, 2001). These and other findings (e.g. Harrington, 1998) indicate that even relatively mild depressive symptoms can result in impaired functioning. Therefore, those with sub-clinical depressive symptoms during adolescence need to be considered at increased risk for negative outcomes.

The developmental importance of peer relations places a premium on understanding their influence on the etiology and psychopathology of health behavior. The study of physical and mental well-being must include consideration of the importance of context, and during adolescence the context is inherently social. Peer relationships among adolescents are commonly organized hierarchically. The daily social world of youth often carries a specific social order with rewards and penalties depending on the skill with which an adolescent navigates this environment. Differences in health by social status have been found among adolescents, showing a similarity to the adult research on this topic. The peer status of youth has been linked to mental health and negative health behaviors into young adulthood (Michell & Amos, 1997; Ostberg, 2002; Roff & Wirth, 1984). Both friendship ties and the overall structure of the social network, in addition to individual social status, have been found to influence adolescent health (Ueno, 2005; Kiesner, 2002). This suggests that the organization, structure, and distribution of social status among peer groups can influence adolescent development.

Prevention work with youth often takes a “social influences” approach. The findings from this study suggest that a social network perspective could help to increase the effectiveness of programs aimed at preventing adolescent depression-related outcomes. Lower social network
status is associated with increased risk, so increasing social integration within a classroom, particularly for those on the fringes of the network may help to decrease depression. Creating a social environment that values acceptance and inclusion could go a long way in decreasing the depressive symptoms of an adolescent at risk. The findings can also help to identify those at the highest risk, who could benefit from more intensive or targeted intervention.

Significant biological, cognitive, and social changes occur during adolescence that can have an impact on developmental competencies related to health behavior decision making. The high potential for both risk and opportunity makes this an important point at which to intervene to promote healthy lifestyle choices as well as prevent dysfunction and risky behavior decisions that can persist throughout adulthood. Many factors have been found to increase vulnerability to depression for adolescents and many of the problem behaviors that prevention research has targeted have been linked to depression as well. While depression is generally conceptualized as an individual disorder with a strong focus on problematic thoughts and perceptions, maladaptive interpersonal functioning also contributes to its development and progression. Preventing distress and dysfunction in the social networks of youth at risk for depression, as well as improving interpersonal competencies, should be a key aim of future prevention work focusing on this developmental period.

The results of this study contribute to a better understanding of how peer relations are related to adolescent depressive outcomes. This work helps to further understand the complicated social environments of adolescents. It further clarifies the association between social network influences and depression during adolescence. It adds to current research examining social integration and depression among adolescents by including two measures of peer status, friend nominations and most liked nominations. These are two related, yet distinct measures of social status that uniquely contribute to depression and depressive symptoms in
their own way. This study also examined these associations in a sample of Chinese adolescents, when the majority of this research has been done in Western cultures. This examination of a collectivistic culture that is undergoing rapid social and cultural changes provides some insight into the social environments of Chinese youth and how their peer interactions influence their psychological well-being.
CHAPTER 3:
Peer Contagion and Adolescent Depression: The Effects of Peers’ Depressive Symptoms and Social Network Status

CHAPTER THREE ABSTRACT

Peer contagion effects have been studied across various disciplines and represent an intriguing phenomenon in the study of social influence. Contagion theories seek to understand social networks as pathways for the spread of “infectious” attitudes, norms, and behaviors. Adolescent peer contagion research has primarily focused on externalizing behaviors, while few studies have looked at internalizing symptoms. This study was designed to examine whether depressive symptoms and social network status of friends are significantly associated with an adolescent’s own self-reported depression in a sample of Chinese adolescents. **Methods:** Measures of depressive symptoms and social network nominations were examined using multilevel linear and logistic regression models for an overall sample of 5,563 10th grade students in China. **Results:** Mean friends’ CES-D scores were significantly associated with depressive symptoms (β=0.10, p<0.01), even after controlling for social cognitions. The proportion of depressed friends was strongly associated with depression (AOR=2.85, p<0.01 for the total sample) with a stronger association for those in professional than academic schools (AOR=3.34 versus AOR=2.44 for academic students, p<0.01 for both). Peers’ social network status was not significantly associated with depressive symptoms with notable exceptions for academic school girls (β=0.07, p<0.05) and professional school boys (β=-0.06, p<0.05). **Conclusions:** Adolescents are embedded within social networks that have the potential to influence health behavior in positive and negative ways. From the network perspective, the psychological well-being of one individual has implications for the health and well-being of their peers.
INTRODUCTION

Research has effectively established that psychological well-being is connected to people's social relationships. Wide ranging work has shown both beneficial consequences of positive social relations (for reviews, see Berkman, Glass, Brissette, & Seeman, 2000; Cohen, 2004), and the detrimental effects negative social interactions can have on psychological and physical health (Okun & Keith, 1998; for review, see Rook, 1992). Research on social network participation, under the term social integration and measured in terms of the variety of relationships one participates and engages in, has found that those who are socially integrated are in better mental health than those who are more socially isolated (for review, see Cohen & Wills, 1985). This robust finding is based on the premise that those who participate in social networks are influenced to normative health behaviors due to social controls and peer pressures (Cassel, 1976; Hammer, 1981). Social integration is also hypothesized to engender general positive affect due to an increased sense of belonging, stability, and self-worth (Cassel, 1976; Thoits, 1983; Wills, 1985). For example, Fowler and Christakis (2008) found that a person is more likely to be happy if directly connected to someone who is happy. They also noted that those at the core of their network are more likely to be happy, while those on the periphery are more likely to be unhappy. The magnitude of the health risks associated with social isolation and low levels of social integration have been compared to the risks associated with smoking, high blood pressure, and obesity (Cohen, Gottlieb, & Underwood, 2000; House et al., 1988).

While the bulk of the research regarding social ties and mental health has been conducted with adult populations, the link between social relationships and depressive symptoms has also been clearly established during adolescence. This finding is not surprising given peer relationships are critical to the social development of an adolescent (e.g. Bronfenbrenner, 1979;
Furman & Buhrmester, 1992; Hartup, 1995). They play a prominent role in identity development, through peer experiences such as social comparison, reflected self-appraisal, and peer group affiliation (Harter, Stocker, & Robinson, 1996). Membership, acceptance, and healthy functioning in larger peer groups are also critical to adolescents’ psychological well-being (Brown & Lohr, 1987). Adolescents spend more of their free time interacting with peers than in childhood and early adolescence (Csikszentmihalyi & Larson, 1984; Larson & Richards, 1991), which results in increased feelings of closeness and intimacy with peers during adolescence (Furman & Buhrmester, 1992). Social interactions become more emotionally rewarding (Larson & Richards, 1991) for youth. Peers are the primary components of an adolescent’s social network and are relied upon more heavily as sources of support and advice during this developmental period (Brown, 1990; Buhrmester, 1996). Therefore, problems in the domain of peer relationships and social environment are likely to be particularly distressing during adolescence (Hammen, 2009; La Greca & Harrison, 2005; La Greca & Lopez, 1998).

Several studies have identified structural features of social networks in childhood and adolescence and examined the effects of social network membership on various outcomes (e.g. Cairns, Cairns, Neckerman, Gest, & Gariépy, 1988; Kindermann, 1996; Urberg, Degirmencioglu, & Pilgrim, 1997; Kiesner, 2002; Ueno, 2005). Social networks have been found to be an important environment in which socialization occurs, for both positive and negative developmental outcomes. For example, social networks have been associated with antisocial behavior and delinquency (Dishion, McCord, & Poulin, 1999), but also with positive academic outcomes (Espelage, Holt, & Henkel, 2003). However, only a few studies have examined how social networks are associated with depressive symptoms among adolescents (Hansell 1985; Ueno 2005).
Peer Contagion and Depressive Outcomes

Peer contagion effects have been studied across various disciplines with a multitude of outcomes. Contagion theories seek to understand social networks as pathways for the spread of “infectious” attitudes, norms, beliefs, and behaviors. Contagion theories are related to a number of other theories, such as Symbolic Interaction, Gatekeeping Theory, and Structurational Theory, which all focus on the influence of social networks and social structures on behavior. Social contagion suggests that individuals adopt the attitudes or behaviors of others in their social network with whom they communicate with or are exposed to. The theory, however, does not require intent or even awareness to influence, only exposure.

Peer contagion effects, have been demonstrated among adolescents for a host of negative behaviors, such as substance use (Kobus, 2003; Li, Barrera, Hops, & Fisher, 2002; Oetting & Beauvais, 1986; Valente, Gallaher, & Mouttapa, 2004), sexual risk behavior (Prinstein, Meade, & Cohen, 2003), and suicidal ideation and behavior (Cerel, Roberts, & Nilsen, 2005; Mercy et al, 2001). The research focusing on adolescent peer contagion has primarily examined the diffusion of externalizing and health risk behaviors and has typically found strong relationships between an adolescent’s own externalizing behavior and that of their friends’ (Dishion, McCord, & Poulin, 1999; Kandel, 1996). Only a few studies have looked at internalizing symptoms and peer contagion, however. Stevens and Prinstein (2005) for example, found that best friends’ reported level of depressive symptoms was prospectively associated with adolescents’ own depressive symptoms and with adolescents’ negative social cognitions. These results suggest that adolescents’ depressive symptoms and cognitions are directly influenced by the presence of similar thoughts and feelings among their close friends. There are more studies among adults that have demonstrated that depressed individuals are likely to select other depressed
individuals as friends and respond more favorably to social interactions that involve a depressed partner (Rosenblatt & Greenberg, 1991).

**Gender, Social Relationships, and Depression**

Consideration of gender is critical in the study of internalizing symptoms, particularly during adolescence. Female adults and adolescents are twice as likely to experience internalizing symptoms as males (Nolen-Hoeksema & Girgus, 1994). In terms of the developmental period, adolescents report more internalizing problems than children (Zahn-Waxler, Klimes-Dougan, & Slattery, 2000). Research examining interpersonal relationships has found that females are more likely to seek emotional support from their social network (Nolen-Hoeksema, 1991) and to value social ties more (Swap & Rubin, 1983) than males. Males do turn to their social networks for support, but the interactions tend to focus more on shared activities or “distractions” (Bolton & Oakley, 1987; Nolen-Hoeksema, 1990).

As for peer and social network influences on internalizing problems, such as depression and depressive symptoms, gender effects are not as clearly delineated as the gender differences in depression outcomes. Evidence has shown that boys are more susceptible to peer influences for certain externalizing problems, antisocial and delinquent behaviors in particular (Berndt, 1979; Brown, Clasen, & Eicher, 1986; Liu & Kaplan, 1999), but findings of gender differences have been mixed for other externalizing and internalizing problems (Cohen, 1977; Kandel, 1978). However, more recent work examining interpersonal relationships and depression has shown a stronger relationship between social support and depression for females than males (Schraedley, Gotlib, & Hayward, 1999). A study, by Hogue and Steinberg (1995) found homophily of internalized distress for adolescent boys and girls equally, but noted some gender differences for those at both the high and low ends of the distress spectrum. More specifically,
males who initially had low internalized distress were found to have an increase in negative affect if they associated with more distressed peers and those who started relatively high in distress tended to have decreased distress over time if members of their social networks were less distressed.

Depression and Social Relationships in the Chinese Culture

Depression rates are increasing everywhere, with depressive disorders affecting all ethnic groups and becoming one of the most prevalent diseases globally (Daly, 2009). For many in China, depression is expressed in physical rather than psychological terms. Often, those experiencing depression in Chinese society report psychosomatic symptoms such as boredom and discomfort, feelings of inner pressure and more physical symptoms of pain, dizziness, and fatigue (Kleinman, 2004). Recent research has shown increased prevalence of depressive symptoms and suicidal ideation in China. Family conflict, work or school stress, peer relations, and financial pressure have been identified as important factors in depression in China (Pearson, Phillips, He, & Ji, 2002; Yip, 2001).

Different cultures may share a similar etiology of depression among adolescents, but patterns in the expression of depression can vary greatly by the socialization that occurs due to cultural traditions, beliefs, norms, and values. An example of this is individualistic and collectivistic cultural orientations, which could predispose adolescents from a particular culture to a greater responsiveness or sensitivity to interpersonal relationships, which in turn may influence the contribution these relationships have on depression-related outcomes. It has been suggested that adolescents in more collectivist cultures could be more prone to distress caused by problematic social interactions, due to greater cultural emphasis placed on social acceptance and approval (Sastry & Ross, 1998; Tafarodi & Smith, 2001).
**Study Hypotheses**

A closer examination of the relationships between friends’ depressive symptoms, friends’ social status, and an adolescent’s own depressive symptoms could provide greater understanding of the cognitive, interpersonal, and social environmental factors that place adolescents at such increased risk for depressive outcomes. The overarching goal of this study was to examine peer contagion effects on adolescent depressive symptoms. To that end, this study used social network methods and a social contagion theoretical perspective to examine how peer social behavior and internalizing problems relate to adolescent depressive symptoms.

The main purpose of the study was to examine whether depressive symptoms and social network status of self-reported friends are significantly associated with an adolescent’s own self-reported depression in a sample of Chinese adolescents. To investigate this, three primary hypotheses were tested:

H1: Friends’ depressive symptoms are positively associated with depressive symptoms.

H2: The proportion of nominated friends’ who are depressed is positively associated with depressive symptoms.

H3: Friends’ social network status based on friend nominations and friends’ status based on most liked nominations are negatively associated with depressive symptoms.

**METHODS**

**Sampling.** Unlike in the United States, China has two primary high school types, academic (regular) and professional (vocational). Students are tested in middle school and scores from those tests determine which school type they will attend. Generally, those attending academic schools have a rigorous schedule of courses for three years of high school (10th through 12th
grades), designed to increase the chances students will pass college entrance exams. Those attending professionals schools are enrolled in a career track, such as computers/IT or public relations, and will complete an internship during their final year(s) in high school with the goal of entering the workforce once they have completed high school. Both school types were included in the study, with an equal number of schools and students from each school type. There are more professional school classes in the study, however, due to a trend for these classes to be smaller.

The study included a total sample size of 5,563 10th grade students from a convenience sample of 24 schools, 12 of each school type, from 124 classes.

Data Collection. The data for this study were collected as pre-intervention, baseline measurements of a larger parent study examining the efficacy of a school-based tobacco prevention program focusing on social influences. All assessments were paper-based surveys and all participants had active parental consent and student assent. Pre-intervention assessments were collected prior to any intervention delivery, with the pre-test occurring approximately one week prior to intervention implementation for those assigned to the program condition. The baseline survey was collected approximately one month prior to the pre-test. There were two reasons for the two waves of pre-intervention data collection: 1) the major holiday, Chinese New Year, occurred during that time and would have disrupted data collection efforts and 2) the assessments were each fairly substantial and splitting the measures between two surveys prevented students from becoming fatigued and improved the quality of the data.
Measures

Depressive Symptoms (CES-D; Radloff, 1977). The Center for Epidemiologic Studies Depression Scale (CES-D) is a self-administered scale containing 20 items. The answers to each item, which indicate the frequency of the symptoms, are structured on a 4-point likert scale ranging from 1 (Less than 1 day) to 4 (5-7 days). The answers are summed across all 20 items. The total scores can range from 0 to 60. Radloff (1977) suggested, and it is commonly accepted, that persons who score 16 or above are likely to be clinically depressed; however, some studies suggest that the cut-point needs to be raised to 24 or higher if the tool is to achieve appropriate diagnostic characteristics (Gotlib, Lewinsohn, & Seeley, 1995; Roberts, Lewinsohn, & Seeley, 1991). A Mandarin-Chinese version of the CES-D (MC-CES-D) has been validated and used in Hong Kong (Cheung & Bagley, 1998; Lam et al., 2004) and among community samples of adolescents in Taiwan, a cut-point of score ≥ 28 has been determined for Chinese youth, with those above this score more likely to have major depressive disorder (Yang, Soong, Kuo, Chang, & Chen, 2004; Lin et al., 2008). The Cronbach’s alpha for the scale for the study sample was good at $\alpha = 0.89$.

Social Network Measures. Sociometric procedures were used to obtain measures of adolescents’ social networks. Peer nominations were used to collect information from each student regarding peer status. Adolescents were asked to list up to five people in their class who they considered their best friends. Students wrote the first and last names of their friends. Similarly, students nominated the five people they considered to be the most liked by people in their class. Peer nominations were later matched to study id’s and names were dropped from the data to protect confidentiality. These nominations were then used to calculate network metrics for the study.
In order to define peer or social status in a school classroom, researchers often divide individuals into different status categories based on their social network nominations. The status categories are created to represent a more normal distribution. Five social network status categories were created from the friend nomination data for this study, similar to those created in past research (Ostberg, 2003; Stutz, 1985). The first category included those who did not receive any nominations. This group, the “marginalized” category, is usually considered at highest risk for many negative health behavior outcomes. The second group consists of the “peripheral” members of the network, who received one or two friend nominations. The “accepted” category is the largest and includes those receiving three to five nominations. The “popular” category is those with six or seven nominations and the “favorite” those who received eight or more. The same five status categories were created for the most liked nominations; however, because the distribution for this type of nomination differs from the friend data, the construction of the categories was different. Most liked nominations, often called “sociometric popularity,” usually have a larger range than friend nomination data with more network members receiving zero or only one nomination. A few network members usually receive the bulk of the most liked nominations in a classroom. Therefore, the marginal category remains the same, but the others are slightly different (peripheral = 1 nomination; accepted = 2-4; popular = 5-8; and favorite = 9 or more nominations).

*Friend Depressive Symptoms and Social Network Status.* Because nominated friends were themselves respondents in the study sample, the level of depressive symptoms reported by each nominated peer was available. Therefore, it was possible to construct a measure of peer group depressive symptoms by calculating the group mean of the individual depressive symptoms reported by each nominated peer. These peer group variables do not include the score of the target adolescent. A “proportion of depressed friends” variable was created using
the dichotomized CES-D variable, where those with a CES-D score of ≥28 are assigned a “1” and all others assigned a “0.” A sum of this variable was calculated for all friends nominated, the sum was then divided by the total number of friends nominated in order to get a proportion.

A mean of the social network status variables for friend and most liked nominations was also calculated as a measure of friends’ social network status.

**Demographic covariates and control variables.** Variables controlled for in the models include: gender (female), school type (academic or professional), socioeconomic status, and age. Socioeconomic status was calculated using both mother’s and father’s education level and a measure of an adolescent’s disposable income. Due to the differences in depression among adolescents, friends’ gender was also controlled for by including a variable that was the proportion of friends nominated who were female.

Perceived social self-efficacy was also controlled for in the models and was measured with the Perceived Social Self-Efficacy Scale (PSSE; Smith & Betz, 2000). This is a twenty-five item scale that asks about confidence in your ability to perform social tasks, with items structured on a 5-point likert scale ranging from 1 (No confidence at all) to 5 (Complete confidence). Answers are summed with total scores ranging from 1 to 125.

**Data Analysis**

Both multilevel linear and logistic regression analysis procedures were used to analyze the data. Multilevel analysis was needed to explain individual-level outcomes with school and class level characteristics. All analyses were done using STATA version 11 (StataCorp, 2009), with social network status variables calculated using UCINet (Borgatti, Everett, & Freeman, 1999).

There is a large body of research indicating cognitions regarding social relationships and self-efficacy are strongly associated with depression-related outcomes (for review, see Jacobs,
Reinecke, Gollan, & Kane, 2008); therefore, perceived social self-efficacy was controlled for in all models. An adolescent’s own social network status was also controlled for in all models - as measured by in-degree, a measure of network centrality which is essentially a standardized measure of the number of friend nominations a student received from classmates.

To examine the first hypothesis, that friend depressive symptoms are positively associated with depressive symptoms, multilevel linear regression analyses were conducted, simultaneously entering friends’ depressive symptoms and the demographic and control variables in the level-one (fixed effects) model and school type in the level-three (school-level random effects) model for depressive symptoms. There were no level two (class level) variables examined, though this level of analysis was included in the random effects model. The second model tested included both mean friend depressive symptoms and mean most liked depressive symptoms. Two additional models with these same independent variables were run using logistic regression with a dichotomized version of the CES-D score as the outcome, with scores of ≥28 being equal to one and all other scores equal to zero. Hypothesis two was tested in a similar manner using the same demographic covariates and control variables, with the proportion of depressed friends serving as the main independent variable in place of mean friend depression scores. The third hypothesis again included the covariates, this time also controlling for mean friends’ depressive symptoms. The main independent variables of interest in these models were friend social network status variables. Finally, gender was examined in each model in order to investigate the fourth study hypothesis and all models were run separately for each gender.
RESULTS

Distribution of Demographic Characteristics and Main Study Variables. The participation rate for the study was high, with a 93.3% participation rate. Table 1 presents descriptive data for the sample. The average age of participants was 15.8 and the mean SES, ranging from 1-10 on a composite measure including mother and father education and allowance per week, was 4.4. The mean depressive symptoms score (CES-D; range: 1-60) for the sample is 17.9. Using a cut-point score of 28 or greater on the CES-D resulted in 16.8% of the sample reporting high depressive symptoms.

<table>
<thead>
<tr>
<th>Table 4. Sample Characteristics</th>
<th>Total</th>
<th>Academic</th>
<th>Professional</th>
<th>Girls</th>
<th>Boys</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classes</td>
<td>124</td>
<td>56</td>
<td>68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean class size (SD)</td>
<td>51.8 (12.2)</td>
<td>55.6 (13.8)</td>
<td>48.3 (9.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (%)</td>
<td>50.3%</td>
<td>49.4%</td>
<td>50.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female (%)</td>
<td>49.7%</td>
<td>50.6%</td>
<td>49.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Age (SD)</td>
<td>15.8 (0.72)</td>
<td>15.7 (0.64)</td>
<td>16.0 (0.77)</td>
<td>15.7 (0.70)</td>
<td>15.9 (0.73)</td>
<td>13-19</td>
</tr>
<tr>
<td>Mean SES (SD)</td>
<td>4.4 (1.5)</td>
<td>5.0 (1.5)</td>
<td>3.8 (1.2)</td>
<td>4.4 (1.5)</td>
<td>4.4 (1.5)</td>
<td>1-10</td>
</tr>
<tr>
<td>Mean CES-D Score (SD)</td>
<td>17.9 (11.0)</td>
<td>18.7 (11.4)</td>
<td>17.1 (10.5)</td>
<td>18.6 (11.4)</td>
<td>17.1 (10.5)</td>
<td>0-60</td>
</tr>
<tr>
<td>CES-D Score ≥ 28 (%)</td>
<td>16.8%</td>
<td>21.7%</td>
<td>16.2%</td>
<td>21.5%</td>
<td>16.2%</td>
<td></td>
</tr>
<tr>
<td>Mean PSSE (SD)</td>
<td>80.4 (19.9)</td>
<td>80.8 (20.4)</td>
<td>80.0 (19.5)</td>
<td>80.3 (18.6)</td>
<td>80.6 (21.3)</td>
<td>1-125</td>
</tr>
<tr>
<td>Social network measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean friend nominations (SD)</td>
<td>3.7 (2.4)</td>
<td>4.0 (2.3)</td>
<td>3.8 (2.3)</td>
<td>4.1 (2.2)</td>
<td>3.7 (2.3)</td>
<td>0-17</td>
</tr>
<tr>
<td>Mean friends nominated (SD)</td>
<td>3.7 (2.0)</td>
<td>3.9 (1.9)</td>
<td>3.6 (2.1)</td>
<td>4.0 (1.8)</td>
<td>3.5 (2.1)</td>
<td>0-5</td>
</tr>
<tr>
<td>Mean most liked nominations (SD)</td>
<td>3.2 (4.3)</td>
<td>3.5 (4.5)</td>
<td>3.5 (4.3)</td>
<td>3.2 (4.2)</td>
<td>3.8 (4.6)</td>
<td>0-40</td>
</tr>
<tr>
<td>Mean most liked nominated (SD)</td>
<td>3.5 (1.9)</td>
<td>3.6 (1.8)</td>
<td>3.5 (1.9)</td>
<td>3.8 (1.8)</td>
<td>3.3 (1.9)</td>
<td>0-5</td>
</tr>
<tr>
<td>Friend social network status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marginalized (0 friend noms.)</td>
<td>3.0%</td>
<td>2.4%</td>
<td>3.2%</td>
<td>2.0%</td>
<td>3.7%</td>
<td></td>
</tr>
<tr>
<td>Peripheral (1-2 noms.)</td>
<td>11.7%</td>
<td>25.7%</td>
<td>28.3%</td>
<td>23.4%</td>
<td>30.8%</td>
<td></td>
</tr>
<tr>
<td>Accepted (3-5 noms.)</td>
<td>49.3%</td>
<td>47.1%</td>
<td>46.8%</td>
<td>49.3%</td>
<td>44.3%</td>
<td></td>
</tr>
<tr>
<td>Popular (6-7 noms.)</td>
<td>28.8%</td>
<td>17.2%</td>
<td>15.0%</td>
<td>17.5%</td>
<td>14.7%</td>
<td></td>
</tr>
<tr>
<td>Favorite (8+ noms.)</td>
<td>7.2%</td>
<td>7.6%</td>
<td>6.7%</td>
<td>7.8%</td>
<td>6.5%</td>
<td></td>
</tr>
<tr>
<td>Most liked network status (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marginalized (0 most liked noms.)</td>
<td>21.0%</td>
<td>22.3%</td>
<td>19.7%</td>
<td>24.6%</td>
<td>17.3%</td>
<td></td>
</tr>
<tr>
<td>Peripheral (1 noms.)</td>
<td>20.1%</td>
<td>20.1%</td>
<td>20.0%</td>
<td>20.3%</td>
<td>19.8%</td>
<td></td>
</tr>
<tr>
<td>Accepted (2-4 noms.)</td>
<td>33.0%</td>
<td>31.5%</td>
<td>34.5%</td>
<td>31.2%</td>
<td>34.9%</td>
<td></td>
</tr>
<tr>
<td>Popular (5-8 noms.)</td>
<td>15.7%</td>
<td>14.7%</td>
<td>16.7%</td>
<td>14.9%</td>
<td>16.7%</td>
<td></td>
</tr>
<tr>
<td>Favorite (9+ noms.)</td>
<td>10.2%</td>
<td>11.4%</td>
<td>9.1%</td>
<td>9.0%</td>
<td>11.3%</td>
<td></td>
</tr>
</tbody>
</table>

The mean score on the perceived social self-efficacy scale was 80.4 with a range of 1-125.

The average number of friends a student nominated was 3.7, and 3.5 was the average for most
liked nominations. The most friend nominations received by a single student was 17 and the most liked nominations received by a single student was 40. About half of the sample (49.3%) had a friend network status of “accepted,” whereas 33% had an “accepted” most liked network status.

**Differences in Study Variables by School and Gender.** A series of t-tests were conducted to determine equivalence on the main study variables for adolescents in the different school types and for males and females. Age and perceived social self-efficacy (PSSE) did not differ between school types or males and females. The mean age was about 16 for all groups and the mean PSSE score was about 80. Academic and professional school students were significantly different on depressive symptoms (t=5.29, p<0.01) with those attending academic schools having significantly higher CES-D scores (a mean score of 18.7 versus 17.1 for those in professional schools). Students in the different school types also differed significantly on the SES measure (t=33.7, p<0.01), which is not that surprising considering those in academic schools are probably more likely to have parents that attended academic schools themselves which also makes it more likely they attended college than parents of professional school students. There were also significant differences on the social network measures for the different school types, with academic school students nominating more friends (t=5.41, p<0.01) and most liked (t=3.38, p<0.01) as well as being nominated more as friends (3.51, p<0.01). Due to these significant differences by school type, all models will be run separately for each school type.

Differences also existed between males and females on certain study variables. As expected, depressive symptoms were significantly different (t=5.13, p<0.01), with females reporting higher mean CES-D scores (18.6 versus 17.1 for males). Females nominated more friends (t=8.87, p<0.01) and more people as most liked (t=9.14, p<0.01). Girls also received more friend nominations (t=6.77, p<0.01) than boys, but boys received more nominations for most
liked (t=5.33, p<0.01) than girls. Males and females did not differ on socioeconomic status.

Again, due to these significant differences in the main variables, the models will be run separately for girls and boys in order to more fully examine the study hypotheses.

**Main Results**

**Multilevel Analysis of Friend Depression and Adolescent Depressive Symptoms.** The first model tested for the study examined the effects of friends’ depressive symptoms on an adolescent’s own depressive symptoms. Perceptions of social self-efficacy were the strongest predictors of depressive symptoms included in the model, confirming past research on cognitive models of depression. As predicted, mean friends’ CES-D scores was significantly associated with depressive symptoms (β=0.10, p<0.01), even after controlling for social cognitions (see Table 2). For the most part, this was consistent across both school type and gender, with the magnitude of the association remaining fairly consistent. Boys in academic schools, however, did not show the association predicted in hypothesis one.

The second model shown in Table 2 includes the mean depressive symptoms for those nominated as most liked. This is significantly associated with depressive symptoms for the total sample, but when looking at the models by school type and gender, it becomes clear that this is mainly due to professional school students (β=0.09, p<0.01). The relationship is strongest for professional school boys (β=0.14, p<0.01), where the association between friends’ depressive symptoms (from model 1) actually becomes non-significant when the most liked CES-D variable is added to the model (model 2), indicating that for boys in professional schools the influences on depressive symptoms from those whom they think are sociometrically popular are greater than the influences from friends.
Table 3 reports logistic regression models with the same independent variables as Table 2, but further examining how these variables are related to depression outcomes for those reporting levels of depressive symptoms that indicate greater impairment. For the most part, the results are the same as those reported in Table 2. However, the magnitude of the associations between most liked peers’ depressive symptoms and depression appears more clearly in this analysis for professional school students. In the previous models, both friend and most liked depressive symptoms were significantly associated with depressive symptoms for girls which is still the case in the logistic regression for depression; however, the adjusted odds ratio is greater for most liked than friends’ CES-D (AOR = 1.23 versus AOR = 1.03).

Table 4 presents the results for the analysis for hypothesis two, which examined the proportion of depressed friends rather than just the average of CES-D scores. As would be expected, since mean friends’ depressive symptoms was associated with depressive symptoms, the proportion of depressed friends is significantly associated with individual CES-D scores (β=0.09, p<0.01), again with the exception of academic school boys. The standardized coefficients in Table 4 are quite similar to those in Table 2, which could indicate this measure of peers’ depressive symptoms is not that different from the mean CES-D score.

However, the logistic regression analysis (Table 5) shows a different picture. The proportion of depressed friends is associated with depression (AOR=2.85, p<0.01 for the total sample), still with academic school boys remaining the exception. The proportion of depressed friends is more highly associated with depression for professional school students (AOR=3.34 versus AOR=2.44 for academic students, p<0.01 for both). Another difference from the models testing the first hypothesis is the association between proportion of depressed most liked is significantly associated with depression for academic school girls (AOR=3.35, p<0.01), which was not the case for mean most liked CES-D. Again, that magnitude of the association between
Table 5: Standardized Coefficients for Multilevel Models of Friend Depressive Symptom on Depressive Symptoms

<table>
<thead>
<tr>
<th>Model</th>
<th>Total Sample</th>
<th>Academic School Type</th>
<th>Professional School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>All</td>
<td>Girls</td>
</tr>
<tr>
<td>Fixed Effects Estimates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Friend CES-D</td>
<td>0.10**</td>
<td>0.09**</td>
<td>0.11**</td>
</tr>
<tr>
<td>Mean Liked CES-D</td>
<td>0.06**</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Prop. of Female Friends</td>
<td>-0.02</td>
<td>-0.03</td>
<td>-0.11</td>
</tr>
<tr>
<td>In-Degree (Friend)</td>
<td>-0.04**</td>
<td>-0.04</td>
<td>-0.05</td>
</tr>
<tr>
<td>PSSE</td>
<td>-0.19**</td>
<td>-0.23**</td>
<td>-0.25**</td>
</tr>
<tr>
<td>Age</td>
<td>0.03*</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>SES</td>
<td>0.08**</td>
<td>0.06**</td>
<td>0.06*</td>
</tr>
<tr>
<td>Female</td>
<td>0.06**</td>
<td>0.08**</td>
<td>0.06*</td>
</tr>
</tbody>
</table>

Random Effects Estimates

| Level 3 (School) | 0.08** | 0.07** |
| School Type | 0.02 | <0.01 |
| Level 2 (Class) | <0.01 | <0.01 | 0.06 | 0.06 | <0.01 | 0.05 | 0.17** | 0.15** | <0.01 | <0.01 | <0.01 | <0.01 | 0.08 | <0.01 |
| Observations (N) | 4026 | 3543 | 1976 | 1748 | 1097 | 980 | 879 | 768 | 2050 | 1795 | 1127 | 1013 | 923 | 782 |

* p<0.10,  ** p<0.05,  *** p<0.01
<table>
<thead>
<tr>
<th>Model</th>
<th>Total Sample</th>
<th>Academic School Type</th>
<th>Professional School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Fixed Effects Estimates (Odds Ratios)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Friend CES-D</td>
<td>1.04**</td>
<td>1.03**</td>
<td>1.03**</td>
</tr>
<tr>
<td>Mean Most Liked CES-D</td>
<td>1.14**</td>
<td>1.02</td>
<td>1.02</td>
</tr>
<tr>
<td>Prop. of Female Friends</td>
<td>0.94</td>
<td>0.98</td>
<td>0.77</td>
</tr>
<tr>
<td>In-Degree (Friend)</td>
<td>0.96**</td>
<td>0.96</td>
<td>0.96*</td>
</tr>
<tr>
<td>Perceived Social Self Efficacy</td>
<td>0.69**</td>
<td>0.60**</td>
<td>0.57**</td>
</tr>
<tr>
<td>Age</td>
<td>1.09</td>
<td>1.04</td>
<td>1.15</td>
</tr>
<tr>
<td>SES</td>
<td>1.17**</td>
<td>1.06</td>
<td>1.14*</td>
</tr>
<tr>
<td>Female</td>
<td>1.43**</td>
<td>1.43</td>
<td></td>
</tr>
<tr>
<td><strong>Random Effects Estimates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 3 (School)</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>School Type</td>
<td>0.13**</td>
<td>0.10*</td>
<td></td>
</tr>
<tr>
<td>Level 2 (Class)</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Observations (N)</td>
<td>4027</td>
<td>3544</td>
<td>1976</td>
</tr>
</tbody>
</table>

*p<0.10, **p<0.05, ***p<0.01
proportion of depressed most liked and depression is greater than that between the proportion of depressed friends and depression for both professional school girls (AOR=7.68 versus AOR=3.28 for friends) and boys (AOR=7.24 versus AOR=2.64 for friends).

**Multilevel Analysis of Friend Social Network Status and Adolescent Depressive Symptoms.** The final analysis consisted of three models examining the association between peers’ social network status and depressive symptoms. As Table 6 indicates, peers’ social network status is not significantly associated with depressive symptoms. However, there are two notable exceptions that are interesting enough to warrant the inclusion of this analysis in the study. First and most surprisingly, for academic girls, the social network status of those they nominate as most liked is significantly positively associated with depressive symptoms (β=0.07, p<0.05). This indicates that the higher the status of those they nominate as most liked, the higher their depressive symptoms. Second, for professional school boys, the social status of those they nominate as friends is negatively associated with depressive symptoms (β=-0.06, p<0.05). This indicates that the higher the status of professional school boys’ nominated friends, the lower their depressive symptoms.

**Interaction Terms.** Due to potential interdependence issues regarding gender and depression, it was necessary to examine the gender of an adolescent’s friends and determine if this was the reason for the significant association between friends’ depression and an individual’s depressive outcomes. The proportion of friends’ nominated who were female was included in all models tested as a control variable. Interaction terms including female friends’ and mean friends’ CES-D and proportion of depressed friends were also included in each of the models tested. These terms are not included in the tables provided as most of the interactions were non-significant. There were two significant interactions to note, both for professional school boys. A significant interaction term was found for mean friends CES-D and proportion of
Table 7: Standardized Coefficients for Multilevel Models of Friend Depression on Depressive Symptoms

<table>
<thead>
<tr>
<th>Model</th>
<th>Total Sample</th>
<th>Academic School Type</th>
<th>Professional School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>Fixed Effects Estimates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prop Depressed Friends</td>
<td>0.09**</td>
<td>0.07**</td>
<td>0.09**</td>
</tr>
<tr>
<td>Prop. Depressed Most Liked</td>
<td>0.08**</td>
<td>0.04</td>
<td>0.09*</td>
</tr>
<tr>
<td>Prop. of Female Friends</td>
<td>-0.01</td>
<td>-0.02</td>
<td>-0.11</td>
</tr>
<tr>
<td>In-Degree (Friend)</td>
<td>-0.04**</td>
<td>-0.04</td>
<td>-0.05</td>
</tr>
<tr>
<td>PSSE</td>
<td>-0.19**</td>
<td>0.23**</td>
<td>-0.25**</td>
</tr>
<tr>
<td>Age</td>
<td>0.03*</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>SES</td>
<td>0.08**</td>
<td>0.06**</td>
<td>0.06*</td>
</tr>
<tr>
<td>Female</td>
<td>0.06**</td>
<td>0.08**</td>
<td></td>
</tr>
</tbody>
</table>

Random Effects Estimates

| | Level 3 (School) | Level 2 (Class) | Observations (N) |
| | | | |
| School Type | 0.10** | <0.01 | 4028 |
| Level 2 (Class) | 0.08** | 0.04 | 2659 |

*p<0.10, *p<0.05, **p<0.01
Table 8: Odds Ratios for Multilevel Models of Friend Depression on Depression

<table>
<thead>
<tr>
<th>Model</th>
<th>Total Sample</th>
<th>Academic School Type</th>
<th>Professional School Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All Girls</td>
<td>All Boys</td>
<td>Boys</td>
</tr>
<tr>
<td>Fixed Effects Estimates (Odds Ratios)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prop. of Depressed Friends</td>
<td>2.84**</td>
<td>2.44**</td>
<td>2.75**</td>
</tr>
<tr>
<td>Prop. of Depressed Most Liked</td>
<td>3.39**</td>
<td>3.96</td>
<td>0.96**</td>
</tr>
<tr>
<td>Prop. of Female Friends</td>
<td>0.94</td>
<td>0.99</td>
<td>0.78</td>
</tr>
<tr>
<td>In-Degree (Friend)</td>
<td>0.96**</td>
<td>0.96</td>
<td>0.96**</td>
</tr>
<tr>
<td>Perceived Social Self Efficacy</td>
<td>0.69**</td>
<td>0.60**</td>
<td>0.64**</td>
</tr>
<tr>
<td>Age</td>
<td>1.09</td>
<td>1.04</td>
<td>1.15</td>
</tr>
<tr>
<td>SES</td>
<td>1.17**</td>
<td>1.06</td>
<td>1.14**</td>
</tr>
<tr>
<td>Female</td>
<td>1.43**</td>
<td>1.57**</td>
<td>1.43**</td>
</tr>
<tr>
<td>Random Effects Estimates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 3 (School)</td>
<td>&lt;0.01</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>School Type</td>
<td>0.18**</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Level 2 (Class)</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Observations (N)</td>
<td>4029</td>
<td>2660</td>
<td>1977</td>
</tr>
</tbody>
</table>

*p<0.10, **p<0.05, ***p<0.01
female friends for professional school boys ($\beta = -0.37$ for depressive symptoms; AOR=1.37 for depression, $p<0.05$ for both). The proportion of depressed friends and proportion of female friends’ interaction was also significant (AOR=1.77, $p<0.01$), though for depression and not depressive symptoms in this case. This indicates that the proportion of friends’ who are female does influence the depression scores of friends for professional school boys. For these boys, having more female friends results in their friends’ having higher depression scores, which in turn influences that individual’s own depression outcomes.

Other interaction terms including friends’ demographic characteristics (age and SES) and mean friends’ depression were also tested. None of these other interaction terms were significant, so the parsimonious models without the interaction terms are presented.

DISCUSSION

A robust body of work exists among the peer relationship research citing meaningful links between adolescents’ and their friends’ psychological characteristics. Research supports the proposition that various social processes occur concurrently at multiple levels of the social environment, though the bulk of the work examining interpersonal relationships and influences focuses exclusively on individual characteristics often to the exclusion of group and system level factors. There are many determinants of depressive symptoms (for review, see Petersen et al., 1993), but it is becoming clear that an individual’s experience of depressive outcomes also depends on whether others in the individual’s social network report depressive symptoms. Depression and depressive symptoms, therefore, are not solely a result of individual experiences, cognitions, and choices but can be an attribute of groups and networks.
Table 9: Standardized Coefficients for Multilevel Models of Friend Social Network Status on Depressive Symptoms

<table>
<thead>
<tr>
<th>Model</th>
<th>Total Sample</th>
<th>Academic</th>
<th>Professional</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**Fixed Effects Estimates**

- **Mean Friend Status**
  - (Friend) -0.01 0.01 -0.01 0.03 -0.03 0.01 -0.06* 0.01 -0.06* -0.03
  - (Friend) 0.02 0.02 0.02 0.01 0.02 0.05 + -0.03 -0.03 -0.03
  - (Liked) 0.03* 0.04* 0.07* 0.01 0.02 0.02 <0.01 0.02 0.02 <0.01

- **Mean Friend CES-D**
  - 0.10** 0.10** 0.11** 0.05 0.11** 0.13** 0.07 0.13** 0.07 0.08 0.08 0.08

- **Prop. of Female Friends**
  - -0.01 -0.02 -0.11 0.07 0.02 -0.04 0.08 0.04 0.04 0.08 0.08 0.08

- **In-Degree (Friend)**
  - -0.04* -0.04* -0.05* -0.03 -0.04* -0.07* -0.05 -0.07* -0.08** -0.05* -0.08** -0.05* -0.08**

- **PSSE**
  - -0.19** -0.23** -0.25** -0.21** -0.16** -0.23** -0.23** -0.23** -0.08**

- **Age**
  - 0.03* 0.03 0.04 0.01 0.04* 0.04 0.06* 0.04 0.04 0.06* 0.03

- **SES**
  - 0.08** 0.06** 0.06* 0.06* 0.06* 0.10** 0.11** 0.11** 0.11** 0.09

- **Female**
  - 0.06** 0.08** 0.08** 0.08** 0.08** 0.08** 0.08** 0.08** 0.08** 0.08**

**Random Effects Estimates**

- **Level 3 (School)**
  - 0.08* 0.09* 0.08* 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02 0.02

- **School Type**
  - <0.01 <0.01 <0.01 0.06 0.06 0.09* <0.01 <0.01 0.08 0.17** 0.17** 0.16** 0.17** 0.17** 0.16**

- **Level 2 (Class)**
  - <0.01 <0.01 <0.01 0.102 0.116 0.1048 0.1065 0.998 0.881 0.2359 0.2280 0.2006 0.1262 0.1229 0.1095 0.1097 0.1051 0.911

- **Observations (N)**
  - 4626 4442 3935 2267 2162 1929 1202 1164 1048 1262 1229 1095 1065 998 881 1097 1051 911

*p<0.10, *p<0.05, **p<0.01
The results of this study support previous research examining the peer contagion effects on internalizing symptoms, that adolescent depressive symptoms are associated with those of their peers. After controlling for individual-level social cognitions and social network status, self-reported friends’ depressive symptoms were positively associated with depressive symptoms for Chinese adolescents, with the exception of academic school boys. Those an adolescent nominated as “most liked,” often considered sociometric popularity, also had some effect on depressive symptoms for professional school students, particularly boys. Both friend nominations and most liked nominations were significantly correlated for all subgroups, as are friends’ and most liked depressive symptoms, though the correlation was moderate-to-small (r<0.50 for all groups, including professional school boys). This points to these two social network measures as being related yet separate distinctions that (as indicated by the model 2 findings in both Table 2 and Table 3) contribute meaningfully in their own ways to depressive outcomes.

The second portion of the analysis examined peer social status and depressive symptoms and the results were more modest. The social network status of those nominated as “most liked” was positively related to depressive symptoms for academic school girls. Similar findings were reported by Prinstein (2007) in a study of peer contagion, though among boys rather than girls. Prinstein suggested that adolescents, in this case academic school girls, could be more likely to “emulate the behaviors of friends who are especially popular among peers.” The present findings could indicate an imbalance of social “power” or “influence” for girls in academic schools, or at least a perceived discrepancy between their own popularity and that of those they consider to be particularly well-liked among their peers. It could also be, as indicated by the higher average “most liked” nominations received for boys than girls, that boys are the ones with all the social “influence” and this imbalance or discrepancy may be more noticeable or
meaningful in academic rather than professional schools. This does make some sense when considering the culturally supported gender inequality that still occurs in China, which could make girls feel as if they have to “work twice as hard for half as much” in terms of social influence.

Friends’ social status was negatively associated with depressive symptoms for professional school boys. This result seems the more straightforward of the two significant associations between peers’ social status and depressive symptoms, since it seems logical that the more friends an individual’s friends have the fewer depressive symptoms they report. It indicates that those who are accepted within their classrooms and who have friends who are accepted experience less internalized distress. Those who are less accepted and are part of a peer group that is less accepted overall report more depressive symptoms. These are often the individuals and peer groups that are considered “at risk” in much of the adolescent health behavior research for outcomes such as substance use, deviant and antisocial behavior, aggression, and suicidal ideation.

The results for friends’ and most liked depressive symptoms relationship to an adolescent’s own depressive outcomes was significant for the total sample of Chinese adolescents, but it was clear when examining the models by the different subgroups that there are noticeable differences in magnitude and meaningfulness for these groups. Chinese youth experience unique social environments that, in some regards, are quite different from Western youth. As much of the previous work on peer contagion effects of depression-related outcomes has been conducted with Western cultures, this study adds to the work by examining these hypotheses in a collectivist, Eastern culture. The meaning and influence social interactions have for Chinese adolescents may affect their association with depressive symptoms. This is a promising avenue for future work, as the impact of rapid social and cultural changes in China is
still unclear and rates of psychological distress and outcomes, such as depression and suicidal behavior is on the rise (Daly, 2009).

**Limitations**

The findings from this study should be considered within the limitations of the research. First, past research examining the influence of social network members (Fowler & Christakis, 2008) has found that the strength of an effect depends on the strength of the tie (e.g. the strength or quality of a friendship). This study did not include measures of the quality or strength of a reported relationship. It may also be the case that the strength of any association is stronger for relationships that are reciprocated (e.g. a reciprocal friendship occurs when both people nominate the other as a friend). Another consideration is the fact that unreciprocated friendships themselves may cause or contribute to depressive symptoms.

Second, while the associations reported were significant, the effects were small. This could potentially limit the meaningfulness of the findings; however some have suggested that small effect size can still have practical applicability (Rosenthal, Rosnow, & Rubin, 2000). This, in conjunction with a fairly conservative analytic strategy suggests that the results do represent meaningful processes for adolescents across the social environments sampled for this study.

The CES-D is a self report assessment of depressive symptoms, rather than a clinical assessment of syndrome or disorder, therefore the findings of this study do not generalize to populations who have diagnosable disorders and it is not possible to determine whether the suggested peer contagion effects are important mechanisms operating in more clinical populations. Also, though the design and measurement of the study enables examination of data from more than one source, which is a considerable strength of the study, the social
network nomination format was limited to school-based peers which may not be the most influential peers for all youth.

Despite these limitations, the results confirm that peers’ depressive symptoms have a significant association with depressive symptoms for Chinese adolescents.

**Implications and Future Directions**

The data analyzed for this study do not allow for identification of causal mechanisms of peer contagion effects on depression-related outcomes, but the results can suggest and aid in understanding potential causal pathways for future testing with longitudinal data. Existing longitudinal results already indicate that friends’ behaviors are significant predictors of adolescents’ own behavior over time (Hogue & Steinberg, 1995; Jaccard, Dodge, & Blanton, 2005; Prinstein, 2007). It may be that those experiencing depressive symptoms share their sadness or dissatisfaction with their friends or commiserate with their peers about their own depressive feelings, thoughts, and attitudes. Some have suggested that emotion is genuinely contagious, and it may be that over time this contagious affect can result in depression. It may also be that social behavior changes towards friends and other peers when one experiences depressive symptoms, which can change and quality and tone of social interactions causing others to experience depressive symptoms as a result.

Adolescents are embedded within social networks that have the potential to influence health behavior in both positive and negative ways. From this network perspective, the health and well-being of one individual has implications for the health and well-being of their peers. The role social relationships play in mental and physical health is significant and by examining theories formulated with considerations of the multiple levels the social environment encompasses, such as peer contagion theories, a better understanding of the complex social
processes that occur to influence health behavior can be gained. This is crucial for the
development, design, and implementation of effective interventions. Past prevention research
efforts have spent a great deal of time, effort, and resources attempting social interventions
focused on adolescents and their peers for a multitude of health outcomes with mixed success.
Even with the large body of work that exists on social influences interventions among
adolescents, the understanding of the ever-changing social forces and environments youth
inhabit is still surprisingly sparse. Attention to social network influences on depressive
symptoms and other depression-related outcomes among adolescents could provide a greater
understanding of peer contagion and other social processes impacting the health of young
people.
CHAPTER 4:
The Classroom Social Network and Depressive Symptoms: Do Network Composition and Characteristics Influence Adolescent Depression?

CHAPTER FOUR ABSTRACT

A school class can be seen as a combination of work group and peer group. The social interplay that takes place within the school class can be considered an influential life situation for the individual adolescent’s social, emotional, and behavioral development. **Methods:** Measures of depressive symptoms and social network nominations were examined at the classroom social network level using multilevel linear regression models for an overall sample of 124 Chinese 10th grade classrooms in 24 schools. **Results:** For the total sample, proportion of peripheral network members based on friend nominations was associated with depressed students (β=0.26, p<0.05). A higher proportion of high status students in a classroom was positively associated with the proportion of depressed in a class for academic school classes (β=0.39, p<0.01). Findings suggest that classes with higher proportions of peripheral members have more depressed students and those with higher proportions of favorite status members have fewer depressed students in professional schools. Measures of social network density, centralization, and reciprocity were not significantly associated with depression in this sample. **Conclusions:** An individual adolescent experiences their social environment often as more than a mere sum of its parts, so examination of each element individually or even additively may not fully describe the complex social processes youth encounter. Social network influences work together interdependently to collectively impact health and well-being.
INTRODUCTION

Several decades of research make a clear link between social relationships and ties and depressive symptoms during adolescence. In general, these studies have examined an individual adolescent’s perceptions of their social ties and social acceptance and have rarely considered social relationships from a holistic perspective – one that considers social interaction as a composite of the perceptions and actions of others. It is therefore important to also view the relationship between social relationships and depression-related outcomes from a broader, more systemic perspective to better understand the processes involved with this association. Group characteristics, such as social network structure, role expectations, and hierarchical social organization, can potentially have a large impact on psychological well-being (Boivin, Coie, & Dodge, 1995).

There have been relatively few studies that have investigated the structure of social networks as it relates to depressive symptoms among adolescents (for exceptions see Hansell 1985; Ueno 2005). Social network measures and methodologies have at least one distinct advantage over non-network studies in that they do not rely on self-report alone. It has been proposed that participation in social networks subject an individual to “social controls and peer pressures that influences normative health behaviors” (Cohen, Gottlieb, & Underwood; 2000). It is also thought that shared norms regarding physical and psychological well-being can be powerful sources of social influence that have direct effects on the health and behavior of social network members (Berkman, Glass, Brissette, & Seeman, 2000).

The study of context and health outcomes spans various disciplines. Much of the sociological literature, for example, has examined the neighborhood context as an important
contributor to health. For adolescents, the school is a more relevant environment. It is the main social environment in which they interact with their peers and serves as the very core of youth culture.

*School Context during Adolescence: The Classroom Social Network*

A school class can be seen as a combination of work group and peer group. It is constant over a relatively sustained period time and is a setting in which adolescents spend a great deal of time at an age when peer relations are important. At the same time, group membership can be considered imposed, rather than a matter of selection. In some ways, group members do not have the ability to exclude or change network membership on their own. They do not control the entry or egress of members as occurs in other types of social networks. These factors all combine to create an environment in which social hierarchies, both simple and complex, commonly occur; unique social norms and cultures are developed; and positive and negative behaviors modeled. Therefore, the social interplay that takes place within the school class can be considered an influential life situation for the individual adolescents’ social, emotional, and behavioral development.

Of the different levels of network analysis (individual, dyadic, and group), the majority of the work has been done at the first two levels, with far fewer studies examining the influence the structure and attributes of the social network may have on the overall health or health behavior of the group (Cillessen, 2007). Much of the work that has examined the influence of classroom network composition and structure has been conducted with children. Findings from studies examining network characteristics of classrooms have found support for the idea that classroom social structure can influence health behaviors in children and adolescents. For example, Ostberg (2003) found that children in classes with no isolated or extremely popular students had
fewer psychosomatic symptoms overall than those in classes that had a more disproportionate distribution of influence (e.g. a few very popular people maintaining the majority of the social “power”). Another study with Chinese children found that in classes characterized as having a high level of social withdrawal, the behavior was more acceptable than in classes with low levels of withdrawal (Chang, 2004). Studies examining aggression have found similar outcomes, with aggressive individuals being more accepted in aggressive playgroups where they are typically rejected in less aggressive playgroups (Boivin, Dodge, & Coie, 1995; Stormshak, et al., 1998; Wright, Giammarino, & Parad, 1986).

Psychological functioning and adaptation are influenced by numerous factors. From an ecological perspective, the classroom is one social context where adolescents spend the majority of their time with peers and should therefore prove influential to mental health outcomes, such as depressive symptoms and depression. The structure and organization of the classroom social network is a facet of the adolescent social environment in need of further elucidation.

**Study Hypotheses**

The present study examined how the structure and characteristics of the classroom social network influences group-level adolescent depression outcomes. More specifically, it examined the social structural characteristics and organization of school classrooms to determine whether these factors influence overall depressive tendencies within a group. The level of analysis, as identified by social network methodologies, was the network level. The primary purpose of the study was to discover if classroom network composition and characteristics were associated with students’ depressive symptoms. To examine this aim, three hypotheses were tested:
H1: Classrooms with higher proportions of marginalized and peripheral network members (those on the fringes of a network) have a greater proportion of depressed students.

H2: Network density and reciprocity are associated with lower proportions of depressed students.

H3: Centralization (network level centrality) is positively associated with the proportion of depressed students.

METHODS

Sampling. Unlike in the United States, China has two primary high school types, academic (regular) and professional (vocational). Students are tested in middle school and scores from those tests determine which school type they will attend. Generally, those attending academic schools have a rigorous schedule of courses for three years of high school (10th through 12th grades), designed to increase the chances students will pass college entrance exams. Those attending professionals schools are enrolled in a career track, such as computers/IT or public relations, and will complete an internship during their final year(s) in high school with the goal of entering the workforce once they have completed high school. Both school types were included in the study, with an equal number of schools and students from each school type. There are more professional school classes in the study, however, due to a trend for these classes to be smaller.

The study included a total sample of 124 10th grade classroom social networks from a convenience sample of 24 schools, 12 of each school type, with 5,563 students. Aggregate data was calculated for each class.
Data Collection. The data for this study was collected as pre-intervention, baseline measurements of a larger parent study examining the efficacy of a school-based tobacco prevention program focusing on social influences. All assessments were paper-based surveys and all participants had active parental consent and student assent. Pre-intervention assessments were collected prior to any intervention delivery, with the pre-test occurring approximately one week prior to intervention implementation for those assigned to the Program condition. The baseline survey was collected approximately one month prior to the pre-test. There were two reasons for the two waves of pre-intervention data collection: 1) the major holiday, Chinese New Year, occurred during that time and would have disrupted data collection efforts and 2) the assessments were each fairly substantial and splitting the measures between two surveys prevented students from becoming fatigued and improved the quality of the data.

Measures

Depressive Symptoms (CES-D; Radloff, 1977). The CES-D is a self-administered scale containing 20 items. The answers to each item, which indicate the frequency of the symptoms, are structured on a 4-point likert scale ranging from 1 (Less than 1 day) to 4 (5-7 days). The answers are summed across all 20 items. The total scores can range from 0 to 60. Radloff (1977) suggested and it is commonly accepted that persons who score 16 or above are likely to be clinically depressed; however, some studies suggest that the cut-point needs to be raised to 24 or higher if the tool is to achieve appropriate diagnostic characteristics (Gotlib, Lewinsohn, & Seeley, 1995; Roberts, Lewinsohn, & Seeley, 1991). A Mandarin-Chinese version of the CES-D (MC-CES-D) has been validated and used in Hong Kong (Cheung & Bagley, 1998; Lam et al., 2004) and among community samples of adolescents in Taiwan where cut-point scores ≥ 28
have been determined, with those above this score more likely to have major depressive disorder (Yang, Soong, Kuo, Chang, & Chen, 2004; Lin et al., 2008). The proportion of depressed students, as measured by those reporting scores greater than or equal to 28 on the CES-D, was the primary outcome of interest and was calculated for each class.

**Social Network Measures.** Sociometric procedures were used to obtain measures of adolescents’ social network status. Peer nominations were used to collect information from each student regarding peer status. Adolescents were asked to list up to five people in their class who they considered their best friends. Students wrote the first and last names of their friends. Similarly, students nominated the five people they considered to be the most liked by people in their class. Peer nominations were later matched to study id’s and names were dropped from the data to protect confidentiality. These nominations were then used to calculate network metrics for the study.

Network level measures of density, reciprocity, and centralization were calculated for each class from these nominations. Network-level density describes the general level of linkage among the members in a network. It is the proportion of nominations in a network relative to the total number possible. A dense network is one in which all the network members are connected directly to every other member, a rare to impossible occurrence in real-world social networks, particularly among adolescents. A sparse network is one where there are few ties between members and a network where communication and social influence would be slow to diffuse. Reciprocity is the extent to which ties are reciprocated between network members in the network as a whole. Assessing network reciprocity can identify imbalances, indicating dysfunction in the network. Centralization is the difference between the number of nominations for each network member divided by maximum possible sum of differences. A centralized
network will have many nominations focused around one or a few network members, while a decentralized network is one in which there is little variation between the number of nominations each member receives (see Figure 6).

![Figure 6. Examples of Centralized and Decentralized Networks](image)

Centralized Network Structure  Decentralized Network Structure

In order to define peer or social network status in a school classroom, researchers often divide individuals into different status categories based on their social network nominations. The status categories are created to represent a more normal distribution. Five social network status categories were created from the friend nomination data for this study, similar to those created in past research (Ostberg, 2003). The first category included those who did not receive any nominations. This group, the “marginalized” category, is usually considered at highest risk for many negative health behavior outcomes. The second group consists of the “peripheral” members of the network, who received one or two friend nominations. The “accepted” category is the largest and includes those receiving three to five nominations. The “popular” category is those with six or seven nominations and the “favorite” those who received eight or more (see Figure 7).
The same five status categories were created for the most liked nominations; however, because the distribution for this type of nomination differs from the friend data, the construction of the categories was different. Most liked nominations, often called “sociometric popularity,” usually have a larger range than friend nomination data with more network members receiving zero or only one nomination. A few network members usually receive the bulk of the most liked nominations in a classroom. Therefore, the marginal category remains the same, but the others are slightly different (peripheral = 1 nomination; accepted = 2-4; popular = 5-8; and favorite = 9 or more nominations). The proportion of students in each class in each status category was calculated as an additional measure of network structure (see Figure 8).

Demographic covariates and control variables. Variables controlled for in the models included aggregated measures of gender (ratio of female students in a class), school type, class size, socioeconomic status (means), and age (mean). Socioeconomic status was calculated using both mother’s and father’s education level and a measure of an adolescent’s disposable income.
**Data Analysis**

Multilevel linear regression analysis procedures were used to analyze the data. Multilevel analysis was needed to explain classroom-level outcomes with school-level characteristics. All analyses were done using STATA version 11 (StataCorp, 2009), with social network variables calculated using UCINet (Borgatti, Everett, & Freeman, 1999) and then imported into STATA.

The analyses for all study hypotheses were treated similarly, with a two-level model including a random effects model for school-level effects and a fixed effects model for classroom-level effects. The control variables were also consistent across the different models, including age, socioeconomic status, class size, and the proportion of female students (gender). In the models examining peer status, the accepted group was used as the reference to avoid over-specification of the models, because it was the largest group, and also because it is considered the “normative” group. All coefficients reported are standardized in order to better compare across models and variables.
RESULTS

Sample Characteristics

*Distribution of Demographic Characteristics and Main Study Variables.* Table 1 presents descriptive data for the sample. Of the 124 classroom that participated in the study, 56 were from academic high schools and 68 from professional schools. The greater number of classes for professional schools was due to the smaller class size in those school (an average class size of 46.3 versus 52.6 for academic schools). The average age of participants was 15.8 and the mean SES, ranging from 1-10 on a composite measure including mother and father education and allowance per week, was 4.4. The mean proportion of female students in classes was 0.49, indicating equal numbers of female and male participants.

The mean depressive symptoms score (CES-D; range: 1-60) for the sample is 17.9. Using a cut-point score of 28 or greater on the CES-D resulted in an average proportion of depressed students in a class of 17%.

The average number of friend nominations received (friend in-degree) was 3.7, and 2.3 was the average for most liked nominations received (liked in-degree). The most friend nominations received by a single student was 17 and the most liked nominations received by a single student was 40. On average, 44% of students in classrooms were categorized as “accepted” using friendships nominations, and 36% using most liked nominations. The mean proportion of marginalized and peripheral network members showed the biggest differences between the different nomination types, with more marginal members for most liked (12%) than friend networks (only 2%).

*Differences in Study Variables by School Type.* A series of t-tests were conducted to determine equivalence on the main study variables for adolescents in the different school types. Gender was not different between school types.
<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participating 10th grade classes</td>
<td>124</td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Professional</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Mean class size (SD)</td>
<td>51.8 (12.3)</td>
<td>24-87</td>
</tr>
<tr>
<td>Academic</td>
<td>55.6 (13.8)</td>
<td>33-87</td>
</tr>
<tr>
<td>Professional</td>
<td>48.3 (9.3)</td>
<td>24-67</td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td>15.8 (0.72)</td>
<td>13-19</td>
</tr>
<tr>
<td>Mean proportion of female students</td>
<td>0.49 (0.19)</td>
<td>1-10</td>
</tr>
<tr>
<td>Mean socioeconomic status (SD)</td>
<td>4.4 (1.5)</td>
<td>1-10</td>
</tr>
</tbody>
</table>

**Depression Outcomes**

- Mean CES-D: 17.9 (11.0) 0-60
- Mean proportion depressed (CES-D≥28): 0.17 (0.07)

**Social network measures**

- Mean Density (SD): 0.07 (0.02)
- Mean Centrality (SD): 0.07 (0.03)
- Mean Reciprocity (SD): 0.35 (0.07)
- Mean proportion of status categories
  - Friend nomination categories
    - Marginal: 0.02 (0.03)
    - Peripheral: 0.26 (0.09)
    - Accepted: 0.44 (0.09)
    - Popular: 0.15 (0.06)
    - Favorite: 0.06 (0.04)
  - Most liked nomination categories
    - Marginal: 0.12 (0.07)
    - Peripheral: 0.11 (0.05)
    - Accepted: 0.36 (0.08)
    - Popular: 0.14 (0.06)
    - Favorite: 0.09 (0.05)
- Mean In-Degree Measures (SD)
  - Friend in-degree: 3.7 (2.4) 0-17
  - Liked in-degree: 2.3 (4.3) 0-40

However, there was a greater mean proportion of popular adolescents based on friend nominations in academic schools versus professional schools (t = 2.1, p<0.05; 16% versus 14% in professional schools). The same is seen for the proportion of favorite students based on most liked nominations (t = 2.7, p<0.01). Network level reciprocity was also different by school type (t = 4.1, p<0.01) with reciprocity lower in professional schools. For demographic variables, professional school students had a higher mean age (t = 12.2, p<0.01), lower average SES (t = 14.7, p<0.01), and smaller class sizes (t = 3.1, p<0.01). The most meaningful differences between
school types for the study were in depressive symptoms, with academic classrooms having a
greater proportion of depressed students (t = 5.3, p<0.01; mean proportion of 20% versus 14%
for professional schools). Therefore, due to these significant differences by school type, all
models were run separately for each school type.

**Main Results**

*Multilevel Linear Regression Analysis of Social Network Status Measures and Depression.*

Table 2 presents the results of models examining social network status (models 1 & 2) and
structure (model 3) on depression, the proportion of depressed students in the class in this case.
The first model tested the associations between status variables based on friend nominations
and depression. Hypothesis one, stating that greater proportions of lower status network
members would be associated with greater classroom-level depression was partially supported
in the analysis. For the total sample, proportion of peripheral network members based on friend
nominations is associated with depressed students (β=0.26, p<0.05), but this association is not
significant for either school type individually. A higher proportion of favorite status students in a
classroom is positively associated with the proportion of depressed in a class for academic
school students (β=0.39, p<0.01). This finding seems somewhat contrary to hypothesis one. It is
the only finding of significance for academic school students. For professional school students,
proportion of peripheral (β=0.30, p<0.01)and favorite (β=-0.23, p<0.05) status individuals in a
class based on most liked nominations are associated with the proportion of depressed in a
class, though in opposite directions. These findings suggest that classes with higher proportions
of peripheral members based on most liked nominations have more depressed students and
those with higher proportions of favorite members have fewer depressed students, but only in
professional schools.
<table>
<thead>
<tr>
<th></th>
<th>Proportion of Depressed (CES-D ≥ 28) in Class (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MODEL 1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
</tr>
<tr>
<td>Fixed Effects Estimates</td>
<td></td>
</tr>
<tr>
<td>Friend Nomination Network Status</td>
<td></td>
</tr>
<tr>
<td>Marginal</td>
<td>0.11</td>
</tr>
<tr>
<td>Peripheral</td>
<td>0.26*</td>
</tr>
<tr>
<td>Accepted</td>
<td>ref.</td>
</tr>
<tr>
<td>Popular</td>
<td>0.03</td>
</tr>
<tr>
<td>Favorite</td>
<td>0.12</td>
</tr>
<tr>
<td>Liked Nomination Network Status</td>
<td></td>
</tr>
<tr>
<td>Marginal</td>
<td></td>
</tr>
<tr>
<td>Peripheral</td>
<td></td>
</tr>
<tr>
<td>Accepted</td>
<td></td>
</tr>
<tr>
<td>Popular</td>
<td></td>
</tr>
<tr>
<td>Favorite</td>
<td></td>
</tr>
<tr>
<td>Network Density</td>
<td>0.02</td>
</tr>
<tr>
<td>Network Centralization</td>
<td>-0.12</td>
</tr>
<tr>
<td>Network Reciprocity</td>
<td>-0.01</td>
</tr>
<tr>
<td>Mean Age</td>
<td>0.54**</td>
</tr>
<tr>
<td>Mean SES</td>
<td>0.35**</td>
</tr>
<tr>
<td>Female (proportion)</td>
<td>-0.42**</td>
</tr>
<tr>
<td>Class Size</td>
<td></td>
</tr>
<tr>
<td>Random Effects Estimates</td>
<td></td>
</tr>
<tr>
<td>School</td>
<td>0.11</td>
</tr>
<tr>
<td>School Type</td>
<td>0.12</td>
</tr>
<tr>
<td>Observations</td>
<td>124</td>
</tr>
</tbody>
</table>

* p<0.10,  † p<0.05,  ‡ p<0.01
Socioeconomic status and gender were associated with the outcome for professional but not academic schools. In the case of socioeconomic status, it was the greatest predictor of the outcome for professional students, with the magnitude of the association quite high (β>0.70 for all three models). Interestingly, higher SES was associated with greater depressive symptoms. Class size was negatively associated with depressive symptoms for professional schools as well.

The third model presented in Table 2 examined three measures of social network structure: density, centralization, and reciprocity. This model tested hypotheses two and three for the study. None of these network measures was significantly associated to the depression outcome, so results did not support the hypotheses.

**DISCUSSION**

During childhood and adolescence, an individual spends a major portion of their time in school and the classroom provides the background social environment that includes social interactions between classmates. This environment, and its attendant social processes and pressures, is an inevitable circumstance of daily life for young people. Naturally, the classroom social network should have an influence on healthy adaptation and adjustment. The social network methodology used in the present study allowed for the examination of adolescent social relationships in their natural and complex state, which can better inform future social theoretical models of risk and protective factors for depression.

Group characteristics may influence the shape of the peer status distribution. For example, certain characteristics such as the level of psychological distress, could determine the existence of the marginal or favorite peer status categories in a classroom. A large spread in the peer status distribution in a class, or where the social status differences between students is great, could be an indication of an imbalance in social influence and “power.” In such situations, we
expect that issues of peer status may be more important and more closely related to depression. The existence of a large proportion of marginal network members is most likely detrimental, not only to those adolescents, but to all students in a classroom, who may fear ending up in that position themselves or could indicate other issues such as bullying or low tolerance for those who do not conform.

The results indicate that social network structure and characteristics are associated with depression outcomes more for professional school students in China than for academic school students. This could have several explanations that require additional investigation to further describe. One explanation could be that depression and depressive symptoms include a more social causal mechanism for professional school students – that is, social factors are more important for the mental well-being of those in professional schools versus those in academic schools. One possible explanation is that because of the immense stress and pressure often put on academic school students by parents, teachers, peers, and society in general to study hard and learn more in order to gain entrance to college and set up a more secure and profitable future, a larger factor influencing depression outcomes would be stress. It may also be that academic school students don’t have the time to socialize in the same manner as professional school students, or that the nature of their social interactions are different. A concern with a “social life” or peer status, not related to academic success, could just be a “luxury” these students cannot afford to indulge in. This generalization does not preclude stress and academic strain from influencing depression among professional students, however. Social interactions and competence may also be skills that are developed and valued more in professional schools; for example, these students are enrolled in majors such as public relations and hospitality where such skills would be seen as an asset. It may also be that adolescents for whom social interactions are more influential to their well-being are drawn to professional schools or certain
majors within those schools. This suggests further study on the differences between these school types, both for individuals and at the classroom social network level, is warranted. This is also a unique cultural phenomenon in China that could benefit from comparison to other cultures that have different school types and systems.

Social status distribution within a classroom was related to classroom level depression for professional school students. The proportion of lower status network members serves as a risk factor for depression, or more specifically, the proportion of depressed adolescents in a classroom. These results indicate that social status in the classroom is important for adolescent mental well-being and that it is important to consider the entire social network composition within the classroom. Ostberg (2003) pointed out that the existence of a wide status distribution in a class can indicate “that the social interplay to a higher degree circulates around issues of popularity and status.”

The existence of the lower status positions could indicate a less healthy social network or at least less than optimal social conditions within a class. Higher proportions of network members in the lower status categories could mean there is less tolerance within a group or that there is more pressure placed on network members to conform. Why classrooms have different distribution bears further study. Social network information such as that used in this study could examine this question by investigating the characteristics of classrooms with different types of status distributions and also identify if patterns of status distribution exist.

The teacher and other school administrators and staff could also have an important impact on these issues. Teachers have a lot influence on the classroom environment and can set the tone and norms for a social network. They can also lend support to certain groups, structures, and characteristics of the network that can affect social interactions and their association with well-being in the classroom.
**Study Limitations**

The findings from this study should be considered within the limitations of the research. Studies that have examined ecological influences on behaviors considered to be individual in nature, such as mental well-being via depression-related outcomes, have often been accused of an inferential error referred to as the *ecological fallacy*. This type of error has been described as misleading due to explaining micro-level events in terms of macro-level properties. Based on this description, much of the work examining social network influences on health behavior outcomes would fall prey to this mistake. Although this limitation warrants mention, the use of multilevel models, covariates to control for contextual effects (e.g. SES, the proportion of female students, etc.), and the use of outcome measures constructed from the proportion of depressed students in each classroom, rather than just taking a simple mean of CES-D scores, allows for confidence that an error in inference based on the ecological fallacy is less likely in the present study.

Generalizability is limited to Chinese adolescents attending either professional or academic high school in a large urban environment. The data collection process also limited nominations within classrooms and could affect the generalizability of the study. The CES-D is a well validated measure of depressive symptoms and has been linked to more clinical outcomes; however, the use of this self report measure does not extrapolate to more clinical populations of adolescents.

The primary limitation of the analysis and the study overall is the reliance on cross-sectional data, which limits the ability to draw causal inferences. This may be even more of an issue in studies examining multiple levels of analysis as there are often concerns regarding school and classroom level effects resulting from some type of selection bias or other circumstances that could lead to systematic biases.
Regardless of the limitations, these findings suggest that classroom social network structure and attributes contribute to adolescent psychological well-being through associations with depression outcomes.

**Implications and Future Directions**

This study adds to the relatively limited research on the association between social network structure and characteristics and mental well-being. Social network research allows for closer examination of the influence social structure and group-level relationships have on health behavior, and can identify how these network characteristics can impact different groups, such as academic and professional school classes, in unique ways that promote different outcomes.

Longitudinal research should be done to provide better understanding of the social processes involved in the relationship between social network influences and adolescent depression. Longitudinal data can further reveal socialization versus selection effects, which data that is cross sectional in nature cannot. Therefore, future work on the longitudinal data collected from this sample, once it becomes available, is critical in order to more closely examine the associations presented in the current findings. Also, most of the work examining social network influences on the mental well-being of adolescents has been done with Western samples. It would be of interest to have a comparable sample of adolescents from a Western culture with which to compare these findings in order to further examine any cultural and societal differences and influences.

An individual adolescent experiences their social environment often as more than a mere sum of its parts, so examination of each element individually or even additively may not fully describe the complex social processes youth encounter. Social network influences work together interdependently to collectively impact health and well-being.
Certain network characteristics could be encouraged that promote positive health behavior outcomes, while others receive subtle deterrents or dissuasion in order to provide protective and preventive effects. Modification of existing social networks could prove a challenge, but for some outcomes might be necessary. However, the best results might most easily come from providing support, guidance, and opportunities for healthy growth of existing classroom social networks for adolescents. A greater understanding of how social network influences affect depression outcomes can suggest the most efficient and effective ways in which to intervene with youth. A developmental mandate for adolescents’ is the need to feel connected to others, so their health and well-being is also connected to that of their peers. Interventions focusing on the social environment, the classroom in particular, may result in greater overall impact. This type of intervention, primarily preventive in nature, has the added benefit of cost effectiveness over more intensive and targeted intervention and treatment later. They also have the potential due to their ecological nature to spread to others, thus setting up potential secondary effects.
CHAPTER 5: DISCUSSION AND CONCLUSIONS

The goal of this dissertation was to investigate the impact of social network influences on depression in adolescents. The three studies assessed this goal by examining the social determinants of depressive symptoms among adolescents at different levels of analysis: the intrapersonal or individual level, the friendship group level, and the classroom social network level. Study One tested a main effects model of depression at the individual level, hypothesizing that social integration would be associated with depressive symptoms. It investigated whether network status was related to depression and depressive symptoms. Study Two moved to the next level of analysis and looked at depressive contagion. This was assessed by testing whether the level of friends’ depressive symptoms and friend social status was related to an adolescent’s own depressive symptoms. Finally, Study Three explored the network level by looking at the classroom social network structure and characteristics and examining how the structure of the classroom social network works to influence depression outcomes. This was accomplished by testing whether social network measures and proportions of high and low status members were related to the proportion of depressed students in the class.

Summary of Main Findings

The analyses in this dissertation examined the classroom social network, the friendship group, and individual data from a large sample of Chinese high school students. Results from the statistical models in the three study chapters indicate that, overall, social network influences are associated with depression-related outcomes. However, this basic pattern varies in relation to gender, school type, and social integration at the classroom, peer group, and individual levels.
At the individual level, consistent with previous social integration research, Study One found support for a negative association between in-degree centrality and depressive symptoms. Those with low peer status in the classroom social network also reported higher depressive symptoms, which is again consistent with past research examining under-integration (Brendgen, Vitaro, & Bukowski, 2000; Falci & McNeely, 2009). High social status, on the other hand, was not associated with depressive symptoms, either as a protective factor as hypothesized, or as a risk factor. This finding at the individual level indicates that while being on the periphery of a classroom social network and only marginally connected to others within a school class puts adolescents at an increased risk for depression outcomes, the opposite does not hold true. More specifically, being accepted and well liked by the classroom network does not, generally speaking, protect an adolescent from developing depressive symptoms or depression. Therefore, being on the low end of the social spectrum appears to be more important for psychological well-being (in a negative manner) than being on the high end.

Another contribution this work makes regarding the peer relationships of adolescents was to examine peer nominations for both friends and those who are most liked in the class. The first study, focusing on individual-level factors, clearly noted that these two measures of peer relationships and status, while related to each other, are distinct constructs and behave in unique ways regarding the outcomes. Status based on friend nominations was more significantly associated with depressive symptoms, indicating that close friendships are perhaps a more important indicator for depression-related outcomes for Chinese adolescents. However, the popular categorization of “most liked” status was important in regards to professional school girls’ depression. This finding suggests that while lower friend status is a risk factor, as expected, it may be that higher “most liked” status is also a risk factor for depression for these girls.
Peer groups also contribute to depression and depressive symptoms, which are not solely a result of individual experiences, cognitions, and choices but can be an attribute of groups and networks. The results of Study Two supports previous work examining peer contagion effects on internalizing symptoms. Peers’ symptoms were associated with depressive symptoms among adolescents. After controlling for individual-level social cognitions and social network status, self-reported friends’ depressive symptoms were positively associated with depressive symptoms for Chinese adolescents, with the exception of academic school boys. Those an adolescent nominated as “most liked,” often considered sociometric popularity, also had some effect on depressive symptoms for professional school students, particularly boys. Friends’ social status was negatively associated with depressive symptoms for professional school boys. It indicates that those who are accepted within their classrooms and who have friends who are accepted experience less internalized distress. Those who are less accepted and are part of a peer group that is less accepted overall report more depressive symptoms. These are often the individuals and peer groups that are considered “at risk” in much of the adolescent health behavior research for outcomes such as smoking, antisocial behavior, aggressive behaviors.

Chinese youth experience unique social environments that, in some regards, are quite different from Western youth. However, as Chapter Three reports, peer contagion effects on depression-related outcomes are present for Chinese adolescents much as they are for Western samples of adolescents.

Finally, the classroom level social network results presented in Chapter Four indicate that social network structure and characteristics are associated with depression outcomes for professional school students in China, but are not present for academic school students. One explanation could be that depression and depressive symptoms include a more social causal mechanism for professional school students – that is, social factors are more important for the
mental well-being of those in professional schools versus those in academic schools. Social status distribution within a classroom is related to classroom level depressive symptoms for professional school students. It appears that the proportion of lower status network members is more important and serves as a risk factor for depression. These results indicate that social status in the classroom is important for adolescent mental well-being and that it is important to consider the entire social network composition within the classroom.

The analyses indicated both expected and unexpected differences regarding gender differences in the influence of social relationships on depression. Based on the robust evidence regarding gender differences in adolescent depression, the findings that girls reported higher overall depressive symptoms in the studies is not surprising. One might also suspect, based on evidence that girls develop more quickly emotionally than boys and value their social relationships and interactions more highly (Rose & Rudolph, 2006; Stapley & Haviland, 1989), that girls would report a greater association between social network measures and depression. Results support the existence of gender-specific conceptions of peer status and social integration since aspects of status are important to the girls in the sample, particularly in professional schools, whereas the boys appear less concerned about popularity and friendships and the associations between these social network measures and depression are either absent or are weaker in magnitude.

School type differences were also found in each of the three studies. While interaction effects by school type were not found in the studies, when the analyses were done separately for each school type, it is clear there are differences. It may be that the interaction effects are more complex than can be determined in these analyses, such as three-way interactions including gender, school type, and social network measures. Nevertheless, there are clear differences between the two school types in the relationship between social network status and
depressive symptoms. The associations are stronger for professional school students in all studies at all three levels of contextual analysis.

Limitations

Although this dissertation benefits from the use of advanced statistical methodology, such as multilevel models and social network analysis, limitations specific to each type of analysis must be addressed. Specific limitations for each statistical model are discussed in their respective chapters; however, a common issue for all of the analyses concerns the relevance of the social network measures for the adolescents involved in the study. First, past research examining the influence of social network members (Fowler & Christakis, 2008) has found that the strength of an effect depends on the strength of the tie (e.g. the strength or quality of a friendship). These studies did not include measures of the quality or strength of a reported relationship; therefore, an assumption (and potential limitation) that must be made is that all friends and most liked nominations are equally influential or that the group-level influence is more important than one individual’s influence on another. It may also be the case that the strength of any association is stronger for relationships that are reciprocated (e.g. a reciprocal friendship occurs when both people nominate the other as a friend). It may be that the quality of social network ties can weight the relationship between these measures and depressive symptoms. For example, it may not matter if an individual has few friends if the quality of those friendships is very high, where friends provide maximum support, feelings of closeness, and understanding.

A second limitation regarding the relevance of the social network nomination measures is a lack of clarity concerning whether the nominated peers are really the peers that exert the most influence on the health and psychological well-being of these adolescents. Adolescents were
asked to nominate their best friends in the class and who they thought was most liked in the class. The studies make assumptions that the networks created from these types of nominations are influential for youth. It seems natural that an individual’s close friends would exert the strongest social influences on health behavior, but that may not be the case. It may be some other type of designation, such as if they had been asked to nominate those they found to be the most influential in the class. Further, since this study was conducted in China with a Chinese sample of adolescents using translated measures, these nomination types may not be culturally relevant designations. Despite these concerns regarding assumptions, these measures have been used extensively in past research and correlate well with other measures of influence. The inclusion of two nomination measures also helps to ease these concerns as they allow some measure of comparison.

There were also contextual constraints these network analyses needed to work within, namely the network nomination data had to be bounded due to time and cost concerns. Therefore, adolescents were not able to nominate as many people as they may have wanted and were limited to five. They also were asked to only nominate from within their classrooms, so some of relationships may have been missed, such as peers outside of the classroom and school environment.

Due to the cross-sectional nature of the data, the statistical models used in the three studies could not establish causation and only identified associations between social network influences and depression. The results can suggest avenues for future research, but cannot explain causal mechanism leading from social network status to depressive outcomes. Further study with longitudinal data is necessary.

Another limitation concerns effect size; while the associations reported were significant, the effects were modest. This could potentially limit the meaningfulness of the findings;
however some have suggested that small effect sizes still have practical applicability (Rosenthal, Rosnow, & Rubin, 2000). It is also possible that modest effects were observed because these studies used measures of actual peer-reported behavior depression rather than measures assessing targets’ perceptions of peer behavior. It is probable that some of the mechanisms governing social influences originate from perceptions of peer behavior rather than actual peer behavior. The stronger effects seen for the measure of perceived social self-efficacy on depression and depressive symptoms confirm this (see results from Chapters 2 and 3). The effects observed are congruent with the idea that social network influences are just one of a number of factors that contribute to adolescent depressive symptoms. These studies were able to determine that even after controlling for these stronger cognitive-perceptual influences, social network influences were still associated with depression, though on a more modest scale. This, in conjunction with fairly conservative analytic strategies, suggests that the results do represent meaningful processes for adolescents across the social environments sampled for this study.

Finally, limitations regarding generalizability need to be addressed. The CES-D is a self-report assessment of depressive symptoms, rather than a clinical assessment of syndrome or disorder, therefore the findings of these studies does not generalize to populations who have diagnosable disorders and it is not possible to determine whether the suggested social network effects are important mechanisms operating in more clinical populations. Generalizability is also limited to Chinese adolescents attending either professional or academic high school in a large urban environment.
Implications and Future Directions

The results of these studies contribute to a better understanding of how peer relations are related to adolescent depressive outcomes. The ultimate goal of such work is to glean useful constructs upon which prevention interventions can operate. These studies also further refined and elucidated methods that could be used to test potential intervention program mediators other than depression-related outcomes, such as aggression, sensation seeking, and inattentiveness; which have all been linked to health behavior outcomes (Barman, Pulkkinen, Kaprio, & Rose, 2004; Greene et al., 2000; Loeber, 1997). Some next steps could be to test these models with these other outcomes and expand the models to examine how health behaviors such as substance use, risky sexual behavior, and disordered eating are associated with social network influences and depression. The primary motivation behind proposing these studies was to inform future prevention work with adolescents that include a greater understanding of how their social world operates and impacts health behavior in order to tap into these powerful social influences. School-based intervention work almost universally aims to change or somehow address social norms, but to date there are few programs that do a good job of even operationalizing what these norms are, let alone effectively intervening on them. Traditional self-report-only measures cannot paint a true picture of the social processes that occur in an adolescent’s environment, because they rely solely on the individual’s interpretation, which may not be accurate, particularly when psychological distress and dysfunction may be involved. Also, by their very nature, social processes require the input of more than a single participant; therefore, to accurately assess them, it should also be necessary to utilize information gathered from the other participants in the social interaction.

The findings presented in this dissertation suggest modifications for improvement of the adapted main effects model presented in Chapter one (see Figure 1). As all three studies
discovered, social relationships and integration, as measured by social network metrics, can be conceptualized in different ways and assessed in relation to an institution (such as a school), social network, or another individual. The findings from this dissertation suggest boys and girls and those in different school types have different conceptions of social worth and influence. They may be oriented to different contexts and types of social networks (e.g. friend versus most liked networks); therefore, specific conceptualizations of social network influences should be carefully formulated and assessed in relation to the particular contexts that are relevant and meaningful to the adolescent.

Another contribution of this work is a greater understanding of the limitation that much of what has been learned about social network influences on depression and the gender differences in this association is from studies primarily using adult and Western culture samples. Considering that Chinese adolescents, even at the ages of 15 and 16, still maintain mostly gender-segregated friendship networks, they may not yet realize the full effects of gender socialization. This could be a contributing factor in the findings from these studies and suggests further exploration of these same associations as the gender socialization process continues across adolescent development.

This work helps to further understand the complicated social environments of adolescents. It further clarifies the association between social network influences and depression during adolescence. However, in the course of examining the research aims of this dissertation, further questions were revealed. These additional questions serve as worthy areas of future research. For example, these results demonstrate the need to further investigate the relationship between school types and gender and depression during adolescence for Chinese youth. Future research is necessary to determine why academic school girls have higher depressive symptoms and why depression is more socially driven for professional school girls.
Another area of future research could be examining how isolation in more than one social environment is related to depression outcomes. For example, if an adolescent is on the social fringes of their peer groups at school and also does not find support at home in their family environment - how do the social influences from both of these different realms interact to impact depression outcomes. Is the risk of depression associated with social isolation in more than one social environment additive or is social isolation in multiple realms multiplicative or even exponential? These are interesting questions for future research that could help to inform comprehensive prevention work including school and family components.

A third future direction for further investigation includes examining the idea of thresholds. One question that arises from the associations found in these studies between measures such as in-degree centrality, or the number of friend nominations an individual receives, and depression is whether there is some threshold for social contact or number of friends or exposure to friends who are depressed beyond which an adolescent is at risk for compromised psychological well-being. Social network analysis has been closely linked to the theory of diffusion of innovations (Valente, 1995; 1996), which would be the model by which these questions can be investigated.

Another area of future research concerns cross cultural comparisons and the unique implications for mental health among Chinese youth. A comparison between these findings and similar studies with adolescents from different cultures, such as comparison to a sample of Western adolescents from the United States, would be beneficial and informative to the field. Are these associations sensitive to cultural differences, and if so, how much of a difference does different cultural context make? Comparing traditionally individualistic and collectivistic cultures could answer some questions from the field of cross-cultural psychology, such as whether social relationships are more influential for those living in collectivistic cultures. Another cultural consideration that could be examined over time within this or other Chinese samples is whether
the rapid social and cultural changes occurring in China over the past several decades has any influence on these relationships. Rates of depression have increased in China over the past several years (Kleinman, 2004) and the suicide rates have also risen dramatically (Daly, 2009), particularly among young people. Teachers involved with this study expressed interest in learning more about mental health and how to better help their students’ psychological adjustment and were very concerned about depression and suicide. This increased awareness of the importance of psychological health and well-being is a fairly recent development in the Chinese educational system, and work such as that presented in this dissertation could help inform future policies, prevention programs, and training for Chinese teachers.

Another context that bears further study and consideration is the different school types. There are clear differences between the two school types in the relationship between social network status and depressive symptoms. The associations are stronger for professional school students. The Chinese school system is set up differently than Western school systems, with academic school students required to spend many more hours per week studying for college entrance exams. They also have more pressure put on them to do well academically by their parents and teachers and more competition from their classmates. They have little free time to socialize, which may be one reason for the differences noted in these studies. Professional school students have more free time and fewer academic pressures. While academic school students, particularly the girls, report the highest levels of depressive symptoms, they do not appear to be that closely associated with what occurs in their social environment. Dealing with school and family stress as well as gender role expectations could be a larger factor in their depression outcomes; however, further study would be required to examine this.

Finally, future prevention of depressive symptoms in adolescents will need to be driven by theory and firmly grounded in empirical research. The studies presented in this dissertation
provide empirical support for promising theoretical constructs that can be used to develop successful health promotion and prevention programs. As the theoretical evidence suggests, although depression is generally conceptualized as an individual disorder with a strong focus on problematic thoughts and perceptions, maladaptive interpersonal functioning also contributes to the development and progression of depression and depressive symptoms (Brown & Lohr, 1987; Coyne, 1976; Lewinsohn, 1974; Cole, 1990). Preventing distress and dysfunction in the social networks of adolescents’ at risk for depression, as well as improving interpersonal competencies, should be a key aim of future prevention work focusing on this developmental period. It is equally important that promotion efforts are designed from a developmental perspective that accounts for the unique experiences and influences of adolescence in order to promote healthy growth and development. Interventions that have been developed to address co-occurring health behaviors, such as substance abuse and anxiety, and for which significant associations with social network influences have also been found (Ennett, et al., 2006; Hirsch & Reischl, 1985; La Greca & Harrison, 2005), could influence depression-related outcomes as well. However, past interventions targeting single problems have typically not measured multiple outcomes. And, despite the promise that broad-based preventive intervention could result in reduction in the incidence of depression, no controlled evaluations of such programs have been published (NRCIOM, 2009). Interventions that are single problem-focused are most likely limited in their potential effects. Comprehensive and integrated programs focusing on multiple levels of adolescent functioning and using both cognitive and interpersonal approaches that address multiple, co-occurring and interrelated outcomes are more likely to be effective in addressing adolescent depression. Therefore, future prevention work could test the effects of interventions that have primarily been developed to address related, co-occurring behaviors, on depression and depressive symptoms among adolescents. This dissertation highlights the importance of
attending in greater detail to the social context in which adolescent depressive symptoms
develop and the potential impact integrating peer-oriented intervention strategies has for
future prevention and treatment efforts.

Conclusions

Once in school, children and adolescents spend a great deal of time interacting with peers in
different ways, so it is not surprising that important markers of healthy adjustment and
adaptation during adolescents include development, maintenance, and participation in healthy
relationships with peers.

The potential of peer relations to influence the etiology, prevention, and treatment of
depression and depressive symptoms stems from their significance in development (Hartup,
1996). Interventions can attempt to harness the power of positive peer influence, and
compensate for negative influences, in preventive interventions with a variety of strategies.
Interventions have engaged peers as counselors, coaches, and role models in efforts to change
risk or behavior in individuals and groups (Pearlman, Camberg, Wallace, Symons, & Finison,
researchers have also experienced tough lessons regarding the power of peer influences to
undermine the good intentions of peer-based interventions under certain conditions (Dishion,
McCord, & Poulin, 1999). This work can hopefully help to further inform such work in order to
maximize program effectiveness.

Social network influences were identified as significant factors, both risk and protective, for
adolescent depression and depressive symptoms. General results indicate that individuals who
are better integrated into their social networks, who have fewer depressed friends, and whose
classroom social networks contain fewer peripheral members are less likely to report depressive
symptoms and depression. This work represents further steps in the investigation of the complex social environments in which adolescents must navigate and which are so meaningful for healthy development.
BIBLIOGRAPHY


StataCorp (2009). *Stata Statistical Software: Release 11.* College Station, TX: StataCorp LP.


Lin et al., 2008.
