THE RELATIONSHIP BETWEEN RISK FACTORS AND PROBLEM BEHAVIORS IN ADOLESCENCE: AN APPROACH TO IDENTIFY A LATENT GENERAL RISK AND A LATENT GENERAL PROBLEM BEHAVIOR FACTORS

A Dissertation
presented to
the Faculty of the Graduate School
University of Missouri-Columbia

In Partial Fulfillment
Of the Requirements for the Degree

Doctor of Philosophy

By
HEEJUNG CHUN

Dr. Rick Short and Dr. Michael Mobley, Dissertation Co-Chairs

August 2007

The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled

THE RELATIONSHIP BETWEEN RISK FACTORS AND PROBLEM BEHAVIORS IN ADOLESCENCE: AN APPROACH TO IDENTIFY A LATENT GENERAL RISK AND A LATENT GENERAL PROBLEM BEHAVIOR FACTORS

presented by Heejung Chun,

a candidate for the degree of doctor of philosophy,

hereby certify that, in their opinion, it is worthy of acceptance.

Rick J. Short, Ph.D.

Michael Mobley, Ph.D.

Peggy Placier, Ph.D.

Tiffany Whittaker, Ph.D.

Andy Knoop, Ph.D.

ACKNOWLEDGEMENTS

Completing this dissertation has been a great experience for me. Through this experience, I have found myself to be a professional/researcher who is greatly interested in at-risk children and adolescents. Looking back over the entire dissertation process, I have learned that many people have helped me get closer to what I was interested in and to transform my interest into actual work. I am grateful to the many people by whom I was influenced and with whom I worked in undertaking this dissertation.

I would like to thank the members of my dissertation committee. My dissertation co-chair, Dr. Michael Mobley, has been of great help and support on this journey by sharing his experience and opinions, by guiding my academic standards, and by mentoring my scholarship. From his supervision, I learned many invaluable attitudes. His focus on pursuing high academic standards, being open to others' opinions, and having positive perspectives have significantly influenced the development of my scholarship. I very much appreciate Dr. Mobley's time and positive influence.

In addition, Dr. Rick Short, my dissertation co-chair, has helped me to formulate my interests into an academic framework. His encouragement of my blossoming ideas made the dissertation framework evolve. I would also like to thank Dr. Tiffany Whittaker, whose methodological expertise ensured my adherence to very advanced statistical methods. I am also grateful to Dr. Peggy Placier for her insightful comments and warm presence. In addition, I would like to thank Dr. Andy Knoop for his nurturing support. He always listened to my concerns and questions and guided me in a clearer direction.

I would also like to thank my supervisors in South Korea. The learning experience I had with Dr. Jeoung-Yoon Choi, Dr. Kyoung Park, and Dr. Yoo-Sook Kim was foundations on which I was able to build this dissertation. Moreover, I thank my mother and my family for supporting me in my accomplishment of this work. Finally, I appreciate that God guided me to accomplish this dissertation and helped me to find this work, which I very much enjoy.

TABLE OF CONTENTS

LIST OF TABLES

LIST 0F FIGURE

Figure Page

THE RELATIONSHIP BETWEEN RISK FACTORS AND PROBLEM BEHAVIORS IN ADOLESCENCE: AN APPROACH TO IDENTIFY A LATENT GENERAL RISK AND A LATENT GENERAL PROBLEM BEHAVIOR FACTORS

Heejung Chun

Dr. Rick Short and Dr. Michael Mobley, Dissertation Co-Chairs

This investigation addressed adolescents' problem behaviors such as school failure, violence, and substance use along with casual sex by identifying a general risk factor and a general problem behavior factor. As a contribution to preventing adolescents' problem behaviors this research study explored three questions and one hypothesis. First, whether the existence of the general risk factor that influences SES, Family, School, and Neighbor risk statuses exists was tested. Second, whether the existence of the general problem behavior factor that influences School Failure, Violence, and Substance Use with Casual Sex problem behaviors exists was investigated. Third, the hypothesized structural model that posits a relationship between the general risk factor and the general problem behavior factor was examined. Fourth, the hypothesized structural model was tested with multiple group analysis for gender, grade-level, and ethnic/racial groups. In this study the data were derived from a nationally representative dataset, commonly called ADD Health dataset. The participants were 6504 adolescents in grades 7 through 12. Results from two separate confirmatory factor analyses demonstrated support for both the existence of the general risk factor via a second-order general risk factor model and the existence of the general problem behavior factor via a second-order problem behavior factor model. Furthermore, results demonstrate that the hypothesized model that describes the influence of the general risk factor on the general

problem behavior factor was supported, indicating a strong close relationship between these two latent factors evidenced by a path coefficient of .74. Lastly, the hypothesized model was tested with multiple group analyses for gender, grade-level and ethnic/racial groups. The multiple group analysis involves separate baseline model test, invariance test, and latent mean difference test. Results of multigroup analyses demonstrated model validity across each culturally distinct subgroup including female and male adolescents, 7^{th} through 9^{th} grade vs. 10^{th} through 12^{th} grade students, and across Caucasian, African American, and Hispanic adolescents. The factorial and structural invariance test resulted in partial invariance models. In addition, latent mean difference in the general risk factor and the general problem behavior factors was evident across culturally distinct groups. The interlinked nature of the risk statuses, shared and unique variances of individual problem behaviors, and the implications of the study for prevention and intervention programs are discussed.

Chapter One: Introduction

This first chapter of the dissertation presents the background of the study, specifies the problem of the study, and describes its significance.

Background of the Study

Several behavioral problems in adolescence have been noticed that deteriorate adolescents' development as well as their value as societal assets. These behavioral problems which have been identified as impacting adolescents' developmental trajectories include teenage sexual activity, alcohol and substance abuse, delinquency and violent behaviors, and school failure. These problem behaviors appear not to be limited to a certain group of adolescents, but rather pervasively affect ordinary adolescents. For instance, the rate of adolescents who have tried alcohol was 52 percent among 8th graders and 80 percent among 12th graders (Johnson et al., 2001). Marijuana use was reported to be highest among individuals aged 12 to 24 years (38 percent) (National Household Survey of Drug Abuse, 1997). In addition, manifestation of violent behaviors has been found in the community sample of adolescents (Tolan, 1988). As many as 40 to 50 percent of inner-city youths report some level of violence exposure (Hammack et al., 2004; Schwab-Stone et al., 1995). Although teen childbirth has declined, the teen childbirth rate remains high. According to the National Center for Health Statistics, the childbirth rate was 48.7 per 1000 females aged 14 to 19 in 2000 (Child Trends, 2001). This rate has been reported to be the highest among all developed countries (Child

Trends, 2001). Lastly, school failure, defined as low school achievement, poor grades, and being retained, has been associated with dropping out (Rumbeger, 2001).

The negative consequences of these widespread problem behaviors can be easily identified. The consequence of involvement in drug use has been known to limit adolescents' educational, career, and marital success, as well as being associated with societal problems such as car accidents (Perry, 2000). Violent behaviors have been found to be linked to more serious antisocial behaviors or crimes. In addition, although academic achievement is not the most important developmental task for adolescents, low achievement in school has been noticed to influence the general adjustment of adolescents as well as to be associated with other types of behavioral problems.

Over the past two decades, one of the important empirical findings or observations for problem behaviors was that these problem behaviors co-occur, that is, one problem behavior is easily linked to other types of problem behaviors (Bingham & Crockett, 1996; Farrington & West, 1982). In the late 1980s, Jessor (1987) suggested that there is a general problem behavior construct that underlies several kinds of problem behaviors. Along with statistical developments such as the structural equation modeling that tests latent variables, the underlying construct of problem behaviors has also been tested. The results from several studies appeared to partially support Jessor's idea. Those studies showed that there was a secondary, higher-order factor that influenced several kinds of problem behaviors. However, it would be important to mention that there was also a unique variance portion in each problem behavior. Both approaches, one that investigates the common variance among several problem behaviors and another that examines the unique variance of individual problem behaviors, would help to account for

variance in problem behaviors. Researchers must decide which approach may be best for their studies.

Among the approaches that address these problem behaviors, the risk factor approach has been utilized. One of the significant contributions of the risk factor approach has been the cumulative factor effects on adjustment, developmental outcomes, or mental health in children and adolescents (Masten, 2001). The studies that have adopted the cumulative risk method have consistently found that the higher the number of risks from multiple settings or domains, the worse the adjustment, developmental outcomes or mental health of children or adolescents (Sameroff, Gutman, & Peck, 2003; Gerard, & Buehler, 2004; Forehand, Biggar, & Kotchick, 1998). The implications of these studies' results would not be extraordinary, given that individuals in worse environments would have more possibilities for negative conditions than individuals in better environments. However, these results have significant implications in terms of how consistently individuals are affected by each of the social domains in which they are embedded: family, school, neighborhood and larger society. Beyond familial factors such as family functioning, parent-offspring relationships, family communication, and parental relationships, the school and neighborhood environments have been an important construct to be explored for their influence on children's and adolescents' adjustment, developmental outcomes, and mental health.

Although the cumulative risk method has been found to be a powerful predictor of the previously mentioned outcomes, several limitations of this method have been asserted. These criticisms were made in terms of the method's artificial dichotomous treatment (Greenberg, Lengua, Coie, and Pinderhughes, 1999), loss of specific

explanation of individual risk effects (Masten, 2001), and underestimation of the explained variance (Ackerman, Izard, Schoff, Youngstrom, and Kogos, 1999). In addition, the relationships among domain risk factors were not addressed in this method. Although several researchers have mentioned that there are covariations among risk indicators, this covariation issue has not yet been addressed in previous research. The present study will seek to explain the covariation among risk indicators from multiple social domains, using structural equation modeling.

This dissertation will seek to identify the general problem behavior factor advocated by the problem behavior theory, as well as the general risk factor indicated by each of the social domain risks. Lastly, the relationship between the latent general risk factor and the latent general problem behavior will be examined.

Problem Statement

Based on the literature review, the present study will address a latent risk factor construct, a latent problem behavior construct and the relationship between the two constructs.

First, the most popular method to examine the risk factor effects is the cumulative risk index method (Sameroff, Gutman, & Peck, 2003; Gerard, & Buehler, 2004; Forehand, Biggar, & Kotchick, 1998). However, several limitations of the cumulative risk index method were suggested. One of the intentions in the present study is to examine the covariations among risk factors. In order to examine the covariantions among risk factors, this dissertation will test whether there is a common latent construct among risk factors. This dissertation will use the structural equation modeling approach to attain this purpose. Since no previous studies have examined the underlying latent

construct among risk factors, the analysis will be conducted in an exploratory manner. This analysis seeks to answer the following research question: Is there an underlying general risk factor that influences socioeconomic status (SES), family, school, and neighborhood risks?

Second, another intention of this dissertation is to test Jessor's problem behavior theory (1987). Four kinds of problem behavior will be included: school failure, violence, substance use, and sexual activity. Based on the previous studies, this dissertation will hypothesize that there will be a higher-order factor that influences each of four kinds of problem behavior. The structural equation modeling will be used to investigate the plausibility of such an underlying higher-order factor. The research hypothesis is that there will be an underlying general problem behavior construct that influences school failure, violence, substance use and sexual activity.

Third, after examining the underlying general risk factors, the present study will examine whether the latent general risk factor predicts the latent general problem behavior. The structural equation modeling will be used for this analysis. This analysis seeks to answer the research question: Will the latent general risk factor predict the latent general problem behavior?

Lastly, if the tested structural model identified above is an acceptable model, I will conduct multi-group comparison analyses examining gender, grade level, and race/ethnicity. This analysis seeks to answer the research question: Will the structural model be invariant in each of race/ethnic, gender, and grade level groups?

Professional Significance

This dissertation attempts to contribute to the field of prevention of problem behaviors in adolescence. The specific significance of the dissertation could be noted in the following efforts. First, this dissertation seeks to identify the latent general risk factor, which has not been addressed in previous studies. The revelation of the latent general risk factor will explain the covariations among several risk indicators. Further, the existence of the latent general risk factor can provide evidence to clarify the relationships among different kinds of risk indicators. Given that individual risks do not have exploratory power on outcome variables, the detection of a latent general risk construct will have meaningful implications for developing a rationale for environmental risk indicators from each of the social domains.

Second, one of the purposes of this dissertation is to test the relationship between the latent risk construct and the latent general problem behavior construct. The cumulative risk index method, which has been used in many studies to test the effect of risk indicators, has been suggested to have the following limitations: (a) the cumulative method can underestimate the variance explained by the risk indicators; (b) the cumulative method treats all variables as dichotomous so that the variance that can be explained by the continuous scale is reduced. The latent variable approach will solve these problems and can provide a more accurate explanation for the relationship between environmental risk and the general problem behavior.

Third, the relationship that includes four kinds of risk factors and four kinds of problem behaviors is a fairly complicated phenomenon. The purpose of testing this relationship will be approached using structural equation modeling (SEM). One of the advantages of the structural equation modeling is the comprehensiveness with which

SEM allows the inclusion of a number of observed variables as well as the latent variables. The structural model to describe the relationship will include ten latent variables, ten risk indicators and twelve problem behavior indicators.

Fourth, the aspiration to address the relationship between the general risk construct and the general problem behavior construct reflects the motivation to provide a rationale to monitor both types of indicators (risk factors and problem behaviors). The detection of a latent construct of general problem behavior will validate the rationale that several problem behaviors can be approached simultaneously by addressing the underlying tendency to engage in several individual problem behaviors. In addition, the detection of a latent construct of general risk factors will provide an effective method to identify the core risk groups that are susceptible to the problem behaviors.

Chapter Two: Literature Review

A large body of literature on the risk factors and problem behaviors provides a basis for this dissertation. First, this chapter will introduce the public health model and then present the significant finding in the previous studies in three sections: risk factors, problem behaviors and relationship between these two constructs.

Public Health Mode

The dissertation intends to address problem behaviors in adolescents based on the public health model. In this section, the concepts of the public health model, as well as the relevance of the dissertation to the public health model, are introduced.

Public health itself has a long history related to medicine because health has been a public concern throughout society (Strein, Hoagwood, & Cohn, 2003). Public health considers population as a client, instead of individuals. This public health perspective has been applied to mental health areas as well as behavior problems. For example, Durlak and Wells (1997) reported meta-analytic results of preventive studies derived from public health perspectives among children and adolescents.

The basic concepts of the public health model can be summarized into four themes: population, empiricism and direct implementation, prevention, and regulation (Runyan, DeVellis, DeVellis & Hochbaum, 1982). The central concern of the public health model is population. Researchers with a public health perspective consider social aspects of health such as lifestyle, socioeconomic status, and health education (Strein et al., 2003). As a way to address public health, epidemiology is a central part of the public

health model (Runyan et al., 1982). The main roles of epidemiology are planning preventive interventions and developing scientific understanding of diseases (Mason & Linnenberg, 1999).

Research based on epidemiology is empirical (Runyan et al., 1982). Epidemiological studies tend to focus on determining the relationship among biological, physiological, genetic, behavioral, social and economic variables rather than seeking theoretical explanations (Strein et al., 2003). One framework to investigate the determining causes of a problem is to identify risk and protective factors among populations related to the problem. One characteristic of the public health model is to adopt a multi-level approach (Hepworth, 2004). Risk and protective factors are identified on several levels such as individual, family, school, community, and society. Also, preventive interventions are targeted to encompass several levels of social systems.

Another element of the public health model is its emphasis on prevention (Runyan et al., 1982; Strein et al., 2003). As reflected in the roles of epidemiology, prevention is a critical part of public health. The information gathered from epidemiological studies is utilized in developing and implementing programs to prevent mental heath problems and promote mental health, and the information can also contribute to the treatment of mental health problems (Strein et al., 2003).

Three levels of prevention have been widely introduced: primary, secondary, and tertiary (Strein et al., 2003). Primary prevention is directed to everyone in a population to prevent any occurrence of diseases or behavior problems. Secondary prevention is intended to stop disease progression or is directed to people who are at risk for certain

problems. Tertiary prevention includes efforts to minimize the effects of disease or disability.

The last element of the public health model is regulation (Runyan et al., 1982). An essential part of the public health model is policy-based practice. To establish structural modifications, regulation, legislation and environmental changes are pursued in the public health model.

The relevance of the dissertation to public health model can be found in several points. First, the dissertation intends to contribute to the prevention of problem behaviors in adolescents: school failure, violence, substance abuse, and sexual activity. The identified risk factors would provide theoretical as well as empirical bases for developing prevention programs for the problem behaviors. Second, the dissertation uses a large-scale dataset — the nationally representative ADD health data. This is consistent with the population-based approach of the public health model. Third, the approach to identify risk factors from several domains, including demographic, family, school and neighborhood, is comparable with the multilevel approach of the public health model.

Risk Factors

Risk factors have been widely studied with several behavioral problems or negative developmental outcomes in children and adolescents. However, the specific purpose of identifying risk factors has not received sufficient attention in many studies. The risk and protective factor approach was derived from prevention science. Prevention science is defined as a systematic study to prevent or moderate major human dysfunction before illness is fully revealed (Coie et al., 1993). Coie et al. (1993) emphasized that risk and protective factors are identified within the context of preventive efforts. Also, Coie et

al. (1993) defined risk factors as "variables associated with a high probability of onset, greater severity and longer duration of major mental health problems" (p. 1013).

Over several decades the risk and protective factors approach has been a widely used research method. One of the techniques within the risk and protective factors research is to identify multiple risks. Research evidence indicates that risk factors tend to cluster in individuals (Bronfenbrenner, 1979, 1994). As a rationale for their investigation of multiple risk factors, Sameroff, Gutman, and Peck (2003) noted that a single factor does not have much explanatory power on negative outcomes. Dawber (1980) found that any single risk factor was not necessary as well as sufficient in detecting heart disease. Dawbe (1980) suggested that multiple risk factors such as hypertension, obesity, lack of exercise, and smoking were significant contributors to heart disease. Also, Rutter (1979) asserted that the important point is not a particular variable, but the number of risk factors routed to psychiatric disorders. In Rutter's study (1979), the psychiatric risk rate depended on the number of risk factors in each family; that is, the psychiatric rates were 2% in the families with zero or one risk and 20% in the families with four or more risks (Sameroff, Gutman, & Peck, 2004).

Often researchers adopt a developmental-ecological perspective in studying risk and protective factors among children and adolescents. The developmental-ecological perspective (Bronfenbrenner, 1979, 1994) takes into account several kinds of variables from multiple settings and multiple systems in which individuals are embedded rather than focusing on intraindividual characteristics. The main tenet is that the development of children and adolescents is affected by the ongoing qualities of the multiple settings in which they are embedded (Gorman-Smith & Tolan, 2004; Bronfenbrenner, 1979).

From this perspective, each of the settings in which children and adolescents reside (e.g., family, schools, communities and larger social influences) is considered important entities that influence children's and adolescents' development. This perspective is significantly different from the traditional developmental theories that placed mounting importance only on the interaction between caregivers and children. Gorman-Smith and Tolan (2003) pointed out that an important difference from the traditional developmental perspectives is "the impact of major developmental influences, such as family functioning, depends on the sociological characteristics of the communities in which youth and families reside" (p. 397).

After reviewing previous studies, Sameroff, Gutman, and Peck (2003) found that one of the operational characteristics of risk factors on human dysfunction is universality, that is, the same risk factors impact several kinds of negative outcomes. They pointed out that considering the universal nature of risk factors, the studies of the developmental processes are required to address multiple risks and multiple outcomes. In addressing multiple risk factors, one of the important issues is to find representative risk factors. Based on the developmental-ecological perspective, risk factors have been categorized into demographic, family functioning, school and neighborhood factors.

Socioeconomic Status (SES) risk factors

In the SES category, poverty, parent education levels, and single parent status have been associated with negative developmental outcomes in children and adolescents. Low socioeconomic status (SES) has been consistently mentioned as a risk factor for negative developmental outcomes. Greenberg, Lengua, Coie, and Pinderhughes (1999) investigated the effects of several risk factors on externalizing and internalizing

problems, authority acceptance, social competence and academic achievement of children.

Greenberg et al. (1999) categorized risk indicators into five groups: specific demographics, SES-race, family risk, mother's depression, and neighborhood. Using the multiple regression analysis, the entry of risk indicators was conducted by the predetermined hierarchical order method: the specific demographic variables including the number of sibling, mothers' ages at the targeted child birth, and single parent status in the first step; parents' occupation, education, and race in the second step; family psychosocial and mother's report of depressive symptoms were entered in the next two steps; quality of the neighborhood environment in the next step; and study site in the last step. In the study, the significance of each individual risk indicator was also reported after controlling for the entry of all other risk indicators. The specific demographic variables were not significant predictors after controlling for all other variables. After the entry of the specific demographic group, the SES-race risk group significantly predicted all variables. At the individual risk level, after controlling for all other variables, parental occupation predicted externalizing and internalizing problems whereas parental education predicted cognitive concentration. Before controlling for the other variables, race appeared to significantly predict all outcomes. However, after controlling for the other variables, the significance of race on all outcomes disappeared. Results of this study indicated that the group of SES variables affected behavior problems as well as academic performance in children. As individual variables, parental occupation influenced children's internalizing and externalizing problems whereas parental education influenced children's academic performance.

Owens and Shaw (2003) gave a more comprehensive explanation for the influence of poverty on children's development. Based on the review of previous studies they suggested that the detrimental effects of poverty can be classified into three areas: (a) poor physical health, (b) lower intellectual attainment and poor school performance, and (c) increased likelihood of social, emotional and behavioral problems. Also, they suggested that in order to explain the poverty variable, the severity or chronicity of poverty should be addressed rather than its presence or absence.

Yates, Egeland, and Sroufe (2003) provided perspectives about relationships among other proximal variables and poverty. According to them, the influence of poverty on children's development is mediated by more proximal variables such as parenting behaviors, family structure, community variables, and the broader social networks. They found that poor families were more likely to have young, single parents (Brooks-Gunn & Duncan, 1997) as well as to be affected by parental depression and substance use disorders (Belle, 1990). In addition, they further noted that poverty and its associated negative life experiences led to poor parental emotional instability, insufficient parental monitoring, and lack of supportive and consistent parenting (Brooks-Gunn et al, 1997).

To date previous research demonstrates that low SES risk factors such as poverty, parent education, and parent occupation significantly contribute to negative developmental outcomes or maladjustment in children and adolescents.

Family factors

Family risk factors might be the most widely studied variables in children and adolescents. Forehand, Bigger, and Kotchick (1998) examined the relationship between the number of family risk factors and three areas of psychosocial adjustment in

adolescents aged 11 to 15 and in young adults aged 19 or out of high school for at least one year. In this study family risk factors were inter-parental conflict, maternal physical health problems, maternal depressive mood, and mother-adolescent relationship problems. Depending on the presence or absence of each risk factor, participants were assigned into one of five levels of risk status. The results showed that the number of family risk factors was not significant with the concurrent internalizing and externalizing problems. However, the long-term relationship between the number of family risk factors and internalizing and externalizing problems was significant. For academic achievement, the number of risk factors was significantly associated with academic achievement concurrently as well as longitudinally. Based on these results, Forehand, Bigger, and Kotchick (1998) concluded that internalizing and externalizing problems and academic achievement resulted at least partially from the experience of family stress of adolescents. The results of the study implied that academic achievement was immediately affected by the family stress that adolescents experienced at home whereas internalizing and externalizing problems in adolescents were influenced by family stresses but manifested over a longer time period.

Greenberg et al. (1999) investigated the relationship between several kinds of risk factors and children's internalizing and externalizing problems, social competence and concentration, reading achievement and math achievement. In regards to family risk factors, these researchers identified five family variables: life stress, family emotional expressions, social support, marital distress, and home environment. In this study a multiple regression analysis was conducted and five groups of risk variables were entered into the regression model in a hierarchical order. The family risk group was significant in

predicting all outcomes after the specific demographic and SES-race risk groups as well as after the entry of all other risk groups. At the individual risk level, life stress was found to significantly predict externalizing and internalizing problems, social competence, concentration and math achievement after controlling for all other variables. Family expressiveness significantly predicted social competence, and concentration after controlling for all other variables. The researchers concluded that among five risk groups including specific demographics, SES-race, family, mother's depression, and neighborhood, family risk group made the strongest unique predictions across all of child outcomes.

Ackerman, Izard, Schoff, Youngtrom, and Kogos (1999) examined the caregivers' emotionality separately from contextual risk factors such as demographic risks, family risks, and negative life events. Caregiver emotionality was found to have interaction effects on the relation between the cumulative contextual risk and adaptation in children. The relation between cumulative contextual risk and children' adaptation was stronger for lower levels of caregiver negative emotionality than for higher levels and also weaker for higher levels of caregiver positive emotionality than for lower levels.

In summary, existing research highlights two primary foci in examining family risk factors. First, psychological aspects of family relationships and roles have been investigated including inter-parental conflict, family emotional expressions, mother-adolescent relationship problems and caregiver emotionality. Second, variables relevant to optimal family climate have been investigated including parental marital status, social support, marital distress and the effect of maternal physical health problems and maternal depressive mood on home environment. These two foci, psychological aspects of family

relationship and roles as well as optimal family climate contribute to children and adolescents adaptation in relationship to cumulative risk factors or individual risk factors.

School Risk Factors

Although the influence of school aspects on the development of children and adolescents has been emphasized, the literature review found very few studies that addressed school risk factors. Gerard and Buehler's study (2004) assessed two school risk factors to measure cumulative risk index, school detachment and perceived prejudice. In this study, they found that cumulative risk was associated with concurrent conduct problems and depressed mood. In Sameroff, Bartko, Baldwin, Baldwin, and Seifer's study (1998), a school climate variable was one of twenty environmental risk factors. They only reported the relationship between the number of risk factors from the twenty environmental factors and the outcome variables. The specific effect of school factors in these two studies was not reported.

Some studies examined the effects of school risk factors separately from other risk factors in relation to developmental outcomes. For instance, Roeser, Midglery, and Urdan (1996) examined the relationships between perception of school belonging as a school risk factor and academic achievement in adolescents. They found a positive relationship between school belonging and academic achievement when controlling for other relevant variables such as prior achievement, demographics, and personal achievement goals.

In Anderman's study (2002), although school belonging was not defined as a school risk factor, the suggested importance of school belonging on several outcomes appeared to be a school risk factor. The researcher investigated the relationship between

school belonging and various outcomes with school-level as well as individual-level characteristics. As individual-level characteristics, grade point average, self-concept, and ethnicity were analyzed. The school-level characteristics were school size, grade configuration, and urbanicity. This study used a nationally representative sample. Anderman (2002) found that school-level characteristics that were associated with the lower levels of perceived school belonging were busing practices, urban schools, and K-8 school buildings. However, school size was not significantly related to the perceived belonging. For the individual-level characteristics, self-concept showed a positive relationship with perceived school belonging. For ethnicity, African Americans and Native Americans reported lower levels of perceived belonging than did European Americans. For the relations with various outcomes, higher levels of belonging were associated with lower levels of depression, social rejection, and school problems as well as greater optimism and higher GPA.

Bowen, Richman, Brewster and Bowen (1998) investigated the relationship among school coherence, school safety, and teacher support. In this study, the sense of school coherence was applied from the work of Antonovsky (1994). The researchers defined the sense of coherence at school with three components: "(a) feel understood by others at school and able to structure the demands from their school environment, (b) perceive themselves as able to handle demands and challenges that they faced at school, and (c) find school challenging and engaging" (p. 274). This definition appeared to be comparable with the concept of school belongingness. Bowen et al. (1998) examined the effects of two variables that influenced the sense of school coherence, that is, perception of danger at school as a risk factor and teacher support as a protective factor. They found

a positive relationship between teacher support and the sense of school coherence and a negative relationship between perception of danger at school and the sense of school coherence. Such results suggested that school coherence was an important school risk factor, which was closely related with the perception of school safety and teacher support.

In summary, although a few studies investigated school risk factors, results from the studies consistently showed that school belonging or school coherence significantly affected outcome variables such as academic achievement, level of depression, social rejection, and school problems and optimism in adolescents' adjustment. In addition, perception of danger at school was identified as a risk factor.

Neighborhood Risk Factors

Duncan, Brooks-Gun and Klebanow (1994) investigated the relation of economic deprivation with childhood development at the family-level poverty as well as at the neighborhood conditions. In the study, cognitive development and problem behaviors at age five were assessed as childhood outcomes. The researchers conducted the ordinary least squares multiple linear regression to test the effects of predictors on intellectual functioning and problem behaviors in children. The researchers found that the family poverty persistence was a significant contributor in predicting IQ and behavior problems whereas the timing of poverty was not significant. The researchers tested whether the neighborhood economic status predicted the IQ and behavior problems after controlling for the family economic status. The neighborhood poverty was measured as two indicators: the fraction of the non-elderly families whose incomes were under $10,000 (low income) and the fraction of non-elderly families with income over $ 30,000

(affluent). They found that the affluent indicator significantly predicted the IQ while the low-income indicator significantly predicted externalizing behavior problems.

Such results indicated that the environmental influence of affluent neighbors was associated with higher levels of IQ whereas the neighborhood climate of low income families influenced externalizing behavior problems. However, these researchers noted that the explanatory power of the neighborhood-based economic status was much smaller than the family-based measure. To account for the ascertained higher number of externalizing behavior problems, the authors suggested two possible hypotheses: 1) mothers who reside in a poor environment might think that allowing aggressive behavior for their children would be more adaptive; or 2) more externalizing behaviors are seen because of the lower quality of schools and child care environments, reflected from higher child-staff ratios and less adult-child interaction.

Greenberg, et al. (1999) developed a Neighborhood Questionnaire to measure the neighborhood quality in terms of safety, violence, drug traffic, satisfaction and stability. They examined the neighborhood effect on internalizing and externalizing problems and on academic achievement in children. They found that the neighborhood factor significantly predicted parent-reported externalizing problems and the teacher-reported authority acceptance and social competence after controlling demographic and family risk variables. However, they suggested that neighborhood factors might be a distal factor rather than a proximal factor on developmental outcomes, given the result that the absolute increment in predicting outcome variances was quite small.

In summary, neighborhood risk factors have been associated with negative developmental outcomes such as internalizing and externalizing behavior problems, and

low academic achievement. The aforementioned studies consistently demonstrated that although neighborhood risk factors were significant predictors for the outcome variables, the unique variance of the outcome variables explained by neighborhood risk factors were small.

Cumulative Risk Index Method

Several researchers have begun to assess "cumulative risk effects." In addressing risk factors, it is worthy to note about cumulative risk effect. Many studies that addressed multiple risk factors utilized a cumulative risk index method. According to Morrison, Gutman, Sameroff, and Cole (2003), the cumulative risk index method involved dichotomizing the continuum of scores of each variable into two groups indicating the presence or absence of risk and then summing up all risk factor scores.

Most of studies that used the cumulative risk index method found that cumulative risk significantly predicted the outcome variables or explained targeted variances. One of the studies using cumulative risk index was the Rochester longitudinal study (Sameroff, Seifer, Baldwin, & Baldwin, 1987) in which cumulative risk index significantly predicted children's IQ as well as social-emotional competence better than any single risk factor. Gerard and Buehler (2004) created a cumulative risk index from 11 environmental risk factors and found a positive, linear association between cumulative risk and problem behaviors.

Despite explanatory power, some researchers have criticized the cumulative risk index method. Greenberg, Lengua, Coie, and Pinderhughes (1999) suggested several problems: first, some variables can be better assessed as continuous variables rather than as dichotomous variables; second, the cumulative risk index method only addressed the

number of risks not the types of risks indicating particular consequences; lastly, the cumulative risk index method did not account for the relative contribution of each risk factor or overlap in risk factors.

In addition, Ackerman, Izard, Schoff, Youngstrom, and Kogos (1999) suggested that the cumulative risk index may have underestimated the extent to which contextual risk factors are associated with children problem behaviors although the cumulative risk index well differentiated children with serious levels of problem behaviors. In Ackerman et al.'s study (1999), the variance explained by the cumulative risk index was much smaller than the contribution of the same individual risk factors. Ackerman et al. (1999) noted that this smaller explanatory power explained by the cumulative risk index in comparison to individual risk factors has been found in several other studies (Fergusson, Horwood, & Lynskey, 1994; Sameroff, Seifer, Baldwin & Baldwin, 1993; Sameroff, Seifer & Bartko, 1997).

Also, Masten (2001) highlighted another potential problem with this method. According to her, although cumulating risk factors evidenced strong association with multiple indicators including psychosocial competence, psychopathology and health, the process underlying the association between risk factors remained elusive.

Problem Behaviors

Problem Behavior Theory

Prior to introducing the problem behavior theory, problem behaviors was defined as "behavior that departs from the norms-both social and legal-of the larger society, it is behavior that is socially disapproved by the institutions of authority and that tends to

elicit some form of social control response whether mild reproof, social rejection, or even incarceration" (Jessor, 1987, p.332).

According to Jessor (1987), problem behavior theory was based on psychosocial nature of human functioning rather than biological, medical, or genetic nature. Problem behavior theory argued that psychological, social and behavioral characteristics determine the involvement of adolescents in problem behaviors. Jessor (1987) defined these characteristics as resulting from the interaction among three systems: the personality system, the perceived environment system, and the behavior system.

The critical point of the problem behavior theory is that the proneness, which is a dynamic state resulting from the interrelationship between each of the above three systems, determines "the likelihood of occurrence of normative transgression or problem behavior" (p. 332). From this statement, it can be emphasized that from the psychological, social, and behavioral characteristics each individual encompasses, the tendency to engage in problem behaviors in general rather than a particular problem behavior is yielded. This conceptualization is considerably different from the previous approaches that usually address each problem behavior distinctly.

Jessor (1987) presented a comprehensive framework about how the personality system, the perceived environment system, and the behavior system influenced involvement in problem behaviors. Variables that comprised the *personality system* were organized into three structures: the motivational-instigation structure, the personal belief structure, and the personal control structure. The motivation-instigation structure involved variables related to directional orientation, that is, whether or not a person head to academic achievement and independence. The personal belief structure included social

criticism, alienation, self-esteem and internal-external locus of control. The variables that were included in the personal control structure were attitudinal tolerance of deviance, religiosity, and positive-negative functions discrepancy.

The perceived environmental system consisted of environmental factors that influenced the involvement in problem behaviors. The variables included were parental support, parental control, friend support, friend control, and parent-friend comparability, parent approval for problem behavior, friend approval for problem behavior, and friend models for problem behavior. The behavior system was comprised of behavior variables that were oriented toward two conventional institutions of society, church and school. Church attendance and school achievement were the key behaviors that have potential to lead to lower involvement in problem behaviors.

Previous Studies that Tested Jessor's Problem Behavior Theory

After the presentation of problem behavior theory and empirical supports for co-occurrence among several problem behaviors, several studies tested Jessor's problem behavior theory. In reviewing some previous studies that tested the syndrome of problem behavior, Gillmore, Spencer, Larson, Tran, and Gilchrist (1998) noted that contrary to Jessor's theory, a single underlying construct was not consistently found. They tested a hypothesis that there was a single underlying construct among problem behaviors with childbearing subjects, comparing three models. In Model 1 four kinds of problem behaviors were accounted for by a single factor. Model 2 described a four factor model in which four distinct factors explained each of four problem behaviors. Model 3 was a second-order factor model in which a single factor accounted for the variance in each of the four first-order factors. The results showed that the four factor model had a better fit

to the data than the single-factor model. However, there was no significant difference between the second-order factor model and the four-factor model. The second-order factor model was preferred because the model could explain the correlation among the first-order factors. Based on these results, the researchers concluded that there was likely a common general factor, or a syndrome of problem behaviors among childbearing adolescents.

Ary, Duncan, Biglan, Metzler, Noell, and Smolkowski (1999) tested the underlying construct of problem behaviors using longitudinal data. The problem behaviors included in their study were antisocial behavior, high-risk sexual behavior, alcohol use, marijuana use, cigarette smoking and academic failure. They also included family conflict and poor family involvement at the first assessment, inadequate parental monitoring and peer deviance at the second assessment, and problem behavior involvement at the third assessment period. They hypothesized that family conflict would be associated with poor family involvement at Time 1. Then these two family variables were expected to predict poor parental monitoring one year later. Also, it was hypothesized that poor parental monitoring would be associated with deviant peers at Time 2. Then poor parental monitoring and association with deviant peers would predict high levels of engagement in problem behaviors at Time 3, six months later.

The hypothesized model yielded acceptable model fit indices. 55.5 percent of the variance in problem behavior was explained in this model. The authors discussed that this study extended the model of the development of antisocial behavior based on Patterson's theory to the development of problem behavior in general. This study supported the effect of family and peer influence on the development of general problem behavior. Also, this

study supported a single construct of collective problem behaviors including antisocial behavior, risk sexual behavior, academic failure, and substance use.

Farrell, Kung, and White (2000) also examined the underlying structure of problem behaviors. These authors tested four competing models. The first model was based on the problem behavior theory in which a single factor accounted for four kinds of problem behaviors including physical and non-physical aggression, drug use, and delinquent behaviors. The second model was a three-factor model in which three distinct factors accounted for the problem behaviors. The third model was a four-factor model in which physical and nonphysical aggression was accounted for by separate factors. The fourth model included a higher-order factor to account for the covariance among factors.

The participants in this study were sixth- and seventh-grade students. The samples were comprised of two groups, an urban sample and a rural sample. The results showed that the one-factor model did not show adequate fit to the data whereas both three-factor and four-factor models showed adequate fits to the data. Considering the three-factor model explained the correlation between physical and nonphysical aggressions, the three-factor model was retained over the four-factor model.

Lastly, the higher-order factor model was examined in which the three first-order factors loaded on a higher-order factor. The three-factor model and the higher-order factor model resulted in the same chi-square test. The authors further examined the influence of other relevant variables on problem behaviors, including peer pressure for drug use and attitudes toward aggression, and suppression of aggression, with the three-factor model and the higher-order factor model. The results provided mixed support for problem behavior theory. In explaining the discrepant results of this study from previous

studies, Farrell et al. (2000) noted that several previous studies used scale scores whereas this study used individual items for problem behaviors. They suggested that examination with scale scores would have failed to find first-order factors as found in this study.

Willoughby, Chalmers, and Busseri (2004) argued that the previous studies to examine the single construct of problem behaviors did not account for meaningful variances in individual behaviors. In addition, they argued that the variance not explained by the single general construct can be considered a unique phenomenon. They noted that several aspects of a problem behavior syndrome should yet be addressed: (a) only limited numbers of problem behaviors have been examined; (b) the variance of individual behaviors explained by the general construct should be addressed instead of finding a structural model to explain covariation among problem behaviors; and (c) the actual level of involvement with individual behaviors.

With a large sample of high school students, they ran confirmatory factor analysis to test the problem behavior syndrome model. They found that a three-factor model yielded better fit than a single factor model. However, given correlations among three factors, they retested a global latent factor model that addressed the correlation among three factors. The fit indices of the global latent factor model were identical to the three factor model. In addition, they examined the co-occurrence of problem behaviors at different levels of involvement in problem behaviors. The extent to which individuals were involved in problem behaviors was categorized into three levels: no involvement, some involvement and high-risk involvement. At the some involvement level, alcohol (81%), direct aggression (75%), and minor delinquency (59%) were reported as the most common behaviors. Also, these behaviors were shown as most likely co-occurring in

those who engaged in another problem behavior. At the high-risk involvement level alcohol, direct aggression, and minor delinquency were the most common behaviors consistent with the some involvement level.

From the aforementioned four studies, three studies compared different models that included a single factor model, three or four factor model and a higher-order factor model. The results from the three studies were consistent although each study differently emphasized the importance of their results. That is, three studies showed that the single factor model did not fit their data well whereas the three or four factor model had better model fits. Further, they tested the higher-order factor model and compared the three or four factor model with the higher-order factor model. The higher-order factor model also showed acceptable model fit to their data. The comparisons between two models did not show significant differences in any study. Some studies emphasized that the higher-factor model was preferred because the model addressed the covariation among the first-order factors whereas Willoughby, Chalmers, and Busseri (2004) did not show certain model preference.

Relationship between risk factors and problem behaviors

Although many studies investigated the effects of risk and protective factors on the negative developmental outcomes in children and adolescents, the risk and protective effects on the problem behaviors, which were defined by the problem behavior theory, were examined in a few studies.

Beam, Gil-Rivas, Greenberger, and Chen (2002) conducted a study to examine the risk and protection effects for adolescent problem behavior. The adolescent problem behaviors included risk taking, school-related deviance, substance use, status offenses,

physical aggression vandalism, and theft. These behaviors were consistent with the definition of Jessor's problem behaviors. Based on the socioecological perspective, they selected risk factors from multiple contexts, family and peer contexts, and a context of having meaningful relationship with nonparental adults. Also, protective factors were derived from same contexts as risk factors. They created context specific cumulative risk indices and participants were assigned a cumulative risk score for each context.

Beam et al. (2002) found that being male and having high risks on peer and extrafamilial contexts were associated with more involvement in problem behavior. They examined nine interaction effects on problem behavior with three cumulative risk indices and three protective factors. Five interactions out of nine interactions were significant. Having positive peer influence moderated the effects of risk factors from all three contexts on problem behavior. Also, perceiving parents and a very important adult person as disapproving of their misconduct moderated the effects of high peer risk on problem behavior.

Jessor, Bos, Vanderryn, Costa, and Turbin (1995) examined the relationships among risk and protective factors and problem behavior. Six risk factors were selected from personality, perceived environmental, and behavior systems. Those risk factors were low expectation for success, a low sense of self-esteem, high hopelessness, high friends model for problem behavior, high orientation to friends relative to parent, and grade point average. Seven protective factors chosen from personality, perceived environmental, and behavior systems were a positive orientation toward school, a positive orientation toward health, high intolerance of deviance, positive relations with adults, high regulatory controls, high friend models for conventional behavior and high

involvement in social activities. With these risk and protective factors, cumulative risk and protective factor indices were computed. The problem behavior was measured in four different areas; problem drinking, delinquent-type behavior, marijuana involvement, and sexual intercourse experience.

Jessor and colleagues (1995) found both risk and protective effects. The number of protective factors was negatively related with the involvement in problem behavior whereas the number of risk factors was positively related with the involvement in problem behavior. In addition, the interaction effect was significant. However, the unique increments of variances explained by protective effects and the interaction effect were much smaller than the variance explained by the risk factors. The individual effects of risk and protective factors were also reported in that, among several risk factors, "friends models for problem behavior" has the largest effect on involvement in problem behavior, whereas, among protective factors, attitudinal intolerance of deviance had the largest effect.

Gerard and Buehler (2004) examined the cumulative risk effect for youth problem behaviors. Based on the ecological theory of Bronfebrenner (1989), they selected risk factors from multiple contexts: family, peer, school, and neighborhood contexts. The selected fourteen risk factors from the several contexts were used to compute the total number of risk factors. They found a significant positive relationship between cumulative risk and problem behavior. The eight percentage of the problem behavior variance was explained by the cumulative risk. In the study, the interaction effect of ethnicity was found, that is, the positive relationship between the cumulative

risk and problem behavior was stronger for white adolescents compared with black adolescents.

In addition to the cumulative risk, Gerard and Buehler (2004) examined the risk effects of individual factors on problem behavior. Five risks out of fourteen risks significantly predicted problem behavior. Those risk factors were divorced/single-parent household, low parental warmth, low peer support, trouble with peers, and low school connectedness. The individual risk factors accounted for 17% of the variance of problem behavior. They also examined the individual risk factors for problem behavior one year later after controlling the antecedent problem behavior. Several risk factors remained significant predictors, which were low parental warmth, peer support, and school connectedness. In addition, these researchers sought to explain why adjustment difficulties arose in the presence of multiple environmental challenges by comparing problem behavior among youth with zero, one, two, three and four affected risk domains. They found that youth who had risk factors in three or four social domains experienced high levels of problem behavior.

Coley, Morris, and Hernandez (2004) examined the influence of out-of-school care arrangement for problem behavior trajectories. Demographic features, parenting monitoring and neighborhood climate were assessed as potential moderating variables. The neighborhood climate was measured by the Collective Efficacy scale that asked questions about social control, neighborhood cohesion and neighborhood trust. After interviewing their mothers, participants were assigned into four groups of out-of school care arrangement: in-home, formal program, out-of-home supervised, and out-of home unsupervised. The problem behavior was measured in terms of three kinds of behaviors:

serious delinquency, drug and alcohol use, and school problems. The individual characteristics associated with type of care were analyzed using chi-square analyses. After the chi-square analyses, wald post hoc tests were used to test bivariate differences between groups. Results showed that Hispanic adolescents showed higher rate of in-home care and lower rates of formal program care than any other ethnic groups. The other groups did no show significant difference; and employed mothers were associated with providing higher rates of in-home care and lower rates of out-of-home unsupervised care.

The main effects of out-of-school care type and interaction effects with antecedent problem behavior, parental monitoring, and collective efficacy were examined in each type of problem behavior. Adolescents with out-of-home supervised as well as with out-of-home unsupervised care were positively associated with drug and alcohol use than adolescents with in-home care. Adolescents with formal-program care and out-of-home unsupervised care showed greater increase in school problems than adolescents with in-home care. For the main effects, they concluded that adolescents with any forms of in-home care showed lower levels of problem behaviors over a 16-month period than adolescents in out-of-home care regardless of whether supervised or unsupervised and structured or unstructured.

Several interaction effects were reported: adolescents with the previous problem behavior history showed greater increase in problem behaviors in the out-of-home care context; parental monitoring appeared more protective for adolescents with out-of-home unsupervised care; the higher level of collective efficacy led to improvement for adolescents with formal program and out-of-home care for drug and alcohol use of

problem behavior whereas the collective efficacy was protective for adolescents with formal programs for school problems.

In general, the aforementioned studies that examined the relationship among risk and protective factors and problem behavior found positive relationships between risk factors and problem behavior and negative relationships between protective factors and problem behavior. There were some similarities and discrepancies across the research methods in these studies as well as the ascertained results. First, many studies adopted the cumulative risk index method. However, Beam et al. (2002) focused on the domain specific effects and created a domain cumulative risk index rather than the total cumulative risk index. In addition, the studies that utilized the cumulative risk index method selected risk factors from multiple settings or systems. Second, half of the studies reviewed examined the interaction effects among predictor variables, whereas the other half of the studies did not. Third, although many studies termed their outcome variable as problem behavior, based on Jessor's problem behavior theory, the breadth of problem behaviors was defined differently. For example, Gerard and Buehler (2004) included aggressive or delinquent behaviors as the problem behavior outcome variable whereas Beam et al, (2002) included several kinds of problem behaviors such as risk taking, school-related deviance, substance use, status offences, physical aggression, vandalism, and theft. Fourth, each study emphasized different results. In Beam et al.'s study (2002), interaction effects from positive peers influence, and the perception of parents as well as a very important adult person as disapproving of their misconduct showed unique explanation for involvement in problem behavior. In addition to the cumulative risk effect, Gerard and Buehler (2004) examined individual risk effects. They found that low

parental warmth, peer support, and school connectedness were the consistent, significant predictors of problem behaviors over time. Coley et al. (2004) focused on the importance of out-of-school care. The researchers found that out-of-home care regardless of whether supervised or unsupervised, was associated with heightened rates of delinquency, drug and alcohol use, and school problems. Lastly, a critical review of this research showed that no single study examined the relationship between risk and protective factors and an underlying construct of problem behaviors. Also, although these studies defined their outcome variable as problem behavior, the measurement of the problem behavior appeared to be based not on the underlying construct but the summed-up scores of several kinds of problem behaviors.

Summary of Literature Review

In order to examine the relationship between risk and problem behavior in adolescence, the literature review highlights two critical domains and their inter-relationship: (a) risk factors, (b) problem behaviors and (c) the relationship between these two constructs.

From the literature review of general risk factors among adolescents, researchers have emphasized that the selection of multiple risk factors across multiple contexts was based on the ecological model. Within this framework, risk factors were identified from four contexts: (1) demographic, (2) family, (3) school, and (4) neighborhood contexts. Demographic risk factors that had consistent, significant explanatory power on developmental outcome or mental health were low SES as measured by poverty level, parent education, and parent occupation variables. Existing research that addressed family risk factors highlighted two primary foci. First, psychological aspects of family

relationships and roles have been investigated including inter parental conflict, family emotional expressions, mother-adolescent relationship problems and caregiver emotionality. Second, variables relevant to optimal family climate have been investigated including parental marital status, social support, marital distress and the effect of maternal physical health problems and maternal depressive mood on home environment. Although a few studies have examined school risk factors, the results consistently showed that lack of school belonging or school coherence were significant risk factors for adjustment or developmental outcome in adolescence. The studies that examined the effect of the neighborhood risk factors found that neighborhood indicators affected adjustment or development outcome in children and adolescent. However, several studies mentioned that the effect of such neighborhood indicators was smaller than other risk factors.

From review of the aforementioned studies examining general risk factors, many researchers have adopted the "cumulative risk index" method. The researchers found significant relationships between the cumulative risk and developmental outcomes or adjustment in children and adolescents. However, several limitations of the cumulative method were suggested. For example, artificial dichotomous treatment, loss of specific explanation of individual risk effects, and underestimation of the explained variance were limitations that have been reported related to the cumulative risk index methodology. Several studies have tested Jessor's problem behavior theory (Gillmore, et al., 1998; Ary, et al., 1999; Farrell, et al., 2000). From reviewed studies, three studies compared different models that included a single factor model, three or four factor model and a higher-order factor model. The results from the three studies were consistent although each study

differently emphasized the importance of their results. That is, these studies showed that the single factor model did not fit their data well, whereas the three or four factor model had better model fits. Further, they tested the higher-order factor model and compared the three or four factor model with the higher-order factor model (Gillmore, et al., 1998; Ary, et al., 1999; Farrell, et al., 2000; Willoughby, et al., 2004). The higher-order factor model also showed acceptable model fit to their data. The comparisons between two models did not show significant differences in any studies. Some studies (Gillmore, et al., 1998; Farrell, et al., 2000) emphasized that the higher-factor model was preferred because the model addressed the covariations among the first order factors whereas Willoughby, Chalmers, and Busseri (2004) did not show certain model preference.

A few studies (Beam, et al., 2002; Jessor, et al., 1995; Gerard & Buehler, 2004) investigated the relationships among risk and protective factors and problem behavior. In general, these studies found negative relationships between risk factors and problem behavior and positive relationships between protective factors and problem behavior. There were some similarities and discrepancies across the research methods in these studies as well as the ascertained results. First, many studies adopted the cumulative risk index method. However, Beam et al. (2002) focused on the domain specific effects and created domain cumulative risk index rather than the total cumulative risk index. In addition, the studies that utilized the cumulative risk index method selected risk factors from multiple settings or systems. Second, some studies examined the interaction effects among predictor variables, whereas other studies did not. Third, although many studies termed their outcome variable as problem behavior, based on Jessor's problem behavior theory, the breadth of problem behaviors was defined differently. For example, Gerard

and Buehler (2004) included aggressive or delinquent behaviors as the problem behavior outcome variable whereas Beam et al. (2002) included several kinds of problem behaviors such as risk taking, school-related deviance, substance use, status offences, physical aggression, vandalism, and theft. Fourth, each study emphasized different results. In Beam et al.'s study (2002), interaction effects from positive peers influence, and the perception of parents as well as a very important adult person as disapproving of their misconduct showed unique explanation for involvement in problem behavior. In addition to the cumulative risk effect, Gerard and Buehler (2004) examined individual risk effects. They found that low parental warmth, peer support, and school connectedness were the consistent, significant predictors of problem behaviors over time. Coley et al. (2004) focused on the importance of out-of-school care. The researchers found that out-of-home care regardless of whether supervised or unsupervised, was associated with heightened rates of delinquency, drug and alcohol use, and school problems. Lastly, a critical review of this research showed that no single study examined the relationship between risk and protective factors and underlying construct of problem behaviors. Also, although these studies defined their outcome variable as problem behavior, the measurement of the problem behavior appeared to be based not on the underlying construct but the summed-up scores of several kinds of problem behaviors.

Chapter Three: Method

This chapter describes the methodology used to examine the presented research questions and research hypotheses. It will discuss the data source, participants' characteristics, the selected indicators to measure underlying factors from the data sources, and lastly the analytic procedure.

Data Source

The data for this study came from the National Longitudinal Study of Adolescent Health (commonly referred to as the ADD Health). The ADD Health study assessed social contextual variables at the individual, family, school, and community levels that influenced adolescents' health and problem behaviors. The ADD heath data consisted of data in Wave I, Wave II, and Wave III. The present study used the data in Wave I that was conducted from September 1994 through December 1995. The data included in-school, school administrator, parent questionnaires as well as in-home interviews.

Sample

The respondents in the ADD Health study were a nationally representative sample of adolescents in grades 7 through 12. The method of random selection of students was administered by stratifying the representing 80 schools by grade and sex and then randomly choosing about 17 students from each stratum. A total of approximately 200 students were selected from each of the 80 pairs of schools. The core sample of 12,105 adolescents then participated in Wave I. The present study used the public data set that

consisted of one-half of the core sample, and one-half of the oversample of African-American adolescents with parents who have a college degree. The total number of respondents in the Wave I Public dataset was 6,504.

Measure

Risk Factors

SES Indicators. Based on the literature review, three variables that reflected low SES were identified. In the present study the three variables were selected: income level, mother's education level and father's education level. One parent was interviewed to report the actual amount of the income. The actual question was "about how much total income, before taxes did your family receive in 1994? Include your own income, the income of everyone else in your household, and income from welfare benefits, dividends, and all other sources." The reported income ranged from $ 0 to $ 999,000. Both parent education levels were asked with ten categories; never went to school; 8th grade or less; more than 8th grade, but did not graduate from high school; went to a business, trade, or vocational school instead of high school; high school graduate; completed a GED; went to a business, trade or vocational school after high school; went to college, but did not graduate; graduated from a college or university; and professional training beyond a 4-year college or university.

Family Indicators. Four variables that influenced family functioning were selected from the ADD Health dataset; Family Fun Time, Family Attention, Family Understanding, and Parent Care. The following four questions were asked to adolescents with the Home Questionnaire: How much do you feel that you and your family have fun together?; How much do you feel that your family pays attention to you?; how much do

you feel that people in your family understand you?; How much do you feel that your parents care about you? These four indicators were assessed on a 5-point scale (1= not at all to 5 = very much).

School Indicators. Four items were selected and defined as indicators for school risk. The items measured the respondents' perceptions of general school environment including school safety, school closeness, school belonging, and school satisfaction. The following questions were asked to adolescents with the school questionnaire: I feel safe in my school; I feel close to people at this school; I feel like I am part of this school; I am happy to be at this school. These four items were assessed on a 5-point scale (1= strongly agree to 5 = strongly disagree).

Neighborhood Indicators. Three items were selected and defined as indicators to measure the latent neighborhood risk variable. These items measured the respondents' perceptions of their neighborhood climate in terms of crime rate, drug use, and school quality. The following three questions were asked to adolescents' parents in the context of asking reasons to live in their resident areas: you live here because there is less crime in this neighborhood than there is in other neighborhoods; you live here because there is less drug use and other illegal activity by adolescents in this neighborhood; you live here because the schools here are better than they are in other neighborhoods. These items were asked in a dichotomous yes/no manner.

Problem Behaviors

School Failure. Three items were selected and defined as indicators to measure the latent factor of school failure. The selected items were academic grades in English, Math, and Science (e.g., A, B, C, and D). The actual questions wre the following: at the

most recent grading period, what was your grade in English or language arts, Math, and Science?

Violence. In order to measure the latent violence factor, three variables were identified, including physical fighting, physical injury to others and group fight. These three items were derived from the delinquency scale in the Home Questionnaire. These three items measured the frequency in which they involved in the violence behaviors. The actual questions were the following: how often did you get into a serious physical fight?; how often did you hurt someone badly enough to need bandages or care from a doctor or nurse?; In the past 12 months, how often did you take part in a fight where a group of your friends was against another group?. These questions were assessed on a four-point scale ranging from 0 (never) to 3 (five or more times).

Substance Use. Three kinds of substance use problems were selected and defined as indicators that measure the latent factor of substance use. Respondents were asked about the frequency with which they used cigarettes, alcohol and marijuana, respectively, during the last 30 days. Respondents were asked to indicate how many days they have smoked cigarettes and marijuana, respectively. The alcohol use was asked on a 7-point scale ranging from 1 (every day or almost every day) to 7 (never).

Sexual Activities. In order to measure adolescents' sexual activities, three items were selected and defined as indicators. These three items asked respondents' experience of casual sexual activity, the number of partners, and the number of non-romantic sexual partners. The responses to these items were reported as the actual numbers of sexual activity and partners.

Analytic Procedure

The analyses took place in four parts: a confirmatory factor analysis of four domains' risk factors, a confirmatory factor analysis of problem behavior, a comparison of two structural models, and general model comparisons with gender, ethnicity and age. The sample was randomly divided into three groups using SPSS so that the first three analyses were conducted with an independent sample. The hypothesized structural equation model was tested with gender, race/ethnicity and grade level, using the entire sample, because the number of some ethnic groups was not be sufficient to run structural equation modeling (SEM) analysis.

Part I: Confirmatory Factor Analysis of Four Domains Risk Factors

The structure of risk factors was tested. The confirmatory factor model was specified, based on the literature review. Each risk factor was indicated by the selected variables from each of the social domains based on the ecological framework (Bronfenbrenner, 1979, 1994): the SES risk factor was indicated by income and both parent education levels; the family risk factor was indicated by Family Fun Time, Family Attention, Family Understanding, and Parent Care; the school risk factor was indicated by school safety, school closeness, school belonging, and school satisfaction; lastly, the neighborhood risk factor was indicated by crime rate, drug use, and school quality. Given the first research question, "Is there a general risk factor that accounts for the domain risk factors?," the four-factor model was compared with the secondary higher-order factor model (See Appendix A, figure 1 and 2 for the part I analysis).

Part II: Confirmatory Factor Analysis of Problem Behavior

In order to test the hypothesis that there will be a plausibility of the secondary higher-order factor that accounts for co-occurring problem behaviors, the underlying construct of problem behaviors suggested by Jessor (1987, 1995) was tested. The analysis was conducted by comparing the first-order four-factor model with the secondary higher-order model.

Part III: Structural Equation Models

After testing the previous two confirmatory factor analyses, one structural equation model was tested that addressed the second research question. Based on the analysis result of the first part, the structural equation model was specified. Under the assumption that there will be secondary higher-order constructs for risk factors and problem behaviors, the following structural equation model, in which the latent general risk factor will predict the latent general problem behavior factor, was tested (See Appendix A, Figure 5 for the part III analysis).

Part IV: Comparison of the Tested Structural Equation Model with Gender, Grade-level and Ethnic/racial groups

Under the assumption that the structural equation model would be acceptable, the given structural equation model planned to be tested with race/ethnic groups, race/gender, and grade level.

Chapter Four: Result

The data analyses took several steps to account for the presented two hypotheses and two research questions. The analysis results are presented in the following four sections; (a) preliminary analysis, (b) confirmatory factor analysis for second-order general risk and general problem behavior factors, (c) testing of the hypothesized structural model, and, lastly, (d) multiple-group analyses of the hypothesized structural model.

Preliminary analysis

The preliminary analysis was conducted in terms of replacement of missing values, data cleaning, dataset allocation and exploratory factor analysis.

Missing data

The variables selected from the ADD Health dataset had missing values ranging from 0 % to 36.7 % (see Table 1 & 2). The top six variables having the highest number of missing values were father's education level (36.7%), four school risk variables, which were School Safety, School Closeness, School Belonging and School Satisfaction, (33.3% to 34.5%), and income (24.2%). Due to the relatively high percentages of missing values for these variables, replacement of missing values was considered and conducted using the SAS imputation method. However, four of the selected indicators were categorical variables. Since the SAS program does not have the capacity to impute categorical missing values, the missing values of these four, which were Neighborhood

Crime, Neighborhood Drug Use, Neighborhood School Quality and Casual Sex indicators, were deleted using the listwise method. It resulted in the total 5421 participants from 6504 participants.

Data Cleaning

After replacing missing values, the skewness and kurtosis of the variables were reviewed in order to examine the non-normality of the selected variables. According to West, Finch, and Curran, (1995) researchers need to address the non-normality of the variables if skewness is greater than 2 and kurtosis is greater than 7. Some of the selected items showed greater values than 2 for skewness and 7 for kurtosis (see Table 1 and Table 2). These variables were Income, Physical Injury to Others, Group Fight, Marijuana Use, Number of Partners and Number of Non-Romantic Sexual Relationship. The variables were transformed using the SPSS Log 10 method. The transformed values of Income, Physical Injury to Others, Group Fight and Marijuana Use were within the acceptable range. Although the transformed values of Number of Partners and Number of Non-Romantic Sexual Relationship were not within the acceptable range, the transformed values were much closer to normality than the original values. In addition, transforming the Parent Care indicator did not help convert the skewness and kurtosis within acceptable ranges and the original values were kept.

Dataset Allocation

The procedures that tested the two research questions and two hypotheses presented in the introduction chapter took several steps of data analyses: exploratory factor analysis, confirmatory factor analyses for the second-order general risk factor and the general problem behavior factor, testing of the hypothesized structural model and,

lastly, multiple group analysis for the hypothesized structural model. The entire dataset was allocated in order to conduct the presented analyses with separate datasets. At first, the dataset was randomly divided into three groups. Then, the first dataset was randomly divided into two groups. As a result, a total of four sub-datasets were created. The first dataset with a sample size of 866 was used for the exploratory factor analysis: the second dataset with a sample size of 923 was run for the confirmatory factor analyses for the second-order general risk model and the general problem behavior model; the third dataset was used to test the measurement model of the hypothesized structural model with the 1815 sample size; the fourth dataset having the 1817 sample size was used to test the structural model of the hypothesized model; lastly, the multiple group analyses were conducted with the entire dataset because the sample size of ethnic/racial groups was not be sufficient for the comprehensive structural model testing.

Exploratory Factor Analysis

In order to examine the factor structure and numbers of the selected variables, an exploratory factor analysis (EFA) was conducted. The actual questions of the selected variables were provided in the Appendix B. The Principal Axis Factoring method was utilized to examine the factor structure of the selected variables. The Direct Oblimin rotation was chosen due to the nature of the covariance of the factors. Twenty-five selected variables from twenty-seven variables had greater than .30 factor loadings to the factors. Two variables, which were Number of Partners and Number of Non-Romantic Sexual Relationship, failed to have greater factor loadings than .30. While excluding these two variables, the exploratory factor analysis was rerun and resulted in seven factors.

The seven-factor solution for the selected risk items and problem items explained 56.3% of the total variance in the selected variables. Factor 1, with 15.5% of the variance, was labeled Family Risk. Factor 2, with 8.5% of the variance, was called Neighborhood Risk. Factor 3, with 8.2% of the variance, was named Violence. Factor 4, with 7.2% of the variance, was labeled School Risk. Factor 5, with 6.6% of the variance, was labeled SES Risk. Factor 6, with 5.7% of the variance, was called School Failure. Lastly, Factor 7, with 4.7% of the variance, was labeled Substance Use with Casual Sex.

The Direct Oblimin rotation method allowed factors to correlate with each other. The correlations among factors ranged from .025 (between Family Risk and SES Risk) .357 (between Violence and Substance Use with Casual Sex). In terms of cross-loadings of the selected items, any items did not have factor loadings greater than .30 in more than one factor.

The results of the EFA were consistent with the research assumption: the SES Risk factor was constructed with Income, Mother Education, and Father Education: the Family Risk factor was constructed with the family relationship variables, which were Family Fun Time, Family Attention, Parent Care, and Family Understanding; the School Risk factor was constructed with the school variables, which were School Safety, School Closeness, School Belonging, and School Satisfaction; the Neighborhood Risk factor was constructed with the Neighborhood Crime, Neighborhood Drug Use, and Neighborhood School Quality; the School Failure factor was constructed with the academic grades in English, Math, and Science; the Violence factor was constructed with Physical Fight, Physical Injury to Others, and Group Fight; and the Substance Use with Casual Sex

factor was constructed with cigarette, alcohol, and marijuana usage and casual sex. The factor loadings are presented in Appendix C.

Confirmatory factor analysis for risk variables and problem behaviors

Background of the WLSMV estimation

Before presenting the confirmatory factor analysis (CFA) results for risk factors, the model parameter estimation method is briefly discussed in terms of the issues to address categorical variables. The categorical variables are problematic under the normal distribution assumption of Maximum-Likelihood (ML) estimation in structural equation modeling (SEM), which is the most commonly used. Employment of ML method for categorical variables results in the problems associated with inflated chi-square model fit and underestimated parameters (Flora & Curran, 2005; Barbakus, Ferguson, & Joereskog, 1987; Muthen & Kaplan, 1992).

One of the statistical approaches to address categorical variables in SEM is to apply the polychoric, polyserial, and/or tetrachoric correlation estimates to model parameters estimation (Flora & Curran, 2005). The polychoric correlation is employed when both variables are dichotomous or ordinal under the assumption of latent continuous variables. Polyserial correlation is employed for the pair of dichotomous/ordinal-interval variables assuming to reflect latent continuous variables. Tetrachoric correlation is applied to both dichotomous variables with the same latent continuous variable assumption.

One of the alternative model parameter estimations is the Weighted Least Squares (WLS) (Muthen, duToit, & Spisic, in press). The WLS estimation method has been developed based on a weight matrix computed by the asymptotic variances and

covariances of polychoric correlations. According to Flora & Curran (2005), Muthen (1983, 1984) extended the application of WLS from continuous but nonnormally distributed variables to dichotomous, ordered categorical, or continuous variables. However, the WLS estimation has been criticized because the weight matrix rapidly increases depending on the number of indicators in a SEM. By the nature of the WLS estimation method, frequently nonpositive definite appears and a very large sample size is necessary to gain valid estimations.

In order to address the limitations of the WLS estimation, Muthen, duToit, & Spisic (1997) presented the robust WLS mean and variance adjusted χ^2 test of model fit estimation (WLSMV) (Nussbeck, Eid, Lischetzke, 2005; Muthen & Muthen, 2001). In the WLSMV estimation, the diagonal matrix is used instead of the full weight matrix to obtain the parameter estimates. Based on Flora and Curran's (2004) simulation study, the WLSMV estimation proved to surpass the WLS estimation in terms of accurate test statistics, parameter estimates, and standard errors. Hence, the WLSMV estimation is the most advanced method for analyzing complex structural equation model with categorical variables. This WLSMV estimated was used in this study.

CFA for risk indicators

Because three indicators out of fourteen indicators in the observed variables were dichotomous, the WLSMV estimation was employed in analyzing the factor structure of the 3 SES, 4 family, 4 school, and 3 neighborhood observed variables. The first research question of this study was whether there is an underlying second-order general risk factor that explains the covariance among the first-order latent SES, Family, School, and Neighborhood risk factors. In order to address the first research question, CFAs were

conducted for two models. The first model was comprised of a second-order general risk factor that subsumed the four first-order SES, Family, School and Neighborhood risk factors (Second-order General Risk Model). On the other hand, the second model consisted of the four first-order risk factors that covaried with each other (First-order Risk Model). These two models were presented in the Appendix A, Figure 1 and 2.

The CFAs were performed using the Mplus version 4 specifying the WLSMV estimation. The results of the CFA for the Second-order General Risk Model and the First-order Risk Model were presented in Table 2. As seen in Table 2, both models had adequate fit to the data. Although the chi-square p-values showed different results in two models, indicating insignificance in one model (0.342) while significance in another model (0.019), since the sample size of 923 was relatively large, it was hard to distinguish the two models based on the chi-square p-values. The Comparative fit index (CFI) and the non-normed fit index (TLI) in both models were close to 1, of which CFI and TLI values above .95 were considered adequate (Hu & Bentler, 1998). In addition, the root-mean square error of approximation (RMSEA) indexes were less than .05 in both models. According to Brown and Cudeck (1993) suggested that RMSEA values of .05 or less indicate a close fit and .08 or less indicate adequate fit. The WRMR was not considered a significant model fit indicator.[1]

The systematic comparison of Model A and Model B was not feasible such as the chi-square difference test since Model A and Model B was not nested in one another. In addition, the Akaike Information Criterion (AIC) that is used to compare non-nested models is not created when using the WLSMV estimation. Thus, the decision to choose one model against another model lied on theoretical explanation. Although empirically

the underlying general risk factor has been considered, literature does not elucidate the existence of the underlying general risk factor that influences SES, family, school and neighborhood risks. However, there were some statistical points of view indicating the reasons to choose the higher-order model over the lower-order model.

In the comparison of the higher-order model with the lower-order model, Marsh and Hocevar (1985) indicated that since the second-order model explains the covariances among the first-order model, the goodness-of-fit of the second-order model cannot exceed the goodness-of-fit of the first-order model that posits the correlations among the first-order factors. Chen, Sousa, and West (2005) asserted several advantages of the second-order models. The most manifest advantage is that the second-order model explains the data in a more parsimonious way with fewer parameters. In addition, the unique portions of the first-order factors that are not explained by the second-order factor can be revealed. Based on these statistical considerations, Second-order General Risk Model over First-order Risk Model was chosen. This Second-order General Risk Model was incorporated in the hypothesized comprehensive structural model in later analyses.

In addition, although the research question focused on identifying the underlying second-order general risk factor, it was important to examine the first-order and second-order standardized factor loadings of the individual risk indicators and first-order factors (see Table 4). All factor loadings of indicators to the posited latent risk factors were significant, which indicated convergent validity (Anderson & Gerbing, 1988). Thus, the latent risk variables were well measured by their indicators.

CFA for Problem Behaviors

The first hypothesis presented in Chapter 1 was that an underlying general problem behavior construct that influences school failure, violence, substance use and sexual activity exists. In order to test this hypothesis, the two confirmatory factor models were compared; First-order Problem Behavior Model and Second-order Genderal Problem Behavior Model. Figural descriptions of these two models were presented in the Appendix A, Figure 3 and 4. These two models were modified from the four first-order factor structure into the three first-order factor structure, based on the exploratory factor analysis.[2] The first-order problem behavior model consisted of the latent School Failure, Violence, and Substance Use with Causal Sex factors that were correlated with each other. The second-order problem behavior model consisted of the second-order general problem behavior factor that influenced the fist-order School Failure, Violence, and Substance Use with Causal Sex factors.

Mplus version 4 was used in two CFAs for observed problem behavior variables specifying the WLSMV estimation. The results were presented in Table 5. The second-order problem behavior model and first-order problem behavior model yielded same model fit results with a negligible difference in the chi-square value. The chi-square p-values were significant in both models. The CFIs and TLIs in both models were .914 and .939, respectively. Although Hu and Bentler (1998) suggested .95 as the criterion value for CFI and TLI, traditionally values above .90 have been considered good fit to data. In addition, the RMSEA value .06 indicated adequate fit to the data based on Brown and Cudeck's (1993) suggestion.

As mentioned earlier, the systematic comparison of the second-order model and the first-order model was not feasible using chi-square difference test. The decision to choose one model over another model lied on the theoretical background. Since the second-order general problem behavior factor was posited based on Jessor's problem behavior theory, the second-order general problem behavior factor was chosen. This second-order general problem behavior model was incorporated as a part of the hypothesized comprehensive structural model in later analyses.

For the factor loadings on the first-order factors and the second-order factor were all significant at the .001 level. Thus, the first-order latent problem behavior factors and the second-order general problem behavior factor were well constructed. The specific standardized factor loadings were provided in Table 6. Given more importance on the second-order factor loadings on the second-order general problem behavior factor, the factor loadings were .44 for School Failure, .59 for Violence and .84 for Substance Use with Casual Sex.

Testing of the hypothesized structural model

The second research question presented in Chapter One inquired about the relationship between latent risk factor and latent problem behavior factor. Based on the results of the confirmatory factor analysis of the risk variables and problem behaviors, it was hypothesized that the second-order general risk factor will influence the second-order general problem behavior factor. In this section, the hypothesized structural model was tested in two steps, which were the measurement model analysis and the structure model analysis. The measurement model analysis is to test whether the observed variables reflect the latent factors well while the structural model analysis is to

investigate whether the hypothesized relationships among latent factors are well specified, based on the adequacy of the measurement model tested.

Measurement Model Analysis

In the measurement model latent variables were set free to covary with each other. This setup provides the basis upon which the path structure among latent variables is built (Newcomb & Bentler, 1988). In the current measurement model the two second-order factors were set free to covary. A confirmatory factor analysis for the measurement model was run using Mplus version 4 specifying the WLSMV estimation. The third dataset with the sample size 1815 was employed in this analysis.

An initial CFA was run and resulted in adequate model fit to the data (see Table 7). The chi-square value was significant. However, as mentioned earlier, the chi-square value is sensitive to sample size so that large sample sizes tend to reject the hypothesized model. The CFI was .932, which was less than. 95 but within the range that was traditionally considered a good fit. The TLI was .951 indicating adequate fit to the data. The value of RMSEA was .046, which indicated a close fit to the data. Overall, the model demonstrated a good fit to the data.

However, some modifications were made in order to improve the measurement model better based on the Lagrange Multiplier test. Five correlations among the observed-variable residuals were added to the model. The added five correlations were; Grade English with Father Education (.15); Grade English with Income (.14); Grade Math with Father Education (.12); Family Understanding with Mother Education (-.15); and Family Understanding with Father Education (-.13). Of the five correlations, the positive associations between academic performance and parent education/income that

have been reported in literature were reflected in the model. In addition, the negative associations between perceived family understanding and parent education were presented in the current model. The final CFA was performed and resulted in better model fit indices (see Table 7).

A chi-square difference test between the initial CFA model and the final CFA model was conducted using Mplus version 4 specifying the DIFFTEST command. The final CFA model resulted in a significant improvement over the initial CFA model with the chi-square difference of 167.082 ($\Delta df = 4$, N=1815), $p<.001$. It would be important to note that according to Muthen and Muthen (2006), the difference in chi-square values for the hierarchical models when using the WLSMV estimation, is not distributed as chi-square. In order to examine the chi-square difference values using WLSMV, Mplus requires setting up a more specified model to H0 and a less restrictive model to H1. The DIFFTEST command takes two steps: the first step is to estimate the H1 model while saving the derivatives needed for the chi-square difference test; the second step is to estimate the H0 model while computing the derivatives from the H0 and H1 analyses (p. 441-442).

The hypothesized factor loadings of the indicators and first-order variables were all significant at the .001 level. The hypothesized factor structures at the first-order and the second-order level were supported. Standardized factor loadings, first-order disturbance variance (or unique variance of the first-order factors) and residual variances of the observed variables were illustrated in Figure 1. The observed variables were in the rectangles and the latent first-order factors and second-order factors were in large circles. The small circles with number indicated error variances for the dependent variables.

There were two kinds of errors: the errors for the observed variables are called residuals and the errors for the latent variables are called disturbance. Given more interest in the second-order factors, the second-order factor loadings of the first-order variables were following: the second-order general risk factor loadings are .26 for SES, .61 for Family, .54 for School and .16 for Neighborhood risk factor: the second-order general problem behavior factor loading were .54 for School Failure, .49 for Violence and .75 for Substance Use with Casual Sex.

Structural Model Analysis

The structural model analysis was conducted based upon the measurement portion of the CFA model. The fourth dataset with the sample size of 1817 was adopted in this analysis. The structural model fitted the data well (see Table 7). The CFI was close to .95 while the TLI was .962, all indicating adequate fit to the data. In addition, the value of RMSEA .042 indicated a close fit to the data. The measurement features and the path structure between two second-order factors were illustrated in Figure 2.

In the structural model the main interest was given to the path between the second-order general risk factor and the second-order general problem behavior factor. The path was significant at the .001 level with the path coefficient .74, indicating that when the second-order general risk factor increases by 1 standard deviation, the second-order general problem behavior factor also increase by 0.74 standard deviations. Also, 54% of the second-order general problem behavior variance was explained by the structural model.

The second-order factor structures of the risk variables and the problem behaviors were supported again with the separate dataset in the structural model analysis.

With the second-order factor structures, the unique variances and the shared variance of the first-order risk variables were revealed (see Figure 2). The squared values of the identified factor loading indicate the explained variance of the variable. That is, the 10 percent of the latent SES factor variance was explained by the general risk factor and the 90 percent of the latent SES factor variance remained as a unique variance. The squared value of the SES factor loading on the second-order general risk factor ($.31^2 \approx .10$) was the explained variance of the SES factor by the second-order general risk factor. The same principle was applied to other factors and indicators. The unique variance of the SES factor indicated the disturbance variance, that is, error variance that was not explained by the general risk factor. The same principle was applied to other first-order factors. The 26 percent of the latent Family Risk factor variance was explained by the general risk factor and the 74 percent of the latent Family Risk factor variance remained as a unique variance (the disturbance variance of the Family factor): The 38 percent of the School Risk factor variance was explained by the general risk factor and the portion of the unique variance was 62 %: the portion of the neighborhood risk factor explained by the general risk factor was the smallest among the four first-order risk factors (5%).

In general the shared variances of the first-order problem behaviors with the second-order general problem behavior factor were larger than the shared variances of the first-order risk variables by the second-order general risk factor (see Figure 2). The second-order general problem behavior factor explained 41% of School Failure, 22 % of Violence, and 51% of Substance Use with Casual Sex. The unique variances were 59%, 78% and 49% for School Failure, Violence and Substance Use and Casual Sex, respectively. The added five correlation coefficient values in the structural model were

consistent with values in the measurement model; Grade English with Father Education (.11); Grade English with Income (.13); Grade Math with Father Education (.11); Family Understanding with Mother Education (-.12); and Family Understanding with Father Education (-.09).

Multiple Group Analysis

Multiple group analyses were conducted to examine whether the hypothesized structural model would be congruent based on gender, grade and ethnic/racial subgroups. The first multiple group analysis was conducted for male and female groups. The second multiple group analysis compared two grade-level groups: lower grade group (7^{th} to 9^{th} grade) and upper grade group (from 10^{th} to 12^{th}). Lastly, ethnic/racial multiple group analyses were subjected to three groups: Caucasians, African Americans and Hispanics.

Although Native Americans and Asian American adolescents were in the ADD Health dataset, the total numbers of youths in these two ethnic groups were 159 and 179, respectively, after cleaning the dataset. According to Kline (2005), 20 cases per parameter represent the upper ideal recommendation for structural equation modeling analysis and 10 cases per parameter represents the lower bound. Considering the number of estimated parameters was 56 in the hypothesized structural model (24 error variances, 8 disturbance variances, 22 factor loadings, 1 factor variance and 1 path coefficient), the sample sizes of these two ethnic/racial were not sufficient and therefore these two groups were excluded from the multiple group analysis.

Multiple group analysis was conducted in four stage process. These processes were partly adopted from the methods suggested by Byrne (2001). Firstly, separate baseline models were tested for each group. Secondly, the simultaneous baseline model

was run to examine configural invariance across groups. That is, same measurement and structural model was run to determine whether the same factor loading and path patterns were equivalent across each group. Thirdly, the first-order and second-order factorial and structural invariance were tested by constraining parameter values to be equal across groups.

In the third stage, the chi-square difference between the unconstrained model and the constrained model was examined for significance. If the constrained model had a worse fit to the data, the next step was to identify source of the non-invariance across groups. This partial invariance test was based on the suggestions from Kline (2005). Also, it is important to note that although Byrne (2001) suggested separating the measurement and structural invariance tests, in this study they were examined conjointly. Lastly, the latent mean difference in the second-order factors were tested based on the final model that was tested for factorial and structural invariance.

Byrne (2001) recommended performing hierarchical invariance tests examining variance invariance, covariance invariance and residual invariance. However, in this multiple group analysis the variance invariance and covariance invariance were not accounted for in accordance with Kline's (2005) suggestion that although indicators measure the same factors in commensurable ways, the variance and covariance may differ across groups (MacCallum & Tucker, 1991). In addition, residual invariance was not tested because constraining residuals to be equal across groups are usually considered too stringent (Byrne, 2001).

Gender Multiple Group Analysis

Separate Baseline Models. In the first stage, the hypothesized structural model was estimated separately for male and female adolescent groups. This analysis was run to set up the baseline model for later invariance test. The extent to which the hypothesized model fitted the separate groups was estimated. For male adolescents, the hypothesized model provided an adequate fit to the data; $\chi^2 = 660.277$, df=107, CFI=0.929, TLI=0.946, and RMSEA= 0.045. For female adolescents, the model also provided an adequate fit to the data; $\chi^2 = 657.571$, df=107, CFI=0.945, TLI=0.960, and RMSEA= 0.043.

The standardized parameter estimates of the hypothesized model were presented for male and female adolescent groups in Table 8. All of the estimated parameter values achieved statistical significance ($p<.001$). The standardized first-order factor loadings ranged from .44 to .98 in the male adolescent group and from .45 to .97 in the female adolescent group. The standardized second-order factor loadings ranged from .24 to .76 in the male group and from .14 to .65 in the female group. The standardized path coefficients from the general risk factor to the general problem behavior were .74 for the male group and .90 for the female group.

Factorial and Structural Invariance Test across Gender Groups. The factorial and structural invariance were tested between male and female groups. First, the simultaneous baseline model (Unconstrained Model) was run in which any parameters were not constrained to be equal between groups. The unconstrained model resulted in an adequate fit to the data (see Table 9). Then, the fully constrained model was run in which the first-order and second-order factor loadings and the path coefficient from General

Risk Factor to General Problem Behavior Factor were constrained to be equal between groups. The fully constrained model also demonstrated adequate fit to the data (see Table 9).

In order to test the factorial and structural invariance, the chi-square difference test was conducted between the unconstrained model and the fully constrained model. As mentioned earlier, when using WLSMV estimation, the chi-square values and degrees of freedom cannot be used for chi-square difference test and Mplus requires specifying the DIFFTEST command to compare models. The chi-square difference test between two groups specifying DIFFTEST command resulted in a significant difference (see Table 9). To identify a partial invariance model between male and female groups, Lagrange Multiplier (LM) test was conducted and modifications were made based on the LM test results.

Based on the LM test results, parameters that had highest modification index values were released consecutively until the partially unconstrained model did not have a significant difference from the unconstrained model. As a result, four parameters in the fully constrained model were released in the order of modification index values. The second-order factor loading of Violence factor, the first-order factor loading of Physical Injury to Others indicator, the second-order factor loading of Substance Use with Casual Sex factor, and the second-order factor loading of SES factor were released in the order.

Therefore, the measurement model invariance of the hypothesized model was partially supported. Considering there were 27 out of 31 factor loadings in the measurement model were equivalent across gender groups (24 first-order factor loadings and 7 second-order factor loadings), the most of the factor structure was equivalent

between gender groups except 4 factor loadings. For the structural invariance, the path coefficient from the general risk factor to the general problem behavior factor remained equivalent across groups in the partially constrained model.

Differences in Second-order Factor Means. In estimating latent mean differences, the measurement invariance test should precede the latent mean difference test. Kline (2005) suggested that at least partial invariance in the measurement model should be proved, indicating same basic factor structure and similar unstandardized factor loadings and intercepts across groups (p. 298). In the current multiple group analysis based on gender, since most of the factor structure was equivalent across groups except a few differences, the latent mean difference was investigated in the second-order factors, which were the general risk factor and the general problem behavior factor.

Latent mean differences were estimated by analyzing relative differences in factor mean values rather than absolute differences. In order to estimate the latent mean differences, the first group was set up as a reference group by fixing the means of its factors in this group to zero. Then the means of factors in the second group were freely estimated. In this latent mean difference test, the male adolescent group was set up as the reference group and then the latent mean difference in the female adolescents group was freely estimated. The intercepts of the observed indicators and the first-order factors were constrained to be equal across groups. The latent mean difference test resulted in a non-significant difference in the general risk factor and a significant difference in the general problem behavior factor (see Table 10). Thus, it was interpreted that in the female group the mean of the latent general problem behavior was significantly lower than in the male

group at the .001 level while there was no significant difference in terms of the mean of the latent general risk factor.

Grade group analysis

Separate Baseline Models. A four stage process to investigate invariance between two grade-level groups was followed. First, the hypothesized structural model was estimated separately for lower grader (7^{th} to 9^{th} graders) in comparison to upper graders (10^{th} to 12^{th} graders). The lower graders and upper graders were distinguished as middle and high school groups after this point. For the middle school group, the hypothesized model demonstrated adequate fit to the data; $\chi^2 = 606.247$, df=107, CFI=0.951, TLI=0.960, and RMSEA=.042. For the high school group, the model also demonstrated adequate fit to the data; $\chi^2 = 581.752$, df=110, CFI=0.945, TLI=0.956, and RMSEA=.041.

The standardized parameter estimates of the hypothesized model were presented for both groups in Table 11. All of the estimated parameter values were statistically significant at the .001 level. The standardized first-order factor loadings ranged from .45 to .97 in the middle school adolescent group. Similar standardized factor loadings were reported in the high school groups with the factor loadings ranging from .48 to .96. In addition, the second-order factor loading patterns were similar across two groups. The standardized path coefficients from the general risk factor to the general problem behavior were .96 for the middle school group and .68 for the high school group.

Factorial and Structural Invariance Test across Grade Groups. The factorial and structural invariance were tested between middle and high school groups. A similar procedure as conducted in the gender multiple group analysis was followed in the second

stage. The hypothesized structural model was run simultaneously for two grade-level groups without constraining any parameters (unconstrained model). The unconstrained model resulted in adequate fit to the data (see Table 12). In the third stage, the fully constrained model was run in which the first-order and second-order factor loadings and the path coefficient from General Risk Factor to General Problem Behavior Factor were constrained to be equal between groups. The fully constrained model also demonstrated adequate fit to the data (see Table 12).

To examine the factorial and structural invariance, the chi-square difference test was conducted between the unconstrained model and the fully constrained model, specifying the DIFFTEST command in Mplus. The chi-square difference test resulted in a significance difference (see Table 12). To establish the partial invariance model, the results from the Lagrange Multiplier (LM) test were reviewed. Similarly performed in the gender multiple group analysis, the parameters with the highest modification index values were released consecutively until the partially constrained model did not reveal a significant difference from the unconstrained model.

Among 31 factor loadings five first-order factors and three indicators were released. The released five first-order factors were SES, Family, Neighborhood, Violence, and Substance Use with Casual Sex. The released three indicators were physical fight, group fight and grade English. In comparison to the gender groups, more parameters were released in the grade-level groups, especially the first-order factors. In summary, the second-order factor loadings were non-invariant across groups. However, most of the first-order factor loadings were equivalent across groups except three factor loadings. For the structural invariance, the path coefficient from the general risk factor to

the general problem behavior factor remained equivalent between groups in the partially constrained model.

Differences in the Second-order Factor Means. In the fourth stage, based on the established partial invariance model, the latent mean differences were tested. The same procedure taken in the gender group analysis was also applied to grade-level groups. The middle school adolescent group served as the reference group by fixing the means of the second-order factors to zero. On the other hand, the means of the same second-order factors in the high school adolescent group were freely estimated. The z scores of the means of the second-order factors in the high school adolescent group exceeded the cut-off value 3.29 at the .001 level (see Table 13). That is, the relative mean values between two groups showed significant differences in the both second-order factors, the general risk factor and the general problem behavior factor. The high school adolescents had significantly higher means of the general risk factor as well as the general problem behavior factor than middle school adolescents.

Ethnic/Racial group analysis

Separate Baseline Models. In conjunction with gender and grade-level multiple group analysis, ethnic/racial group analysis was provided. As mentioned earlier, three ethnic/racial groups, Caucasian, African American, and Hispanics, served as subgroups. However, two-group analyses were adopted instead of conducting a three-group analysis due to the technical convergence problem. Caucasian versus African American and Caucasian versus Hispanic group comparisons were conducted.

The ethnic multiple group analysis took the same four-stage process as noted earlier to examine measurement and structural invariance and latent mean difference

across groups. First, the hypothesized structural model was estimated separately for Caucasian, African American, and Hispanics. All of the baseline models for each of three groups revealed adequate fit to the data; for Caucasian group, $\chi^2 = 713.092$, df=108, CFI=0.939, TLI=0.959, and RMSEA=.042; for African American group, $\chi^2 = 362.525$, df=90, CFI=0.931, TLI=0.938, and RMSEA=.051; for Hispanic group, $\chi^2 = 157.720$, df=85, CFI=0.960, TLI=0.965, and RMSEA=.039.

The standardized parameter estimates of the hypothesized model that was conducted separately for three groups were presented in Table 14. Most of the estimated parameter values were statistically significant at the .001 level. Two factor loadings, which were the first-order SES factor in African American model and the first-order Neighborhood factor in Hispanic model, were significant at the .01 level. The first-order factor of SES in Hispanic model did not reach the .05 significance level. The z score of the first-order SES factor loading was 1.856. However, the first-order factor loadings and second-order factor loadings across three ethnic/racial groups were similar.

Factorial and Structural Invariance Test across Grade Groups. The factorial and structural invariance were tested across three ethnic/racial groups. In the second stage, two simultaneous baseline models (unconstrained model) ware estimated for Caucasian and African American groups as well as for Caucasian and Hispanic groups. The two unconstrained models resulted in adequate fit to the data in both analyses (see Table 15). In the third stage, the fully constrained models were estimated in which the first-order and second-order factor loadings as well as the path coefficient from General Risk Factor to General problem Behavior Factor were constrained between groups. The two fully constrained models also demonstrated adequate fit to the data (see Table 14).

To investigate the factorial and structural invariance, the chi-square difference tests were conducted between the unconstrained models and the fully constrained models, specifying the DIFFTEST command in Mplus. The chi-square difference test between Caucasian and African American resulted in a significance difference (see Table 15). The partial invariance model for Caucasian and African American groups was established by releasing the parameters with the highest modification index values based on the Lagrange Multiplier (LM) test. One second-order factor loading, School Risk, and one first-order factor loading, Cigarette Use, were released in the partial invariance model. For Caucasian and Hispanic group comparison, the chi-square difference test was not significant, indicating that all first-order factor loadings, second-order factor loadings and a path coefficient were invariance between Caucasian and Hispanic groups.

Differences in the Second-order Factor Means. In the fourth stage, the latent mean differences were tested. For Caucasian and African American group comparison, the latent mean difference test in the general risk factor and general problem behavior factor was based on the partial invariance model. The Caucasian adolescent group served as the reference group by fixing the means of the second-order factors to zero. The means of the same second-order factors in the African American adolescent group were freely estimated. The z scores of the mean of the general problem behavior factor in the African American adolescent group exceeded the cut-off value 1.96 at the .05 level while the mean difference of general risk factor was not significant (see Table 16). That is, African American adolescent group showed a higher mean score in the general problem behavior factor than Caucasian adolescent group.

For Caucasian and Hispanic group comparison, since all factor loadings and path coefficient were invariant between groups, the latent mean difference was tested in the fully constrained model. The test revealed that the mean of the general risk factor in the Hispanic adolescent group was significantly higher at the .01 level while there was no significant difference in the mean of the general problem behavior factor between two groups.

Chapter Five: Discussion

The widespread problem behaviors in adolescence, which are school failure, violence, substance use, and teenage casual sex, were addressed in this study by identifying the latent general risk and problem behavior factors as well as the relationship between the general risk and general problem behavior factors. The first step in this study derived multiple risk indicators from four environmental domains (SES, Family, School, and Neighborhood) based on the developmental-ecological perspective. Further, the existence of the general risk factor that underlies these four environmental domains was investigated and indeed supported. The second step addressed frequently co-occurring problem behaviors in adolescents by identifying the general problem behavior factor based on Jessor's theory. The third step that addressed the hypothesized nexus relationship between the general risk and general problem behavior factors was advanced with the support of the existence of the general risk factor and general problem behavior factors. Lastly, gender, grade-level, and racial/ethnic group differences for the relationship between the general risk and the general problem behavior factors were tested using multiple group analysis. In this chapter, the results are discussed in the following four subsections: General Risk, General Problem Behavior, Nexus between General Risk Factor and General Problem Behavior Factor, and Multiple Group Analysis. Next, implications and suggestions are provided with the following subtitles: Implications of General Risk Factor, Implications of General Problem Behavior Factor,

and General Implications and Suggestions. Lastly, the limitations of the study are discussed.

General Risk

Based on an ecological perspective (Bronfenbrenner, 1979; 1994), many researchers have identified numerous individual risk factors associated with adolescents' adjustment and mental health problems. The identified risk factors across multiple contexts included the following: low socioeconomic status and poverty (Greenberg et al., 1999; Owens & Shaw, 2003), family stress (Forehand et al., 1998), caregivers' emotionality (Ackerman et al., 1999), school detachment and perceived prejudice (Gerard & Buehler, 2004), school climate (Sameroff et al., 1998), school belonging (Anderman, 2002), school coherence and school safety (Bowen et al., 1998), neighborhood economic status (Duncan et al., 1994), and neighborhood safety, violence, drug traffic, satisfaction, and stability (Greenberg et al., 1999). In addition to the identification of individual risk factors, there has been an empirical finding that risk factors tend to cluster in individuals, indicating that a given risk factor will often occur in conjunction with one or more other risk factors (Luthar, 1993).

This study sought to address the potential coexisting or comorbid risk variables across multiple domains by determining if an underlying construct of the overlapping risks factors across multiple domains existed. The first research question explored whether there was an underlying latent risk construct that influenced several environmental domains, including SES, Family, School, and Neighborhood. This question was supported, indicating that this is a valid way to explain the relationship among risk factors across four environmental domains. That is, results suggest an existing

underlying second-order general risk factor that influences the first-order risk factors in SES, Family, School, and Neighborhood.

The results demonstrated that the selected risk indicators representing the latent SES, Family, School, and Neighborhood risk factors were all significantly loaded on the posited first-order factors. These results were consistent with previous research studies (Greenberg et al., 1999; Forehand et al., 1998; Sameroff et al., 1998; Anderman, 2002; Bowen et al., 1998; Duncan et al., 1994) wherein the following was established: (a) income and parent education levels were established as SES Risk indicators; (b) the characteristics of family relationship, which were measured as family fun time, family attention, family understanding, and parent care, were established as Family Risk indicators; (c) the characteristics of the school environment, including school safety, school closeness, school belonging, and school satisfaction, were established as School Risk indicators; and (d) lastly, the neighborhood characteristics, including perceptions about neighborhood crime, neighborhood drug use, and neighborhood school quality, were established as Neighborhood Risk indicators.

The identification of an underlying general risk factor suggests that the selected risk statuses defined within the context of SES, Family, School, and Neighborhood domains are systematically interrelated. This study offers evidence that adolescents who are at risk in one domain have an increased likelihood of being at risk in other domains. Such findings offer a potential explanation of the coexistence of risk statuses across several domains. The existence of the general risk factor offers impetus for researchers to investigate the underlying mechanisms that are associated with coexisting risk factors across multiple domains.

Shared and Unique Variance of General Risks

In having established the existence of a general risk factor, the next step of this study was to investigate the interrelationship among risk factors. Therefore, this study sought to detect the overlapping portion between several risk factors, that is, the shared and unique variance associated with a potential general risk factor. The analytic method used in this model, in comparison to the cumulative risk index (CRI) method, differentiates two advantages: use of continuous variables and capacity to estimate the shared variance across risk variables by identifying the latent second-order general risk factor. The identified second-order general risk factor reflects the overlapping shared variance across several risk domains; its relationship to problem behaviors is discussed later.

Although the shared variance among risk factors was the main interest in this study, it is also important to note that the results demonstrated unique variances in each of the first-order risk factors that are not explained by the second-order general risk factor. In detail, relatively large portions of the first-order Family and School factors were explained by the second-order general risk factor evidenced by factor loadings of .49 for Family and .78 for School while relatively small portions of the latent SES and Neighborhood factors were explained by the second-order general risk factor evidenced by factor loadings of .25 for SES and .14 for Neighborhood. It is worth noting that the Family and School risk indicators were measured based on the adolescents' perceived adjustment within their family and school environments, which are environments wherein adolescents have direct contacts with significant others, while the SES and Neighborhood risk indicators were measured by parents' socioeconomic status and the family's

neighborhood quality, which do not reflect adolescents' perceived assessment of these conditions. Since the SES and Neighborhood risks are determined by external forces beyond adolescents' sphere of influence and control, the general risk factor associated with these two domains may represent distal effects rather than proximal effects.

General Problem Behavior

This study tested Jessor's theory (1987) by hypothesizing the existence of the underlying general behavior factor investigated through a confirmatory factor analysis. Jessor (1987) argued that even though the manifestations of each independent problem behaviors look distinct, these problem behaviors are indeed interrelated. He suggested that there is an underlying tendency that influences several problem behaviors simultaneously. The results demonstrated support for the hypothesized second-order general problem behavior model. Such findings indicate the existence of overlapping occurrences of several problem behaviors in adolescents. These results are consistent with previous studies that compared three or four first-order factor models with a second-order general problem behavior model (Farrell et al., 2000; Gillmore et al., 1998; Willoughby et al., 2004). Based on theory, the second-order factor model has been consistently selected over the first-order model thereby supporting a general problem behavior factor as hypothesized by Jessor (1987).

More specifically, the results of the confirmatory factor analysis (CFA) indicated that all of the selected problem behavior indicators, which were posited to represent the latent problem behavior factors, significantly loaded on the factors. In this study, the selected indicators of the latent problem behavior factors were as follows: (a) academic grades in English, Math, and Science for School Failure factor; (b) the frequency in

physical fight, physical injury to others, and group fight for the Violence factor; and (c) lastly, the frequency in cigarette use, alcohol use, and marijuana use along with the experience of casual sex for the Substance Use with Casual Sex factor.

However, it is also worthy to note that the CFA results demonstrated some unique variances of each problem behavior that were not explained by the general problem behavior. As a consequence, in knowing both the shared variance explained by the general problem behavior factor as well as the unique variance unrelated to the general problem behavior factor it is possible to more adequately address each identified problem behavior. Such results clarify the variance of each distinct problem behavior explained by the general problem behavior as recommended by Willoughby et al. (2004). In the current study, 19% of the School Failure variance, 35% of the Violence variance, and 69% of the Substance Use with Casual Sex variance were explained by the problem behavior factor. Thus, a substantial portion of the variance in substance use such as cigarette, alcohol, and marijuana consumption along with casual sex was explained by the general problem behavior factor in comparison to school failure and violence, which were explained with some portion of the variance.

Many previous studies have attempted to address the etiology of individual problem behaviors. Findings of this study clarify the portion explained by the general problem behavior suggesting that the tendency for adolescents to depart from societal norms was reflected by various forms of behavior problems including school failure, violence, and substance use along with casual sex. Nonetheless, other factors are also involved in the etiology of individual problem behaviors. The portions of the individual

problem behaviors explained by other factors are represented in the unique variance of the first-order school failure, violence, and substance use with casual sex.

Nexus between General Risk Factor and General Problem Behavior Factor

In having established support for the existence of a general risk factor and a general problem behavior factor, this study then sought to investigate whether a relationship exists between these two identified latent factors. The hypothesized structural model between the two latent factors was constructed by combining the general risk model and the general problem behavior model with a path directed from the second-order general risk factor to the second-order general problem behavior factor. The results demonstrated that the relationship between the general risk factor and the problem behavior factor was supported. Specifically, all first-order and second-order factor loadings as well as the path coefficient were significant at the .001 level. Most of all, the strength of the influence of the general risk factor on the general problem behavior factor was strong evidenced by a path coefficient of .74. This magnitude means that if the general risk factor increases by 1 standard deviation, the general problem behavior increases by .74 standard deviation. This signifies a very close and strong relationship between these two latent factors. Thus, 54% of the general problem behavior variance was explained by the general risk factor, which is more than half of the variance. Although researchers have found positive relationships between risk factors and problem behaviors (Beam et al., 2002; Gerard & Buehler, 2004; Jessor et al., 1995), the relationship between the latent risk factor and the latent problem behavior factor is newly explored and supported in this study.

Multiple Group Analyses

A series of multiple group analyses were tested in order to examine whether the hypothesized structural model consistently demonstrates adequate fit to gender, grade-level, and ethnic/racial subgroups. In other words, the hypothesized model was tested to examine whether the hypothesized model can be validated for each subgroup. In addition, the difference of the mean structure of the hypothesized model was compared across groups.

Gender Multiple Group Analysis

The factorial and structural invariances of the hypothesized model were tested across gender. In addition, the mean differences of the second-order factors in the hypothesized model were compared across gender. In the current gender multiple group analysis, the four factor loadings were not invariant, indicating that some of the factor structure of the hypothesized model was not equivalent across gender groups as mentioned above. Thus, based on the partial invariance model, the latent mean difference in the second-order risk and problem behavior factors were examined and revealed mixed results across gender. There was no significant mean difference in the general risk factor, indicating that the extent to which male and female adolescents were exposed to the general risk was similar. However, the male adolescents had a significantly higher mean score in the general problem behavior factor than the female adolescents, indicating that the extent to which adolescent males engage in problem behaviors was more severe than adolescent females.

Since the approach to compare the mean score differences in the latent factors has only been recently developed, it is hard to compare these results with previous studies.

However, as mentioned earlier, previous studies have reported more evidence of problem behaviors among male adolescents in comparison to female adolescents (Cairns & Cairns, 1994; Goldstein, 1984; Stouthamer-Loeber & Loeber, 1988).

Grade-level Multiple Group Analysis

The factorial and structural invariance of the hypothesized model as well as the mean differences of the second-order factors in the hypothesized model were tested with the grade-level groups. The invariance test across grade-level groups resulted in the partial invariance in the measurement part of the hypothesized structural model. This finding suggests that although the hypothesized model can be applied to both grade-level groups, some parts of the factor structure, especially the second-order factors, of the hypothesized model exhibit different patterns across two grade-level groups.

Based on the partial invariance model, the latent mean differences in the second-order general risk and problem behavior factors were significantly different in the general risk and the general problem behavior factors, identifying higher scores in the upper-grade group (grades 10 through 12). An interpretation of such results suggests a more severe exposure to general risk among adolescents in the upper-grade group. In addition, the extent to which adolescents engage in the problem behaviors was more severe among high school students compared to those in the lower-grade group (grades 7 through 9).

Such findings may be explained by the fact that high school adolescents may have been exposed to conditions of multiple risk statuses for a longer period of time in comparison to middle school adolescents. For example, in this study, SES, Neighborhood, School, and Family risk characteristics may reflect stable effects over time as opposed to temporary conditions. An alternative explanation for grade-level mean

score differences may be the nexus relationship between the general risk factor and general problem behavior. In this case, the higher mean score of the general risk factor can explain the higher mean score of the general problem behavior factor. That is, high school students are more exposed to risk statuses, and as a consequence, they engage in more problem behaviors. Regardless of the explanation, this result is consistent with Richards et al.'s study (2004) that showed that older African American adolescents reported greater levels of delinquency and drug use than younger African American adolescents.

Ethnic/Racial Multiple Group Analysis

The hypothesized model was tested for three ethnic/racial adolescent subgroups wherein African Americans and Hispanics were both examined in comparison to Caucasians. In this study, the separate analyses of the hypothesized structural model across the comparative ethnic/racial groups (African Americans vs. Caucasians and Hispanics vs. Caucasians) supported the existence of the general risk factor and the general problem behavior factor as well as the nexus relationship between these two latent factors. Such findings of ethnic/racial variations on risk statuses and for problem behaviors are consistent with some studies (Choi, Harachi, Gillmore, & Catalano, 2005).

The factorial and structural invariances were tested between Caucasians and African Americans. The invariance test of the hypothesized model between Caucasians and African Americans yielded a partial invariance model. Based on the partial invariance model, when the mean differences in the general risk and the general problem behavior factors were compared between Caucasian and African American groups, there was no significant difference in the mean structure of the general risk factor. However,

the latent mean difference of the general problem behavior factor was significant, indicating that the extent to which African American adolescents engage in problem behaviors was more severe than Caucasian adolescents. This result appears to be consistent with the previous finding by Gorman-Smith and Florsheim (2000) indicating African American youth tend to exhibit more externalizing behavior problems than Anglo American youth.

The invariance test of factor loadings in the hypothesized structural model was also conducted between Caucasian and Hispanic groups. The test proved invariance of all factor loadings between two groups. However, the mean structure test yielded that the extent to which Hispanic adolescents were exposed to the general risk was more severe than Caucasian adolescents while there was no significant difference in the extent to which Caucasian and Hispanic adolescents engage in problem behaviors. Similarly, Vega, Khoury, Zimmerman, Gil and Warheit's study (1995) found no significant difference in problem behavior engagement between Hispanic adolescents and Caucasian adolescents as measured problem behaviors with the Child Behavior Check List (CBCL).

Implications and Suggestions

Implications of General Risk Factor

To assess the degree of association between risk status and problem behavior, this study utilized a different analytic method. The general risk factor method utilized continuous aspect of risk variables and simultaneously accounted for the overlapping nature of multiple risk variables. By comparison, the cumulative risk index (CRI) method, commonly used in past research studies, represents a less robust analysis given its reliance on counting the number of risk statuses using artificial cutoff scores.

Ackerman et al. (1999) has criticized this analytic approach given that it tends to underestimate the amount of the explained variance of the problem behavior.

In addition to the methodological advancement in detecting the influence of multiple risks on the problem behavior engagement in adolescents, the general risk factor can be emphasized in the light of the supported hypothesized structural model. In this study, the general risk factor was conceptualized as a network of risk statuses across multiple domains. Support for finding a general risk factor model suggests that the association of risk factors influences several kinds of problem behaviors rather than individual risk factors being exclusively associated with individual problem behaviors. In other words, the associated linked nature of risk statuses across domains may increase our explanatory power of their impact on adolescents' adjustment. Indeed, the results from this study demonstrate that when the general risk factor increases by 1, the composite of each individual School, Family, SES, and Neighborhood risk factor increases by .62, .51, .31, and .23, respectively. These four individual risk factors collectively are strongly associated through the general risk factor. Hence, it appears that multiple risk status factors are interrelated among adolescents. Such an empirical finding may argue for a "comorbidity" perspective regarding the nature of multiple risk statuses.

Given the powerful impact of the interrelated nature of the risk factors on the manifestation of adolescents' problem behaviors, it is critical for researchers to further investigate and understand the associated linked nature of risk statuses as a means to increase the level of optimal development and adjustment of adolescents. Is there an explanatory model to account for the associated linked nature of risk statuses? We suggest that the general risk status factor may reflect an "internalized cognitive schemata

pattern." The interdependence of risk statuses across domains may relate to how adolescents assess environmental stimuli and determine how best to respond in any given situation. As a consequence, constructs such as coping styles (Heppner, Cook, Wright, & Johnson, 1995), problem-solving (Heppner & Krauskopf, 1987), hope (Snyder, 1994), optimism/pessimism (Chang & Sanna, 2003), and self-efficacy (Bandura, 1986) represent an aspect of the "internalized cognitive schemata pattern" that may explain the underlying associated linked nature of risk statuses. Research demonstrates that such internalized cognitive schemata patterns influence adolescents' capacity to avoid or overcome at-risk circumstances or conditions. As an example, if exposed to negative environmental stimuli for a long time, some adolescents may become hopeless and exhibit ineffective coping styles and problem-solving skills and low self-efficacy. Given the intention to identify risk factors as a preventive measure, it seems important to determine the nature of the association or connection of common risk factors across multiple domains.

Implications of General Problem Behavior Factor

The meaning of the underlying general problem behavior factor was discussed as the tendency to depart from societal norms in the problem behavior section. On this point, the implications of the general problem behavior factor are further reflected in relationship to the general risk factor. Based on the results, adolescents who are exposed to a risk factor tend to be exposed to other risk factors, and then they likely engage in several kinds of problem behavior, which in this study were school failure, violence, and substance use with casual sex. The tendency of the co-occurrence or "comorbidity" of problem behaviors such as school failure, violence, and substance use with casual sex as

assessed in this study appears similar to Jessor's hypothesized syndrome of problem behavior, consisting of marijuana use, sexual intercourse, active protest, drinking, problem drinking, and general deviant behavior.

Jessor (1987) contents that the determinants of the problem behavior proneness is a result of three systems: the personality system, the perceived environment system, and the behavior system. In this study, the four risk factors, SES, Family, School, and Neighborhood as well as the general problem behavior factor were hypothesized to be influenced by the general risk factor. While Jessor derived the determinants from the individuals' appraisals of self and others as well as their environment, this study adopted an ecological framework and emphasized environmental influence in four domains. Therefore, the environmental quality impacting adolescents' lives was highly appraised to influence the problem behavior manifestation rather than emphasizing intraindividual values and attitudes. Based on this study's results, the environmental quality as defined by SES, Family, School, and Neighborhood, was shown to significantly influence problem behavior manifestation.

In summary, by testing the hypothesized structural model that involved the second-order risk and problem behavior factors, this study offered a significant outcome in accounting for the relationship between risk factors and problem behaviors. First, the study provided a comprehensive description of the relationship between risk variables and problem behaviors in adolescents. In particular, this study identified the specific portions of the shared variance and unique variances of the latent factors. For example, Figure 2 exhibited that 52% of school failure, 22% of violence, and 52% of substance use with casual sex were influenced by the general problem behavior factor. Second, the

methodology that was used in addressing risk factors demonstrated an advancement beyond the previous studies by addressing the continuous aspect of the risk variable as well as the overlapping nature of the risk variables. Third, the existence of the general risk factor provides support for the powerful impact of the interrelated nature of the four risk factors on problem behavior manifestation. In addition, the interrelated nature of the risk factors among SES, Family, School, and Neighborhood is warranted for future study. Fourth, the existence of the general problem behavior factor provides support for Jessor's problem behavior theory, indicating that the several manifestations in engaging in problem behaviors are influenced by the underlying problem behavior proneness. Lastly, the finding of the relationship between the latent general risk factor and the latent general problem behavior factor provides support for the influence of environmental quality impacting on adolescents' problem behavior manifestation. It appears that an ecological framework approach inclusive of SES, family, school, and neighborhood offers increased explanatory power regarding problem behavior engagement.

General Implications and Suggestions

This study results are discussed in terms of their implications and suggestions in the areas of prevention, intervention, and future adolescent research. The existence of a general risk factor was evidenced in this study. This finding suggests that the interrelated nature of risk factors across multiple domains may have a significant impact on adolescents' optimal development and healthy adjustment process. The most essential prevention and intervention efforts must address adolescents' at-risk status within individual as well as across multiple domains. Results from this study unequivocally highlight the likelihood that adolescents at risk in one domain tend to be at risk in other

domains. From an ecological framework perspective in accounting for SES, Family, School, and Neighborhood differences, research demonstrates that some children and adolescents encounter multiple risks across such environmental domains. In addition, within a developmental perspective, research shows that over time there is a high possibility of being at risk in one or more domains for many adolescents. As a consequence it seems important for educators and psychologists to help children and adolescents learn how to successfully overcome and/or minimize risks as they negotiate developmental tasks and face sociocultural and interpersonal challenges. In order to minimize or prevent adolescents' vulnerability across varying domains early identification of risk indicators is highly recommended.

In addition to the early risk identification, a change in environmental quality among at-risk adolescents must be considered. Given the interrelated nature of risk factors across environmental domains as evidenced by the general risk factor, it can be also expected that a positive input or change in one domain might affect the adolescents' adjustment in other domains. Hence, it may be important and effective to target one specific risk domain. In choosing one specific target risk domain, the school domain might be the most feasible target factor among the four environmental domains given that potentially there is less controllability over SES, family conditions, and neighborhood. In addition, based on the confirmatory factor analysis results of the general risk factor in this study, the school domain had the most contribution in constructing the general risk factor. This result might be a little surprising because oftentimes family characteristics are quite influential on the adolescents' development and adjustment. However, the findings in this study remind us of the significant amount of time – nearly 35 to 45 hours per week – that

adolescents spend in school interacting with their peers and teachers opposed to family interactions. As a consequence, psychologists need to underscore the significant role and influence of school and its environments on adolescents' adjustment and development. Furthermore, in relationship to problem behaviors, the school risk status made a significant contribution in predicting problem behavior engagement.

Relative to the importance of school environment on psychological outcomes, several school-related variables have been recognized as influencing adolescents' lives (Anderman, 2002; Boekaerta, 1993; Cowen, 1991). One such important school factor is school belonging. Researchers have found that the high level of school belonging is positively associated with optimism and GPA while negatively associated with depression, social rejection, and school problems (Anderman, 2002). Also, Finn and Rock (1997) found that school engagement is a predictor for school success after controlling for background and psychological variables such as self-esteem and locus of control. In addition, classroom management climates, school size, severity of discipline policies, and rates of participation in extracurricular activities (McNeely, Nonnemaker, & Blum, 2002) represent school characteristics that increase adolescents' feeling of school belonging. Thus, it seems critical for teachers, school administrators, and psychologists to acknowledge the importance of safety, belonging, closeness, and satisfaction in school settings. Future studies might focus on how school climate fosters comfort and safety for adolescents.

Beyond interventions to change the environmental quality, results from this study highlight the significance of prevention efforts relative to addressing problem behaviors. As evidenced by the second-order problem behavior factor, prevention efforts targeting

adolescents' proneness to engage in problem behaviors may be most efficient and effective intervention strategies. For example, adolescents may benefit from instruction on developing prosocial behaviors. While promoting prosocial behaviors, this researcher argues that prevention programs should teach adolescents to develop cognitive schema such as problem-solving skills, hope, and coping styles. This approach offers a proactive and preventive effort to shield adolescents from experiencing negative outcomes. Resilience studies have found that self-esteem (Garmezy & Devine, 1984; Rutter, 1985) and hopefulness (Masten & Powell, 2003; Worrell & Hale, 2001) have been associated with resilient adolescents' characteristics.

Moreover, resilience studies highlight the critical importance of understanding the developmental context of at-risk adolescents. Therefore, prevention and intervention programs need to address both risk and protective factors within the context of development (Masten, 2001). In particular, this study offers significant support for understanding risk factors among adolescents. The nature of the general risk factor and the general problem behavior factor among adolescents has been investigated within a developmental context. Results suggest that being exposed to varying risk statuses may stagger adolescents' development such that their growth and adjustment within and across multiple domains may be jeopardized. We argue that the one common feature among adolescents at-risk may be the lack of prosocial behaviors which are needed to successfully negotiate their environment. Interestingly, the development of prosocial behaviors may be related to specific cultural differences among adolescents.

Implications of Multiple Group Analysis

In understanding cultural considerations in the context of development among adolescents, distinct groups were investigated via multiple group analyses. First of all, the generalizability of the hypothesized model was supported in gender, grade-level, and ethnic/racial groups. That is, the existence of the general risk and the general problem behavior factors and the relationship between these two factors were validated in each of these distinct cultural groups. Therefore, the concept of the general risk factor and the general problem behavior factor can be generally applied to all adolescents regardless of their gender, grade-level, and ethnic/racial identity.

However, the invariance test of factor loadings yielded some variations in gender, grade-level, and ethnic/racial comparisons. For the gender comparison, among 31 factor loadings, four loadings were not invariant: the Physical Injury to Others indicator and the Violence, Substance Use with Casual Sex, and SES factors. For the grade-level comparison, five second-order factor loadings and three first-order factor loadings out of a total of 31 factor loadings were not invariant: the SES, Family, Neighborhood, Violence, and Substance Use with Casual Sex factors and the Physical Fight, Group Fight, and Grade English indicators. For the ethnic/racial comparison, two factor loadings were not invariant: the School factor and the Cigarette Use indicator between the African American and the Caucasian groups. These results provide subpopulation variations on the general risk factor and the general problem behavior factor. Future studies might investigate these subgroup differences to further specify the structure of the general risk factor and the general problem behavior factor in each culturally distinct subgroup.

Moreover, in addition to the invariance test of the model, the multiple group analysis demonstrated important mean score differences in the latent factors for gender,

grade-level, ethnic/racial groups. Based on the results, the male group had a higher tendency to engage in problem behaviors than the female group. This result is consistent with previous studies indicating male adolescents manifest more behavior problems than female adolescents (Cairns & Cairns, 1994; Goldstein, 1984; Stouthamer-Loeber & Loeber, 1988). In regards to grade-level comparison, the upper-grade-level group (7^{th}, 8^{th}, & 9^{th} graders) had higher mean scores in the general risk factor as well as in the general problem behavior factor in comparison to the lower-grade-level group (7^{th}, 8^{th}, & 9^{th} graders). That is, 10^{th}, 11^{th}, and 12^{th} grade adolescents in this study were exposed to a higher degree of risks as well as problem behaviors compared to 7^{th}, 8^{th}, and 9^{th} graders. This result warrants more urgent intervention needs for high school students (10^{th} – 12^{th} graders) than junior high school students (7^{th} – 9^{th}). Regarding the ethnic group difference, African American adolescents had a higher mean score in the general problem behavior factor than Caucasian adolescents. Hispanic adolescents had a higher mean score in the general risk factor than Caucasian adolescents. These results warrant future investigation to examine ethnic/racial differences in exposure to risk factors and problem behaviors noting ecological influences on varying domains such as SES, Family, School, and Neighborhood impacting the environmental quality of adolescents.

Limitations

There are several limitations to this study that should be mentioned. First, this study did not address the resilience characteristics of at-risk adolescents. The inclusion of protective factors along with risk factors on the problem behavior manifestation would offer further insights on adolescent developmental process. As a consequence,

investigation of protective factors would have offered additional suggestions and recommendations for prevention and intervention programs.

Second, this study used an existing dataset, the ADD Health. Although the dataset included a substantial number of items, the measurement of the variables was based on predetermined definitions and methods. For example, a social desirability bias effect may have been unaccounted for by the use of self-reported questionnaires and interview methods in measuring income, parent education levels, neighborhood characteristics, and commitment in problem behaviors.

Third, the questionnaires that asked about risk factors and problem behaviors were administered at the same time period such that there was no time precedence for the measured risk factors over the problem behaviors. In order to declare causality, three conditions should be attained: (a) there is time precedence, (b) the direction of the relation among variables is correctly specified, and (c) the relationships among the variables are not spurious (Kline, 2005). Hence, in this study the time precedence requirement between the general risk factor and the general problem behavior factors was not established.

Fourth, the sample sizes included in the data analyses were considerably large, ranging from 564 to 1,817. Given that the hypothesized structural model was comprehensive, including 56 estimated parameters, the large sample size was necessary. With this large sample size, small effects involved in the hypothesized structural model could have been detected. However, the significance levels of empirical findings might have been slightly increased.

Fifth, for the problem behaviors that were examined in this study, which were school failure, violence, substance use, and teenage casual sex, the severity and duration of these behaviors are also important characteristics that need to be addressed. In this study, although some items assessed behaviors over a 1-year period and their frequency, the severity and duration of behaviors were not systematically addressed. Therefore, it is unknown as to when certain behaviors became problematic for adolescents. It seems important for future studies to capture the severity and duration of problem behaviors.

Sixth, Asian Americans and Native Americans were excluded in the multiple ethnic/racial group analysis due to insufficient sample sizes within the ADD health dataset. It is recommended that future studies test a hypothesized structural model that includes Asian Americans and Native Americans within the ethnic/racial multigroup comparison analyses.

Footnotes

[1] The Weighted Root Mean Square Residual index (WRMR) has been introduced by Muthen and Muthen (2006). Values less than 1 are considered good. However, since WRMR is a very new model fit index, the application of WRMR has not been proved to various occasions. For example, in the Mplus discussion online section Muthen stated that WRMR does not work well for growth models and multiple-group models.

[2] The selected two sexual activity indicators, Number of Partners and Number of Non-Romantic Sexual Relationship, failed to have greater factor loadings than .30 and were excluded. However, another sexual activity indicator, Casual Sex, formed a factor by associating with substance use indicators.

References

Ackerman, B. P., Izard, C. E., Schoff, K., Youngstrom, E. A., & Kogos, J. (1999). Contextual risk, caregiver emotionality, and the problem behaviors of 6- and 7-year-old children from economically disadvantaged families. *Child Development*.70, 1415-1427.

Anderman, E. M. (2002). School effects on psychological outcomes during adolescence. *Journal of Educational Psychology*, 94(4), 795-809.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin,* 103 (3), 411-423.

Antonovsky, A. (1994). The sense of coherence: An historical and future perspective. In H.I. McCubbin, E.A. Thompson, A.I. Thompson, & J.E. Fromer (Eds.), *Sense of coherence and resiliency: Stress, coping, and health*. Madison, WI: The University of Wisconsin-Madison.

Ary, D. V., Duncan, T. E., Biglan, A., Metzler, C. W., Noell, J. W., & Smolkowski, K. (1999). Development of adolescent problem behavior. *Journal of Abnormal Child Psychology*, 27(2), 141-150.

Babakus, E. Ferguson, C and Joereskog, G. (1987), The sensitivity of Confirmatory Maximum Likelihood Factor Analysis to Violations of Measurement Scale and Distributional Assumptions. *Journal of Marketing Research*, 24(2), 222-228.

Bandura, A**.** (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Beam, M. R., Gil-Rivas, V., Greenberger, E., & Chen, C. (2002). Adolescent problem behavior and depressed mood: Risk and protection within and across social contexts. *Journal of Youth and Adolescence*, 31, 343-357.

Belle, D. (1990). Poverty and women's mental health. *American Psychologist*, 45(3), 385-389.

Bingham, C. R. & Crockett, L. J. (1996). Longitudinal adjustment patterns of boys and girls experiencing early, middle, and late sexual intercourse. *Developmental Psychology*, 32, 647--658.

Boekaerts, M. (1993). Being concerned with well-being and with learning. *Educational Psychologist*, 28, 149-167.

Bowen, G.L., Richman, J.M., Brewster, A., & Bowen, N. (1998). Sense of school coherence, perceptions of danger at school, and teacher support among youth at risk of school failure. *Child & Adolescent Social Work Journal,* 15*,* 273–286.

Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard University Press.

Bronfenbrenner, U. (1994). Ecological models of human development. In T. Husen & T. N. Postlethwaite (Eds*.), International encyclopedia of education* (2nd ed., Vol. 3). Oxford: Pergamon.

Brooks-Gunn, J., and Duncan, G.J. (1997). The effects of poverty on children. *The Future of Children,* 7*(2*), 55–71.

Brown, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K.A. Bollen & J.S. Long (Eds.), *Testing structural equation models* (pp. 136-162). Newbury Park, CA:Sage.

Byrne, B.M. (2001). *Structural Equation Modeling with AMOS*. Mahwah, NJ: L Erlbaum Associates

Cairns,R. B. & Cairns, B. D. (1994). *Lifelines and risks: Pathways of youth in our time.* Cambridge: Cambridge Press.

Chang, E. C., & Sanna, L. J. (2003). Experience of life hassles and psychological adjustment among adolescents: does it make a difference if one is optimistic or pessimistic? *Personality and Individual Difference*, 32, 876-879.

Chen, F.F., Sousa, K.H., & West, S.G. (2005). Testing measurement invariance of second-order factor models. *Structural Equation Modeling*, 12(30), 471-492.

Child Trends, (2001). *CTS Trends: At a glance*, Washington, DC: Author.

Choi, Y., Harachi, T. W., Gillmore, M. R., & Catalano, R. F.(2005). Applicability of the social development model to urban ethnic minority youth: Examining the relationship between external constraints, family socialization, and problem behaviors. *Journal of Research on Adolescence*, 15, 505-534.

Coie, J. D., Watt, N. F., West, S. G, Hawkins, J. D., Asarnow, J. R., Markman, H. J., Ramey, S. L., Shure, M. B., & Long, B. (1993). The science of prevention: A conceptual framework and some directions for a national research program. *American Psychologist*, 48*,* 1013–1022.

Cole, R., Morrison Gutman, L., & Sameroff, A. (2003). Academic Growth Curve Trajectories From 1st grade to 12th grade: Effects of Multiple Social Risk Factors and Preschool Child Factors. *Developmental Psychology,* 39(4*)*, 777-790.

Coley, R. L., Morris, J., Hernandez, D. (2004). Out-of-school care and problem behavior trajectories among low-income adolescents: Individual, family, and neighborhood characteristics as added risks. *Child Development,* 75, 639-657.

Dawber, T. R. (1980). *The epidemiology of atherosclerotic disease*. Harvard University Press.

Duncan, G. J., Brooks-Gunn, J., and Klebanow, P. K. (1994). Economic deprivation and early children development. *Child Development*, 65, 296-318.

Durlak, J. A., & Wells, A. M. (1997). Primary prevention mental health programs for children and adolescents. *American Journal of Community Psychology*, 26, 775-802.

Farrell, A. D., Kung, E. M., White, K. S., & Valois, R. (2000). The structure of self-reported aggression, drug use, and delinquent behaviors during early adolescence. *Journal of Clinical Child Psychology*, 29, 282-292.

Farrington, D. P., & West, D. J. (1982). The Cambridge study in delinquency development, 1980. In F. Dutile, C. Fouste, & D. Webster (Eds.). *Early childhood intervention and juvenile justice (*pp. 11-21). Lexington, MA: D.C. Health.

Fergusson, D. M., Horwood, L. J., & Lynskey, M. T. (1994). Structure of DSM-III-R criteria for disruptive childhood behaviors: Confirmatory factor models. *Journal of the American Academy of Child and Adolescent Psychiatry,* 33, 1145-1155.

Finn, J.D., & D.A. Rock. 1997. Academic success among students at risk for school failure. *Journal of Applied Psychology* 82 (2): 221–34.

Flora, D. B., & Curran, P. J. (2005). An empirical evaluation of alternative methods of estimation for confirmatory factor analysis with ordinal data. *Psychological Methods*, 9(4), 466-491.

Forehand, R., Biggar, H. & Kotchick, B.A. (1998). Cumulative risk across family stressors: Short- and long-term effects for adolescents. *Journal of Abnormal Child Psychology,* 26, 119-128.

Garmezy, N., & Devine, V. (1984). Project Competence: The Minnesota studies of children vulnerable to psychopathology. In Watt, N. F., Anthony, E. J., Wynne, L. C., & Rolf, J. E. (Eds), *Children at risk for schizophrenia: A longitudinal perspective,* (pp. 289-303). New York, NY, US: Cambridge University Press.

Gerard, J. M., & Buehler, C. (2004). Cumulative environmental risk and youth maladjustment: The role of youth attributes. *Child Development*, 75, 1832-1849.

Gillmore, M. R., Spencer, M., Larson, N., Tran, Q., & Gilchrist, L. (1998). Childbearing adolescents and problem behavior theory. *Journal on Social Service Research*, 24(1/2), 85-110.

Goldstein, H. S. (1984). Parental composition, supervision, and conduct problems in youths 12 to 17 years old. *American Academy of Child and Adolescent Psychiatry,* 23, 679–684.

Gorman-Smith, D., & Tolan, P.H. (2003). Positive adaptation among youth exposed to community violence. In S. Luthar (Ed.), *Resilience and Vulnerability in the Context of Childhood Adversities* (pp. 392-413). New York: Cambridge University Press.

Greenberg, M. T., Lengua, L. J., Coie, J., Pinderhughes, E. E., & The Conduct Problems Prevention Research Group (1999). Predicting developmental outcomes at school entry using a multiple-risk model: Four American communities. *Developmental Psychology*, 35, 403-417.

Gutman, L. M., Sameroff, A. J., & Cole, R. (2003). Academic growth curve trajectories from 1st grade to 12th grade: Effects of multiple social risk factors and preschool child factors. *Developmental Psychology*, 39, 777-790.

Hammack, P. L., Richards, M. H., Luo, Z., Edlynn, E. S., & Roy, Kevin. (2004). Social support factors as moderators of community violence exposure among inner-city African American young adolescents. *Journal of Clinical and Adolescent Psychology,* 33(3), 450-462.

Heppner, P. P., & Krauskopf, C. J. (1987). An information processing approach to personal problem solving. Major contribution in *The Counseling Psychologist, 15*, 371-447.

Heppner, P. P., Cook, S. W., Wright, D. M., Johnson, W. C., Jr. (1995). Progress in resolving problems: A problem-focused style of coping. *Journal of Counseling Psychology, 42*, 279-293.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterization model misspecification. *Psychological Methods*, 3, 424-453.

Jessor, R. (1987). Problem-behavior theory, psychosocial development, and adolescent problem drinking. *British Journal of Addiction*, 82, 331-342.

Jessor, R., Van Den Bos, J., Vanderryn, J., Costa, F. M., & Turbin, M. S. (1995). Protective factors in adolescent problem behavior: Moderator effects and developmental change. *Developmental Psychology*, 31, 923-933.

Johnson L. D., O'Malley, P. M., & Bachman, J. G. (2001). *Monitoring the future national survey results on drug use, 1975-2000: Vol.1. Secondary school students*

(NIH Publication No. 01-4924, pp. 1-226). Bethesda, MD: National Institute on Drug Abuse.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: Guilford Press.

Krishnakumar, A. & Black, M.M. (2002) Longitudinal predictors of competence among African American children: The role of distal and proximal risk factors. *Journal of Applied Developmental Psychology, 23*, 237-266.

Luthar, S.S. (1993). Annotations: Methodological and conceptual issues in research on childhood resilience. *Journal of Child Psychology and Psychiatry*, 34 (4), 441-453.

MacCallum, R. C., & Tucker, L. R. (1991). Representing Sources of Error in the Common-Factor Model - Implications for Theory and Practice. *Psychological Bulletin,* 109(3), 502-511.

Marsh, H. W., & Hocevar, D. (1985). Application of confirmatory factor analysis to the study of self-concept: First- and Higher Order Factor Models and Their Invariance Across Groups. *Psychological Bulletin*, 97(3), 562-582.

Mason, M.J. & Linnenberg, D. (1999). Applying public health science to the counseling profession: An initial examination. *British Journal of Guidance & Counseling.* 27, 527-537.

Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist,* 56(3), 227-238.

Masten, A. S., & Powell J. L. (2003). A resilience framework for research, policy, and practice. In S.S. Luthar (Ed). *Resilience and vulnerability: Adaptation in the context of childhood adversities* (pp. 1-28). New York: Cambridge University Press.

McNeely, C. A., Nonnemaker, J. M., & Blum, R. W. (2002) Promoting school connectedness: Evidence fom the national longitudinal study of adolescent health. *Journal of School Health*, 72(4), 138-146.

Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika,* 58, 525–543

Muthen, B. (1983). Latent variable structural equation modeling with categorical data. *Journal of Econometrics,* 22, 43-65.

Muthen, B. (1984). A general structural equation model with dichotomous, ordered categorical, and continuous latent variable indicators. *Psychometrika,* 49:115-132.

Muthen, B., & Kaplan, D. (1992). A comparison of some methodologies for the factor analysis of non-normal Likert variables: A note on the size of the model. *British Journal of Mathematical and Statistical Psychology*, 45, 19-30.

Muthén, B., du Toit, S.H.C., & Spisic, D. (1997). Robust inference using weighted least squares and quadratic estimating equations in latent variable modeling with categorical and continous outcomes. Accepted for publication in *Psychometrika*.

Muthen. L. K., & Muthen, B. O. (2001). *Mplus: User's guide. Los Angeles*: Muthen & Muthen.

Muthen. L. K., & Muthen, B. O. (2006). *Mplus: User's guide. Los Angeles*: Muthen & Muthen.

Newcomb, M. D., & Bentler, P. M. (1988). Impact of adolescent drug use and social support on problems of young adults: A longitudinal study. *Journal of Abnormal Psychology,* 97(1), 64-75.

Nussbeck, F. W., Eid, M., & Lischetzke, T. (in press). Analyzing multitrait-multimethod data with structural equation models for ordinal variables applying the WLSMV estimator: What sample size is needed for valid results? *The British psychological Society.*

Owens, E. B., & Shaw, D. S. (2003). Poverty and early childhood adjustment. In S. S. Luthar (Ed.), *Resilience and vulnerability: Adaptation in the context of childhood adversities* (pp. 267 - 292). Cambridge, UK: Cambridge University Press.

Perry, C. L. (2000). Preadolescent and adolescent influence on health. In B. D. Smedley & S. L Syme (Eds.), *Promoting health: Intervention strategies from social and behavioral research* (pp. 217-253). Washington, DC: National Academy Press.

Roeser, R., Midgley, C., & Urdan, T.C. (1996). Perception of the school psychological environment and early adolescents' psychological and behavioural functioning in school: The mediating role of goals and belonging. *Journal of Educational Psychology*, 88, 408-422.

Rumbeger, R. W. (2001). *Why students drop out of school and what can be done*. A paper prepared for the conference, "Dropouts in America: How severe is the Problem?" What Do We Know About Intervention and Prevention?" Harvard University.

Runyan, C., DeVellis, R.F., DeVellis, B.M., & Hochbaum, G. (1982). Health psychology and the public health perspective: In search of the pump handle. *Health Psycholog*y, 1, 169-180.

Rutter, M. (1985). Resilience in the face of adversity: Protective factors and resistance to psychiatric disorder. *British Journal of Psychiatry,* 147, 598-611.

Rutter, M. (1979). Protective factors in children's responses to stress and disadvantage. In M. W Kent & J. E. Rolf (Eds.) *Primary prevention of psychopathology: Social competence in children* (pp. 49-62). Hanover, NH: University Press of New England.

Sameroff, A. J., Bartko, W. T., Baldwin, A., Baldwin, C., & Seifer, R. (1998). Family and social influences on the development of child competence. In M. Lewis & C. Feiring (Eds.), *Families, risk, and competence* (pp. 161-185). Mahwah, NJ: Erlbaum.

Sameroff, A. J., Seifer, R., & Bartko, W. T. (1997). Environmental perspectives on adaptation during childhood and adolescence. In S. S. Luthar, J. A. Burack, D. Cicchetti, & J. Weisz (Eds.). *Developmental Psychopathology: Perspectives on adjustment risk and disorder* (pp. 507-526). New York: Cambridge University Press.

Sameroff, A. J., Seifer, R., Baldwin, A., & Baldwin, C. (1993). Stability of intelligence from preschool to adolescence: The influence of social and family risk factors. *Child Development*, 64, 80-97.

Sameroff, A., Gutman, L.M., & Peck, S.C. (2003). Adaptation among youth facing multiple risks: Prospective research findings. In S.S. Luthar (Ed). *Resilience and vulnerability: Adaptation in the context of childhood adversities* (pp. 364-391). New York: Cambridge University Press.

Schwab-Stone, M. E., Ayers, T. S., Kasprow, W., Voyce, C., Barone, C., Shriver, T., & Weissberg, R. (1995). No safe haven: A study of violence exposure in an urban community. *Journal of the American Academy of Child and Adolescent Psychiatry*, 34, 1343-1352.

Snyder, C. R. (1994). Hope and optimism. In V. S. Ramachandran (Ed.), *Encyclopedia of human behavior, Vol. 2* (pp. 535-542). San Diego, CA: Academic Press.

Stouthamer-Loeber, M., & Loeber, R. (1988). Parents as intervention agents for conduct problem children and juvenile offenders. *Journal of Child and Youth Services*, 11, 127-148.

Strein, W., Hoagwood, K., & Cohn, A. (2003). School psychology: A public health perspective I, Prevention, populations, and systems change. *Journal of School psychology,* 41, 23-38.

Tolan, P. (1988). Socioeconomic, family, and social stress correlates of adolescent antisocial and delinquent behavior. *Journal of Abnormal Child Psychology*, 16, 317-333.

Vega, W. A., Khoury, E.L., Zimmerman, R.S., Gil, A.G., & Warheit, G.J. (1995). Cultural conflicts and problem behaviors of Latino adolescents in home and school environments. *Journal of Community Psychology, 23*, 167-179.

West, S. G., Finch, J. F., and Curran, P. J. (1995), "*Structural equation models with nonnormal variables*," in Structural Equation Modeling: Concepts, Issues, and Applications, ed. R. Hoyle, Thousand Oaks, CA: Sage. 56-75.

Willoughby, T., Chalmers, H., and Busseri, M.A. (2004). Where is the Syndrome? Examining Co-occurrence Among Multiple Problem Behaviors in Adolescence. *Journal of Consulting and Clinical Psychology, 72*(6): 1022–1037.

Worrell, F. C., & Hale, R. L. (2001). The relationship of hope in the future and perceived school climate to school completion. *School Psychology Quarterly, 16*(4), 357-369.

Yates, T.M., Egeland, B., & Sroufe, L.A. (2003). Rethinking resilience: A developmental process perspective. In S.S. Luthar (Ed.), *Resilience and vulnerabilities: Adaptation in the context of childhood adversities* (pp.243-266). New York: Cambridge University Press.

Appendix A

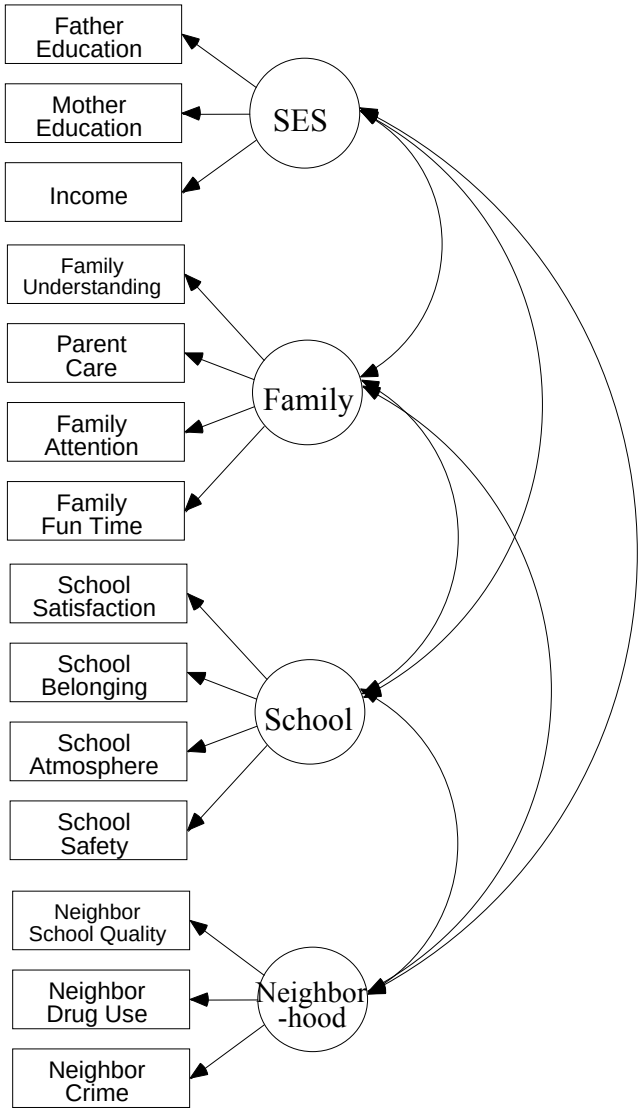

Figure 1 First-order Risk Factor Model from Ecological Framework

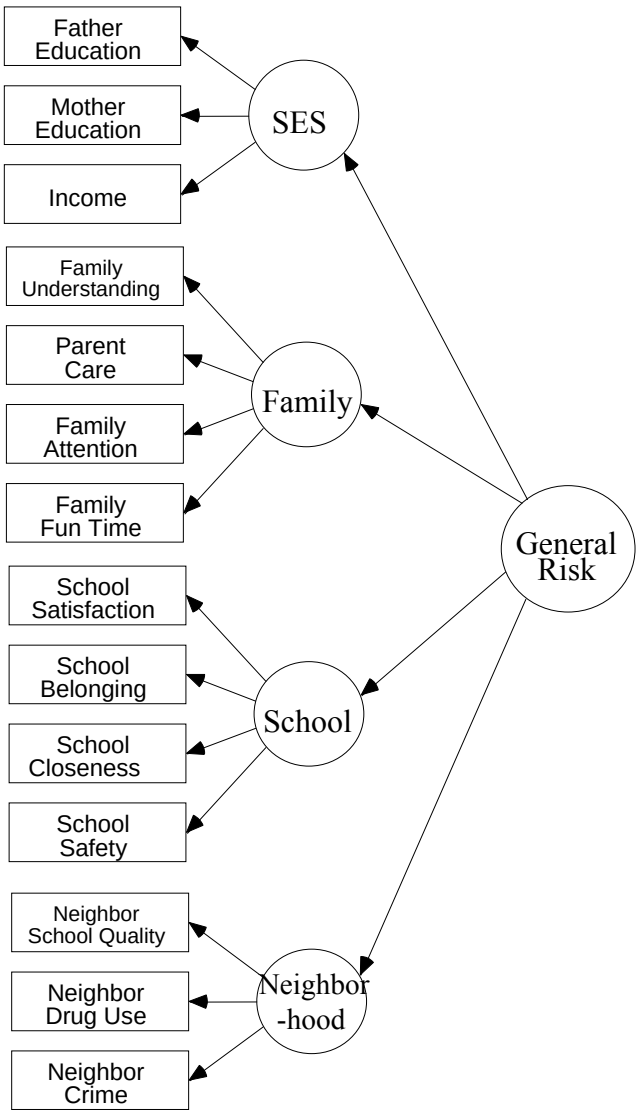

Figure 2 Second-order General Risk Model from Ecological Framework

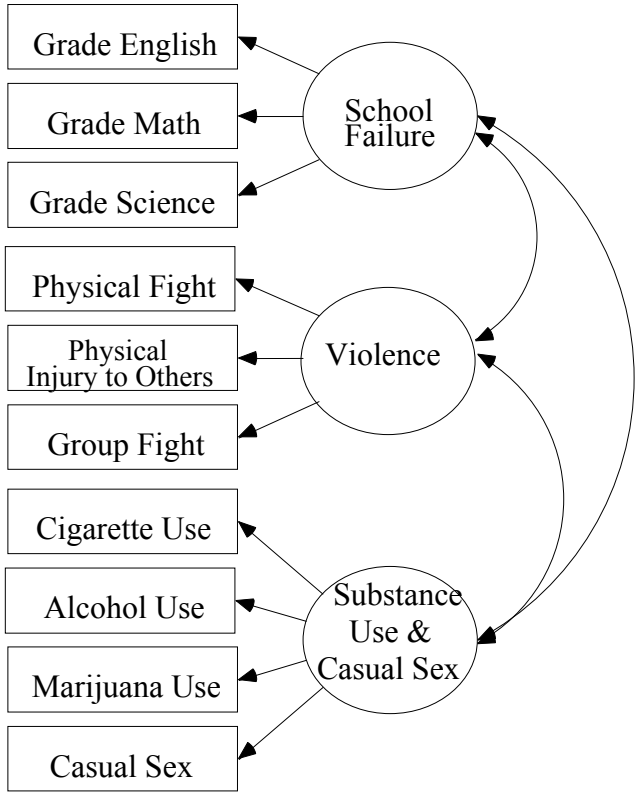

Figure 3 Model I of Problem behaviors

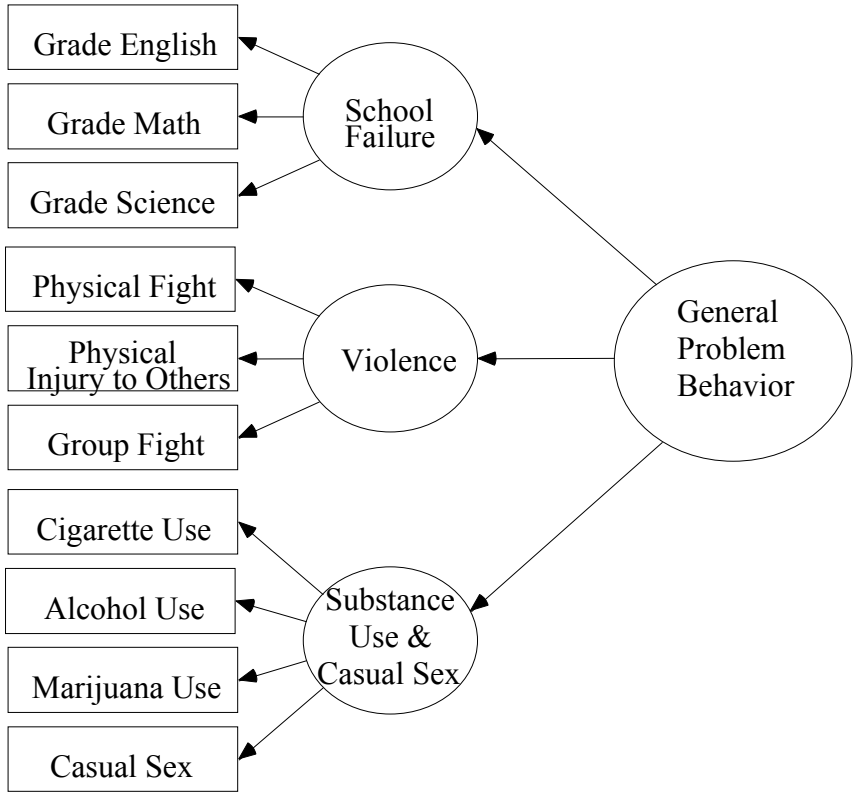

Figure 4 Model 2 of Problem behaviors from Problem Behavior Theory

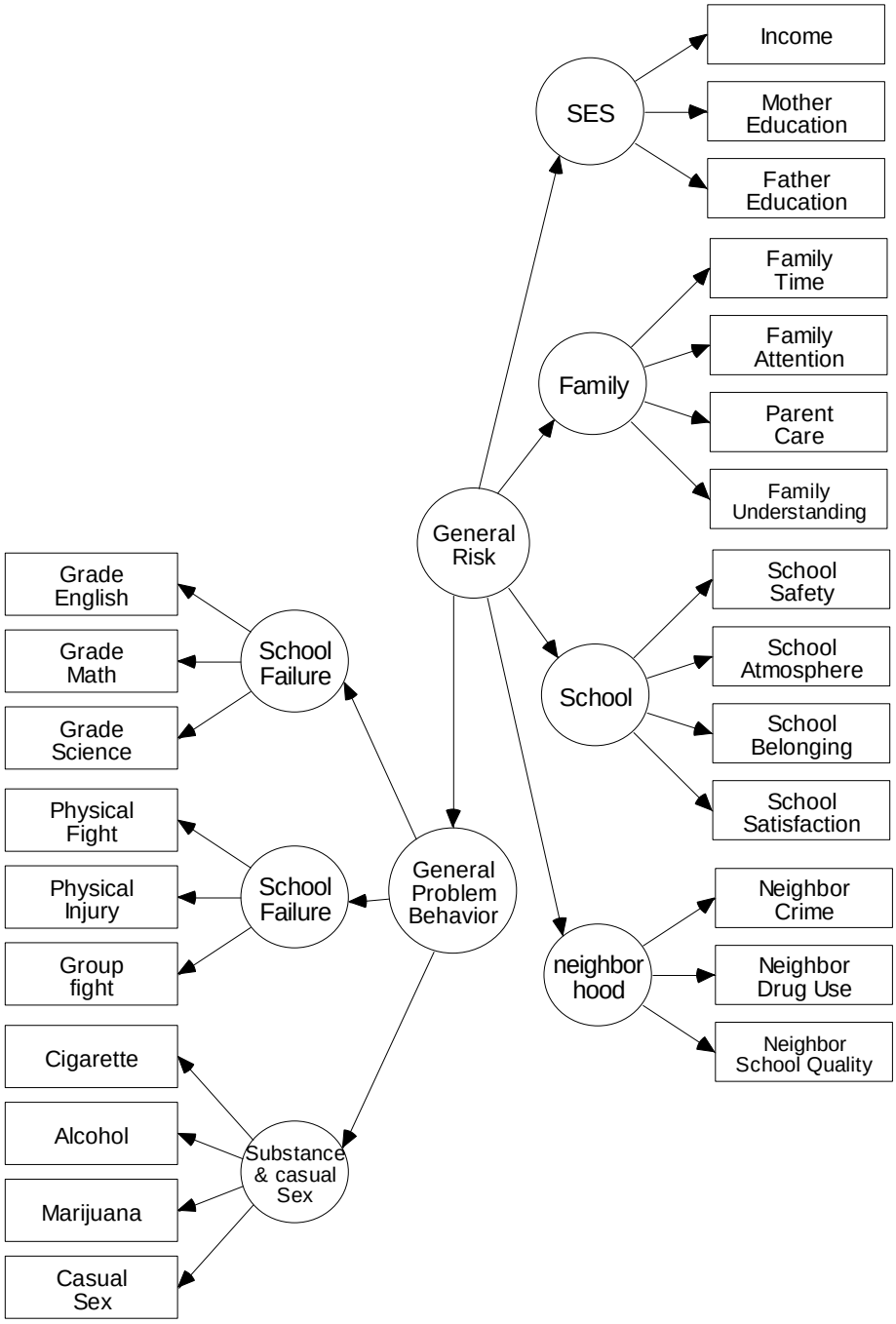

Figure 5 Ecological Framework and Problem Behavior Theory

Appendix B The Selected Risk and Problem Behavior Items from the ADD Health Study

Indicators	Actual Questions
	SES Risk
Income	About how much total income, before taxes did your family receive in 1994?
Mother Education	How far did your current (spouse/partner) go in school?
Father Education	How far did you go in school?
	Family Risk
Family Time	How much do you feel that you and your family have fun together?
Family Attention	How much do you feel that your family pays attention to you?
Parent Care	How much do you feel that your parents care about you?
Family Understanding	How much do you feel that people in your family understand you?
	School Risk
School Safety	I feel safe in my school.
School Closeness	I feel close to people at this school
School Belonging	I feel like I am part of this school.
School Satisfaction 1	I am happy to be at this school.
	Neighborhood Risk
Neighbor Crime	You live here because there is less crime in this neighborhood than there is in other neighborhoods.
Neighbor Drug Use	You live here because there is less drug use and other illegal activity by adolescents in this neighborhood.

Neighbor School Quality	You live here because the schools here are better than they are in other neighborhoods.
	School Failure
Grade English	At the {MOST RECENT GRADING PERIOD/LAST GRADING PERIOD IN THE SPRING}, what was your grade in English or language arts?
Grade Math	What was your grade in mathematics?
Grade Science	What was your grade in science?
	Violence
Physical Fight	How often did you get into a serious physical fight?
Physical Injury to Others	How often did you hurt someone badly enough to need bandages or care from a doctor or nurse?
Group Fight	In the past 12 months, how often did you take part in a fight where a group of your friends was against another group?
	Substance Use with Casual Sex
Cigarette Use	During the past 30 days, on how many days did you smoke cigarettes?
Alcohol Use	During the past 12 months, on how many days did you drink alcohol?
Marijuana Use	During the past 30 days, how many times did you use marijuana?
Casual Sex	Not counting the people you have described as romantic relationships, have you ever had a sexual relationship with anyone?

Appendix C Exploratory Factor Analysis Results

Variables	Factor Loadings	Defined Factor Label
Income	0.32	
Mother Education	0.68	SES Risk
Father Education	0.80	
Family Fun Time	0.76	
Family Attention	0.84	Family Risk
Parent Care	0.47	
Family Understanding	0.69	
School Safety	0.51	
School Closeness	0.66	School Risk
School Belonging	0.81	
School Satisfaction	0.70	
Neighborhood Crime	0.87	
Neighborhood Drug	0.85	Neighbor Risk
Neighborhood School	0.44	
Grade English	0.62	
Grade Math	0.64	School Failure
Grade Science	0.64	
Physical Fight	0.80	
Physical Injury	0.73	Violence
Group Fight	0.58	

Appendix C (continued)

Variables	Factor Loadings	Defined Factor Label
Cigarette Use	0.57	
Alcohol Use	0.65	Substance Use with
Marijuana Use	0.45	Casual Sex
Casual Sex	0.35	

Table 1

Descriptive Statistics of the Selected Risk Variables

	Missing %	Mean	SD	Skewness	Kurtosis
Income	24.22%	47.70	56.35	8.78	119.73
Transformed Income			0.38	-0.88	2.42
Mother Education	13.70%	5.58	2.34	-0.28	-1.00
Father Education	36.65%	5.68	2.47	-0.23	-1.02
Family Fun	0.45%	3.75	1.03	-0.55	-0.20
Family Attention	0.42%	3.93	0.94	-0.68	0.13
Parent Care	0.37%	4.79	0.57	-3.35	13.20
Family Understanding	0.45%	3.61	1.01	-0.40	-0.29
School Safety	34.53%	2.23	1.07	0.82	0.23
School Closeness	33.35%	2.44	1.11	0.61	-0.26
School Belonging	33.99%	2.43	1.19	0.63	-0.43
School Satisfaction	34.15%	2.47	1.23	0.61	-0.52
Neighborhood Crime	14.65%	0.60	0.49	-0.42	-1.82
Neighborhood Drug Use	15.33%	0.56	0.50	-0.25	-1.94
Neighborhood School Quality	14.67%	0.47	0.50	0.12	-1.99

Note. SD = Standard Deviation.

Table 2

Descriptive Statistics of the Selected Problem Behavior Variables

	Missing %	Mean	SD	Skewness	Kurtosis
Grade English	2.71%	2.24	1.06	0.77	0.46
Grade Math	2.46%	2.51	1.23	0.53	-0.43
Grade Science	2.49%	2.51	1.34	0.61	-0.65
Physical Fight	0.89%	0.45	0.77	1.83	2.86
Physical Injury to Others (PIO)	0.95%	0.24	0.59	2.86	8.70
Transformed PIO			0.14	2.09	3.37
Group Fight	0.80%	0.25	0.60	2.76	8.08
Transformed Group Fight			0.15	1.99	2.92
Cigarette Use	0.58%	4.26	9.52	2.09	2.67
Alcohol Use	0.25%	6.36	1.30	-2.16	3.86
Marijuana Use	3.40%	9.98	52.67	9.97	123.11
Transformed Marijuana Use			0.59	2.11	3.66
Casual Sex	1.40%	0.26	0.44	1.08	-0.84
Number of Partners (NP)	0.37%	0.79	4.96	23.19	718.69
Transformed NP			0.26	3.23	11.22
Number of Non-Romantic Sexual Relationship (NNSRR)	0.40%	0.30	1.96	28.71	1242.13
Transformed NNSRR			0.17	4.00	18.92

Note. SD = Standard Deviation.

Table 3

Summary Statistics for the Risk models examined

	χ^2	df	*P*	CFI	TLI	RMSEA
Second-order General Risk Model	55.783	36	0.019	0.991	0.993	0.024
First-order Risk Model	44.102	41	0.342	0.999	0.999	0.009

Note. The presented chi-square values and the degree of freedom cannot be used for chi-square difference test computed by the WLSMV estimation because the degree of freedom is not directly determined from the specification of the model.

CFI= Comparative Fit Index; TLI=Tucker Lewis Index or Non-normed Fit Index; RMSEA=Root Mean Square Error of Approximation.

Table 4

Standardized Factor loadings in Second-order Risk Model

Indicators	First-order Factors	Factor Loadings	
		1st Order	2nd Order
Income		0.41***	
Mother Education	SES	0.74***	0.25***
Father Education		0.74***	
Family Fun		0.78***	
Family Attention	Family	0.75***	0.49***
Parent Care		0.44***	
Family Understanding		0.67***	
School Safety		0.56***	
School Closeness	School	0.66***	0.78***
School Belonging		0.80***	
School Satisfaction		0.71***	
Neighborhood Crime		0.98***	
Neighborhood Drug	Neighborhood	0.93***	0.14***
Neighborhood School		0.62***	

Note. ***p <.001

Table 5

Summary Statistics for the Problem Behavior Equivalent models examined

	χ^2	Df	*P*	CFI	TLI	RMSEA
Second-order Problem Behavior Model	91.487	21	< .01	0.914	0.939	0.060
First-order Problem Behavior Model	91.486	21	< .01	0.914	0.939	0.060

Note. The presented chi-square values and the degree of freedom cannot be used for chi-square difference test computed by the WLSMV estimation because the degree of freedom is not directly determined from the specification of the model.

CFI= Comparative Fit Index; TLI=Tucker Lewis Index or Non-normed Fit Index; RMSEA=Root Mean Square Error of Approximation.

Table 6

Standardized Factor loadings in Second-order Problem Behavior Model

Indicators	First-order Factors	Factor Loadings	
		1st Order	2nd Order
Grade English		.74***	
Grade Math	School Failure	.60***	.44***
Grade Science		.63***	
Physical Fight		0.75***	
Physical Injury to Others	Violence	0.80***	.59***
Group Fight		0.67***	
Cigarette Use		0.52***	
Alcohol Use	Substance Use with	0.63***	.83***
Marijuana Use	Casual Sex	0.69***	
Casual Sex		0.59***	

Note. ***p <.001

Table 7

Summary of the Model-Fit Statistics of the Hypothesized Structural Model

	χ^2	Df	*P*	CFI	TLI	RMSEA
Initial CFA	510.981	106	< .01	0.932	0.951	0.046
Final CFA	415.963	105	< .01	0.947	0.962	0.040
SEM	442.315	107	< .01	0.945	0.962	0.042

Note. The presented chi-square values and the degree of freedom cannot be used for chi-square difference test computed by the WLSMV estimation because the degree of freedom is not directly determined from the specification of the model.

CFI= Comparative Fit Index; TLI=Tucker Lewis Index or Non-normed Fit Index; RMSEA=Root Mean Square Error of Approximation.

Table 8

Summary of the Separate Baseline Models for Gender Groups

Indicators	First-order Factors	Male		Female	
		Standardized Factor Loadings			
		1st Order	2nd Order	1st Order	2nd Order
Income	SES	.49***	.24***	.54***	.37***
Mother Education		.71***		.68***	
Father Education		.71***		.70***	
Family Fun Time	Family	.74***	.51***	.72***	.54***
Family Attention		.74***		.78***	
Parent Care		.44***		.45***	
Family Understanding		.71***		.71***	
School Safety	School	.55***	.52***	.56***	.57***
School Closeness		.61***		.61***	
School Belonging		.78***		.79***	
School Satisfaction		.76***		.73***	
Neighborhood Crime	Neighbor-hood	.92***	.21***	.97***	.14***
Neighborhood Drug		.98***		.95***	
Neighborhood School		.58***		.60***	

Table 8 (continued)

Indicators	First-order Factors	Male		Female	
		Standardized Factor Loadings			
		1st Order	2nd Order	1st Order	2nd Order
Grade English	School Failure	.69***		.66***	
Grade Math		.57***	.58***	.66***	.55***
Grade Science		.64***		.68***	
Physical Fight	Violence	.70***		.81***	
Physical Injury		.71***	.50***	.61***	.44***
Group Fight		.67***		.55***	
Cigarette Use	SUCA[a]	.63***		.58***	
Alcohol Use		.57***	.76***	.57***	.65***
Marijuana Use		.69***		.70***	
Casual Sex		.64***		.69***	
Path		Standardized Path Coefficients			
General Risk to General Problem Behavior		.74***		.90***	
Residual Covariates		Correlation Coefficients			
Grade English with Father Education		.17***	.14***		

Table 8 (continued)

	Male	Female
Residual Covariates	Correlation Coefficients	
Grade English with Income	.12***	.11***
Grade Math with Father Education	.12***	.09***
Family Understanding with Mother Education	-.12***	-.11***
Family Understanding with Father Education	-.13***	-.12***

Note. SUCA[a] indicates Substance Use with Cause Sex.

***p <.001

Table 9

Summary of Invariance Test across Gender Groups

	Δχ2	Δdf	*P*	CFI	TLI	RMSEA
Unconstrained Model				0.935	0.953	0.044
Fully Constrained Model				0.945	0.957	0.042
Partially Constrained Model				0.944	0.958	0.042
Unconstrained vs. Fully constrained	55.416	17	<.00			
Unconstrained vs. Partially Constrained	20.930	16	>.05			

Note. The presented chi-square values and the degree of freedom cannot be used for chi-square difference test computed by the WLSMV estimation because the degree of freedom is not directly determined from the specification of the model.

CFI= Comparative Fit Index; TLI=Tucker Lewis Index or Non-normed Fit Index; RMSEA=Root Mean Square Error of Approximation.

Δχ2 = difference of chi-square values; Δdf = difference of degrees of freedom.

Table 10

Latent Mean Differences in the General Risk and Problem Behavior Factors between Gender Groups

	Unstand. [a] Estimates	SE	*Z*	*P*	Stand. [b] Estimate
General Risk	-0.004	.012	- 0.32	>.05	-0.014
General Problem Behavior	-0.250	.025	-10.13	< .00	-0.643

Note. SE= Standard error; Unstand. [a]= Unstandardized; Stand. [b]= standardized.

Table 11

Summary of the Separate Baseline Models for Grade-level Groups

Indicators	First-order Factors	Middle [a]		High [b]	
		Standardized Factor Loadings			
		1st Order	2nd Order	1st Order	2nd Order
Income		.53***		.51***	
Mother Education	SES	.69***	.39***	.77***	.25***
Father Education		.67***		.70***	
Family Fun Time		.75***		.72***	
Family Attention	Family	.76***	.42***	.77***	.52***
Parent Care		.45***		.48***	
Family Understanding		.64***		.72***	
School Safety		.55***		.51***	
School Closeness	School	.58***	.32***	.62***	.43***
School Belonging		.73***		.72***	
School Satisfaction		.65***		.69***	
Neighborhood Crime	Neighbor	.95***		.95***	
Neighborhood Drug	--	.97***	.15***	.96***	.15***
Neighborhood School	hood	.58***		.59***	

Table 11 (continued)

Indicators	First-order Factors	Middle [a] Standardized Factor Loadings		High [b] Standardized Factor Loadings	
		1st Order	2nd Order	1st Order	2nd Order
Grade English	School Failure	.79***		.64***	
Grade Math		.61***	.54***	.55***	.57***
Grade Science		.67***		.60***	
Physical Fight	Violence	.76***		.76***	
Physical Injury		.64***	.58***	.70***	.50***
Group Fight		.67***		.58***	
Cigarette Use	SUCA[c]	.55***		.58***	
Alcohol Use		.59***	.80***	.56***	.74***
Marijuana Use		.70***		.68***	
Casual Sex		.62***		.65***	

Path	Standardized Path Coefficients	
General Risk to General Problem Behavior	.96	.68

Residual Covariates	Correlation Coefficients	
Grade English with Father Education	.14***	.14***

Table 11 (continued)

	Middle [a]	High [b]
Residual Covariates	Correlation Coefficients	
Grade English with Income	.11***	.08***
Grade Math with Father Education	.10***	.12***
Family Understanding with Mother Education	-.12***	-.08***
Family Understanding with Father Education	-.12***	-.11***

Note. Middle [a] : Grade 7th, 8th & 9th. High [b]: Grade 10th, 11th & 12th. SUCA [c] indicates Substance Use with Cause Sex.

***p <.001

Table 12

Summary of Invariance Test across Grade-level Groups

	Δχ	Δdf	*p*	CFI	TLI	RMSEA
Unconstrained Model				0.941	0.954	0.043
Fully Constrained Model				0.944	0.954	0.043
Partially Constrained Model				0.945	0.957	0.042
Unconstrained vs. Fully constrained	102.358	17	.00			
Unconstrained vs. Partially Constrained	21.564	13	.06			

Note. The presented chi-square values and the degree of freedom cannot be used for chi-square difference test computed by the WLSMV estimation because the degree of freedom is not directly determined from the specification of the model.

CFI= Comparative Fit Index; TLI=Tucker Lewis Index or Non-normed Fit Index; RMSEA=Root Mean Square Error of Approximation.

Δχ2 = difference of chi-square values; Δdf = difference of degrees of freedom.

Table 13

Latent Mean Differences in the General Risk and Problem Behavior Factors between Grade-level Groups

	Unstand. [a] Estimates	SE	*Z*	*P*	Stand. [b] Estimate
General Risk	0.037	0.010	3.889	<.000	0.311
General Problem Behavior	0.111	0.026	4.218	<.000	0.257

Note. SE= Standard error; Unstand. [a]= Unstandardized; Stand. [b]= standardized.

Table 14

Summary of the Separate Baseline Models for Ethnic/Racial Groups

Indicators	First-order Factors	Caucasian		African American		Hispanic	
		Standardized Factor Loadings					
		1st Order	2nd Order	1st Order	2nd Order	1st Order	2nd Order
IC		.50***		.50***		.36***	
ME	SES	.63***	.35***	.78***	.17**	.69***	.13
FE		.69***		.70***		.75***	
FF		.75***		.70***		.73***	
FA	Family	.77***	.55***	.76***	.44***	.71***	.56***
PC		.48***		.42***		.36***	
FU		.73***		.68***		.65***	
SS		.56***		.49***		.56***	
SC	School	.60***	.52***	.65***	.54***	.59***	.58***
SB		.79***		.79***		.74***	
SS		.77***		.70***		.75***	
NC	Neighbor--hood	.92***		1.00***		.90***	
ND		.98***	.15***	.93***	.24***	1.00***	.18**
NS		.58***		.60***		.59***	

Table 14 (continued)

Indicators	First-order Factors	Caucasian		African American		Hispanic	
		Standardized Factor Loadings					
		1st Order	2nd Order	1st Order	2nd Order	1st Order	2nd Order
GE	School Failure	.69***		.74***		.65***	
GM		.57***	.64***	.63***	.35***	.63***	.58***
GS		.64***		.66***		.63***	
PF	Violence	.75***		.74***		.63***	
PIO		.68***	.52***	.70***	.47***	.74***	.43***
GF		.62***		.65***		.70***	
CU	SUCA	.66***		.55***		.52***	
AU		.61***	.74***	.50***	.87***	.55***	.77***
MU		.67***		.71***		.73***	
CS		.71***		.63***		.67***	
Path		Standardized Path Coefficients					
GR to GPB		.83		.52		.80	
Residual Covariates		Correlation Coefficients					
GE with FE		.14 ***	.14 ***	.11 ***			

Table 14 (continued)

	Caucasian	African American	Hispanic
Residual Covariates	Correlation Coefficients		
GE with IC	.13 ***	.05 *	.11 **
GM with FE	.09 ***	.12 ***	.05
FU with ME	-.10***	-.15 **	.07
FU with FE	-.12 **	-.15 **	.06

Note. IC =Income; ME=Mother Education; FE=Father Education; FF=Family Fun; FA=Family Attention; PC=Parent Care; FU=Family Understanding; SS=School Safety; SC=School Closeness; SB=School Belonging; SS=School Satisfaction; NC=Neighborhood Crime; ND=Neighborhood Drug; NS=Neighborhood School; GE=Grade English; GM=Grade Math; GS=Grade Science; PF=Physical Fight; PIO=Physical Injury to Others; GF=Group Fight; CU=Cigarette Use; AU=Alcohol Use; MU=Marijuana Use; CS=Casual Sex; GR=General Risk; GPB=General Problem Behavior; SUCA= Substance Use with Casual Sex.

*p <.05. **p<.01. ***p<.001.

Table 15

Summary of Invariance Test across Ethnic/Racial Groups

	Δχ	Δdf	*p*	CFI	TLI	RMSEA
Caucasian versus African American						
Unconstrained Model				0.919	0.932	0.052
Fully Constrained Model				0.923	0.934	0.052
Partially Constrained Model				0.926	0.937	0.050
Unconstrained Model vs. Fully Constrained Model	35.326	16	0.003			
Unconstrained Model vs. Partially Constrained Model	19.084	14	0.162			
Caucasian versus Hispanic						
Unconstrained Model				0.935	0.953	0.044
Fully Constrained Model				0.945	0.957	0.042
Unconstrained Model vs. Fully Constrained Model	55.416	17	0.398			

Note. The presented chi-square values and the degree of freedom cannot be used for chi-square difference test computed by the WLSMV estimation because the degree of freedom is not directly determined from the specification of the model.

CFI= Comparative Fit Index; TLI=Tucker Lewis Index or Non-normed Fit Index; RMSEA=Root Mean Square Error of Approximation.

Δχ2 = difference of chi-square values; Δdf = difference of degrees of freedom.

Table 16

Latent Mean Differences in the General Risk and Problem Behavior Factors across Ethnic/Racial Groups

	Unstand.[a] Estimates	SE	*Z*	*P*	Stand.[b] Estimate
Caucasian versus African American					
General Risk	0.030	0.018	1.652	0.099	0.225
General Problem Behavior	0.258	0.130	1.978	0.048	0.297
Caucasian versus Hispanic					
General Risk	0.076	0.025	2.978	0.003	0.405
General Problem Behavior	0.056	0.057	0.994	0.320	0.128

Note. SE= Standard error; Unstand.[a] =Unstandardized; Stand.[b] =standardized; Z= Z-score.

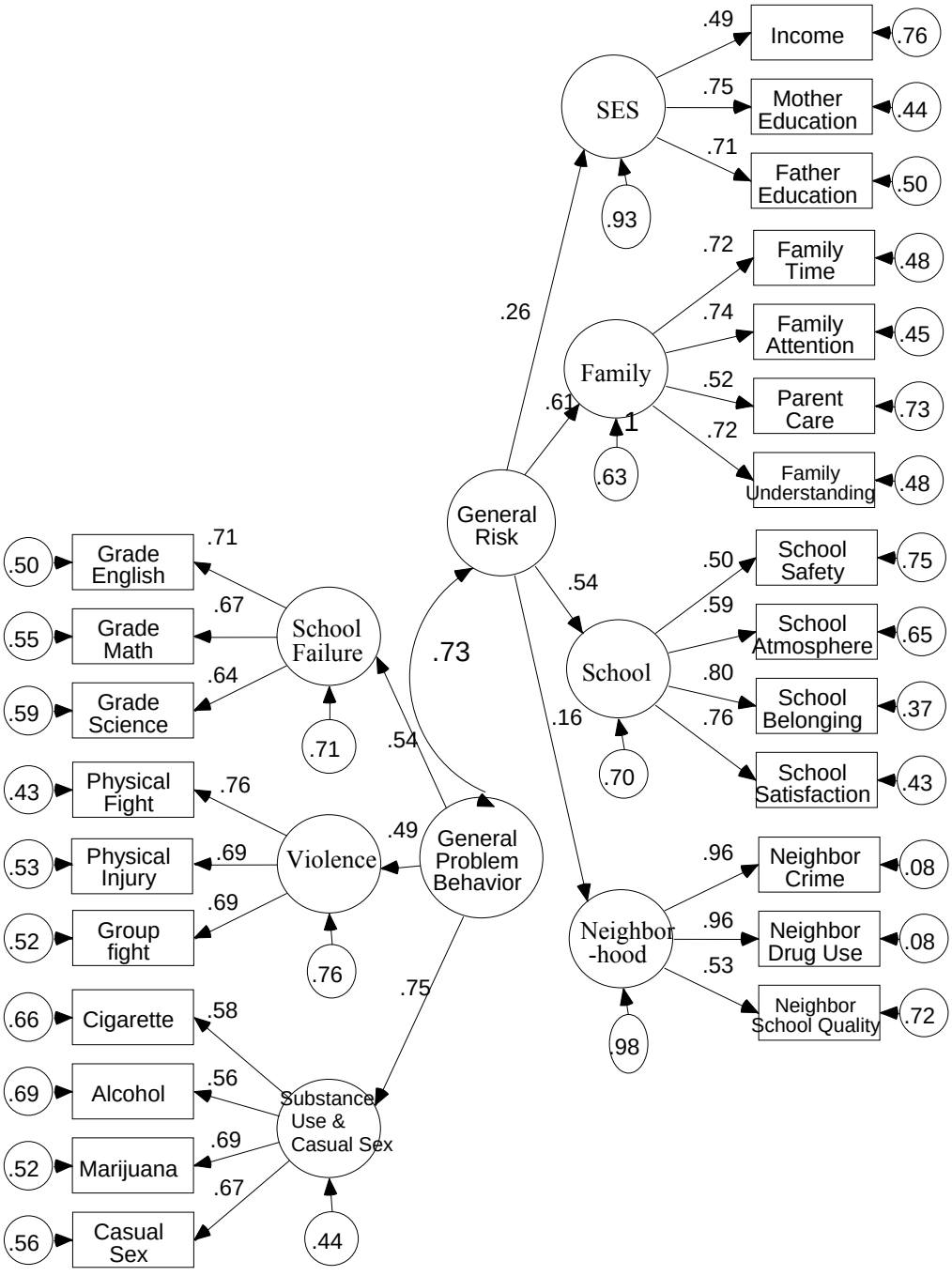

Figure 1 Final confirmatory factor analysis model

*Large circles indicates latent construct, rectangles are observed variables, and the numbers in the small circles pointed to the observed variables are residual variances. The numbers in the small circles pointed to the latent variables are disturbance variances. Standardized factor loading are presented in the above of the arrowed lines.

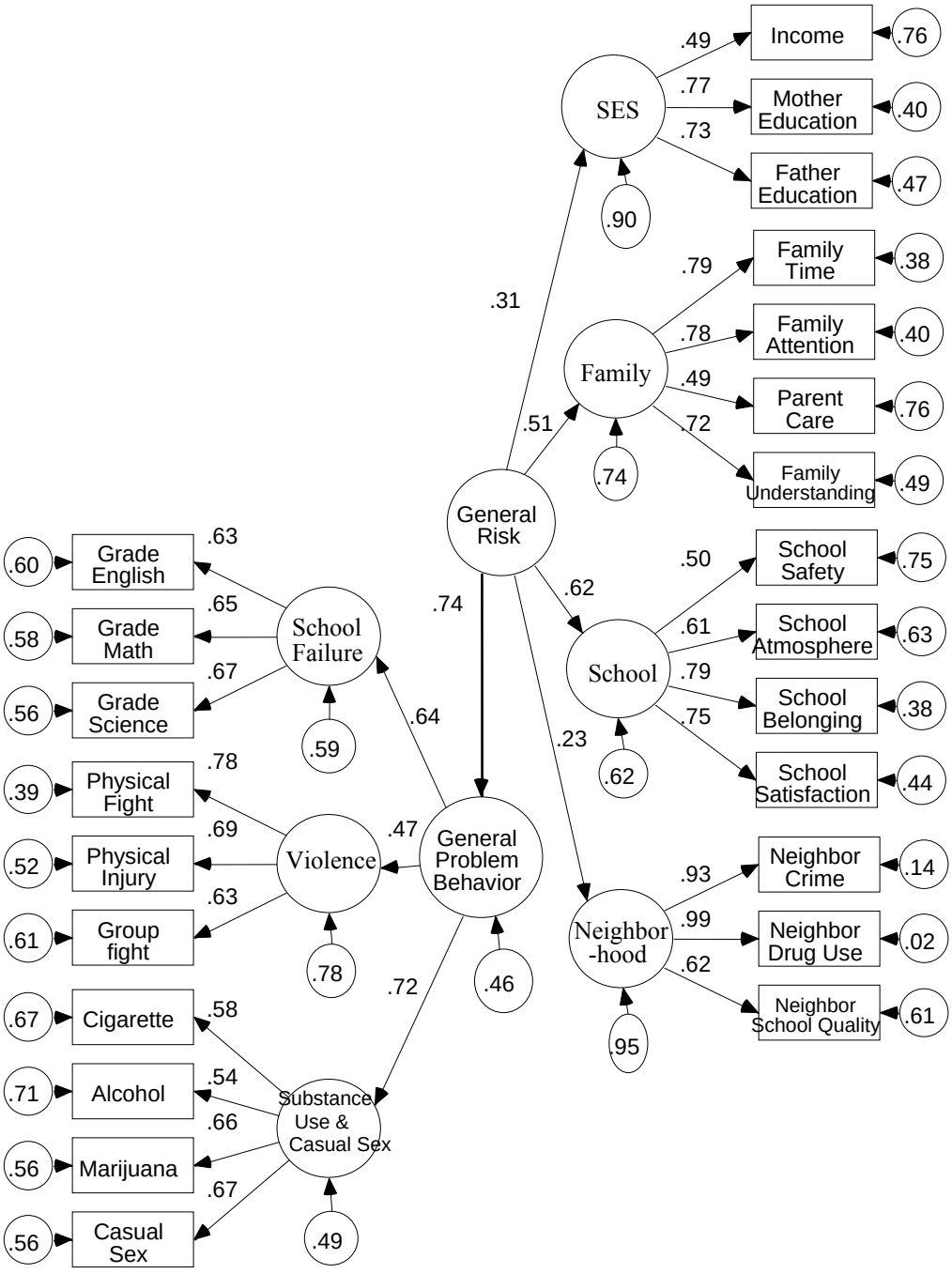

Figure 2 Structural Model Analysis

Large circles indicates latent construct, rectangles are observed variables, and the numbers in the small circles pointed to the observed variables are residual variances. The numbers in the small circles pointed to the latent variables are disturbance variances. Standardized factor loading are presented in the above of the arrowed lines.

VITA

Heejung Chun was born September 26th, 1970 in Seoul, South Korea. After attending public schools in Seoul, she earned the following degrees: B.A. in Educational psychology from Seoul Women's University in Seoul, South Korea (1994); M.Ed. in Counseling Psychology from Seoul Women's University in Seoul, South Korea (1996); and Ph.D. in School Psychology from University of Missouri-Columbia (2007). She worked at psychiatric departments for three years and at a mental health center for one year after receiving her mater's degree. Her research interests include adolescent problem behaviors, risk and protective factors, resilience, prevention and intervention.